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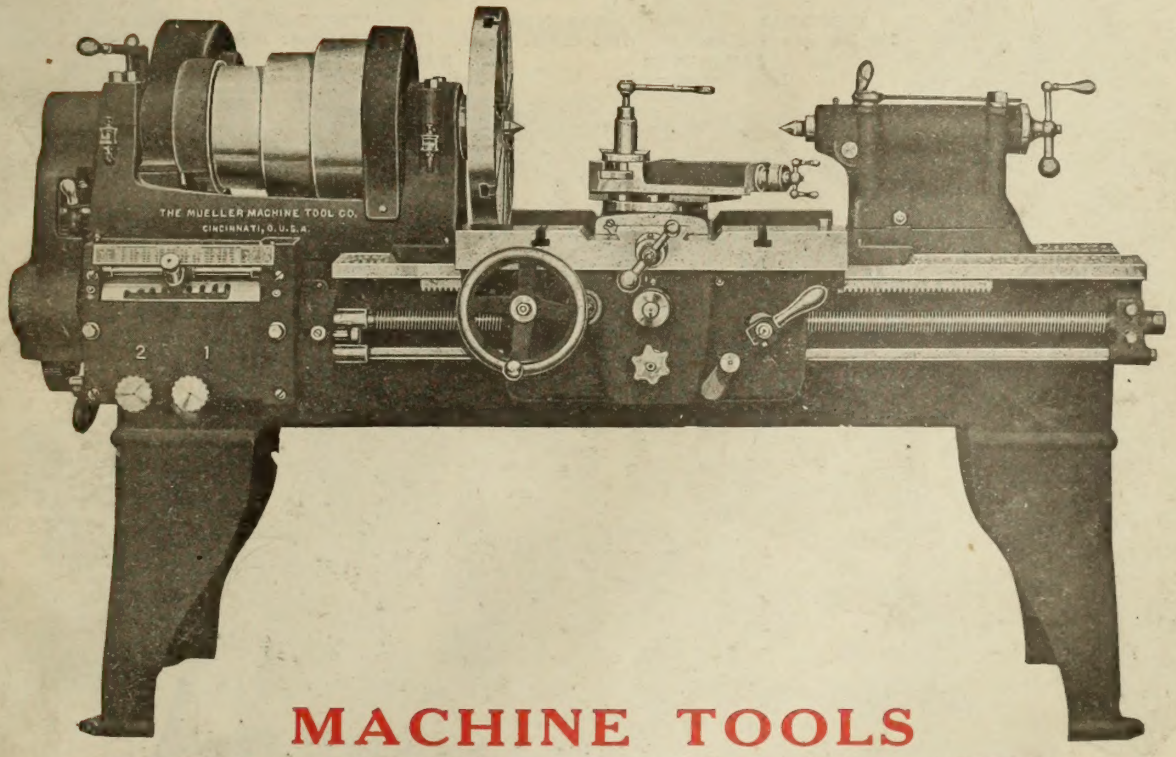
CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

VOL. XXIII., No. 1 Publication Office: Toronto, January 1, 1920 $3.00 per year. Subscription Price

QUALITY SERVICE

THE GEO. F. FOSS MACHINERY & SUPPLY CO. LIMITED · MONTREAL · Foss



MACHINE TOOLS
CONCRETE MIXERS MILL SUPPLIES
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The Geo. F. Foss Machinery and Supply Co., Limited
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You Need a Good Die Stock Set

if you need one at all.

Because a **GOOD** Die Stock Set embodies:

1. Accuracy in its product.
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P. & W. Die Stock Dies **ARE GOOD DIES.**

BETTER than most because of the interchangeable feature in their chasers. A broken chaser in a P. & W. Die doesn't mean a new set of chasers. You can get a new chaser to replace a breakage and the new one "fits in" perfectly in your old set. That's the 6th point **"ECONOMY IN OPERATION."**

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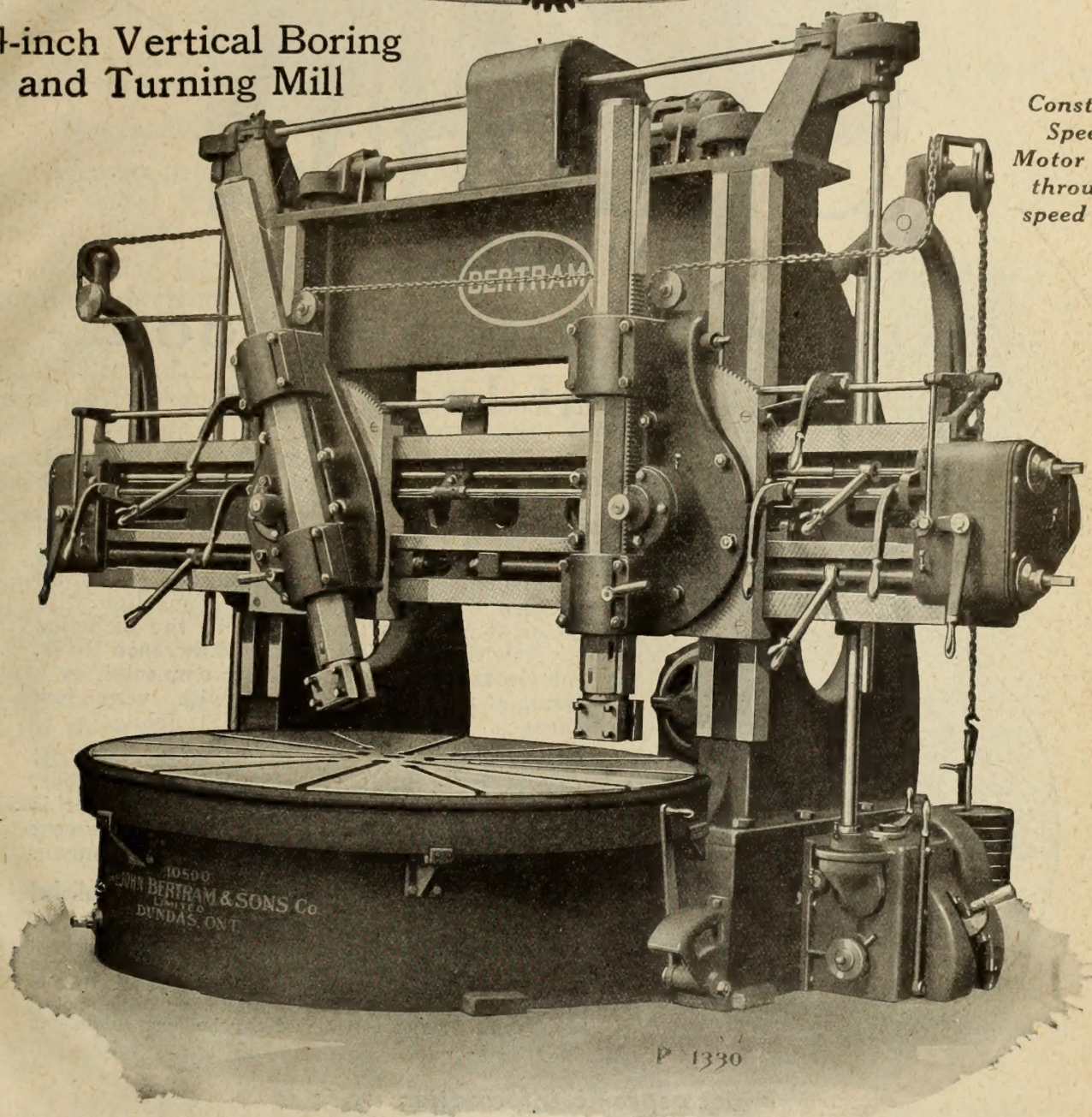
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The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



The John Bertram & Sons Co., Limited

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Canadian Machinery and Manufacturing News, January 1st, 1920. Vol. 23, No. 1. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50 Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

Mr. Manufacturer!

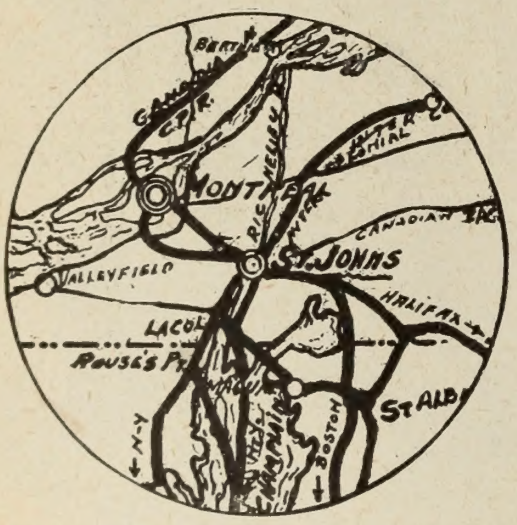
The City of

ST. JOHNS,

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Is an exceptionally good industrial location

Read these Facts:—



ST. JOHNS POSSESSES EXCEPTIONAL TRANSPORTATION FACILITIES from the source of raw material to the distributing centres for the finished product. On the main lines of the Grand Trunk, Canadian Pacific and Intercolonial Railways; connected with all Eastern U.S. railways; direct connection with docks at Montreal; connected by the Richelieu River with New York, the St. Lawrence River, the Great Lakes. All railways connected by a terminal switching system with very low charges. No custom delays at St. Johns.

THE CHEAPEST LABOR CENTRE IN THE COUNTRY. Skilled and semi-skilled labor, both male and female, is plentiful. Labor is unorganized and there is a remarkably low cost of living. Strikes and labor troubles unknown.

Inducements to New Industries are Unparalleled

Fifteen years' tax exemption with period subject to extension; all public improvements required, such as streets, sidewalks, waterworks, sewers. Also a bonus to you of five per cent. on your pay-roll for five years. If you desire it, the city will advance this to you to be applied to the purchase or erection of any building suitable to your purpose.

For more specific information write to

The Secretary of the City Council

St. Johns, Quebec, Canada

The Machine Which Has Revolutionized Gear Cutting

Books were once so rare that only the very wealthy could own them.

Gutenberg's invention of the printing press somewhere around 1450 revolutionized this condition. Books then came within the reach of everybody; education spread and civilization advanced.

So with gears—accurate gears.

Their manufacture was a thing of infinite pains, of utter dependability upon the skill of the workman, the sureness of his hand and infallibility of his eye.

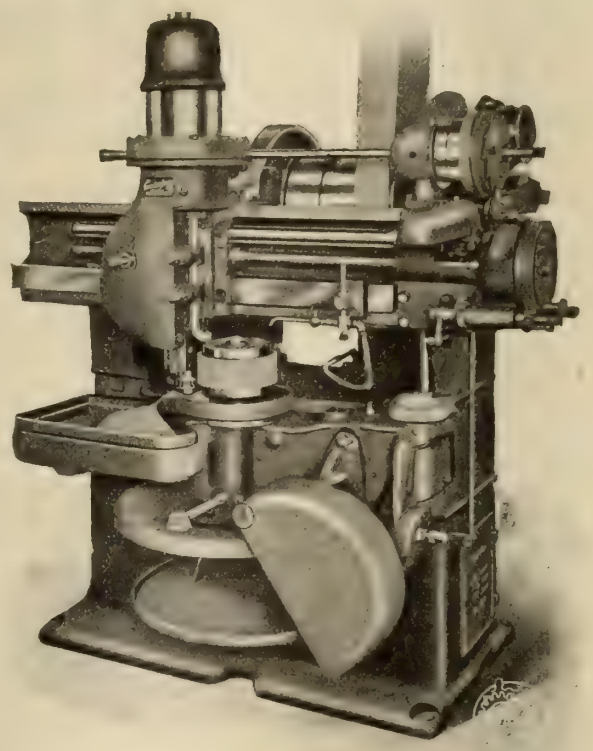
Then came the Fellows Gear Shaper and the Gear Shaper Cutter.

Accurate gears in commercial quantities were placed within the reach of every manufacturer.

You may ask how this machine can justify such claims?

There are several reasons why these claims are justified: First, because the Fellows Gear Shaper Cutter is a generated cutter; second, it is ground all over after hardening, including the involute curves on the teeth, which are generated with a precision that is beyond question.

The skill of the workman making this cutter is not called upon to a superhuman degree. That pitfall is avoided; also, still another pitfall is avoided in this way. By careful inspection and proper inspecting instruments, every cutter can be checked to the finest degree of accuracy.



The Fellows Gear Shaper—the machine which made commercial gear cutting possible.

Just three more points: Each Fellows Gear Shaper Cutter is an original cutter. It is not a copied duplicate. Each Fellows Gear Shaper Cutter is inspected after every important operation and receives a final inspection such as no other gear cutting tool can receive. Each Gear Shaper Cutter operates on the generating principle, producing gears consistently, rapidly and economically.

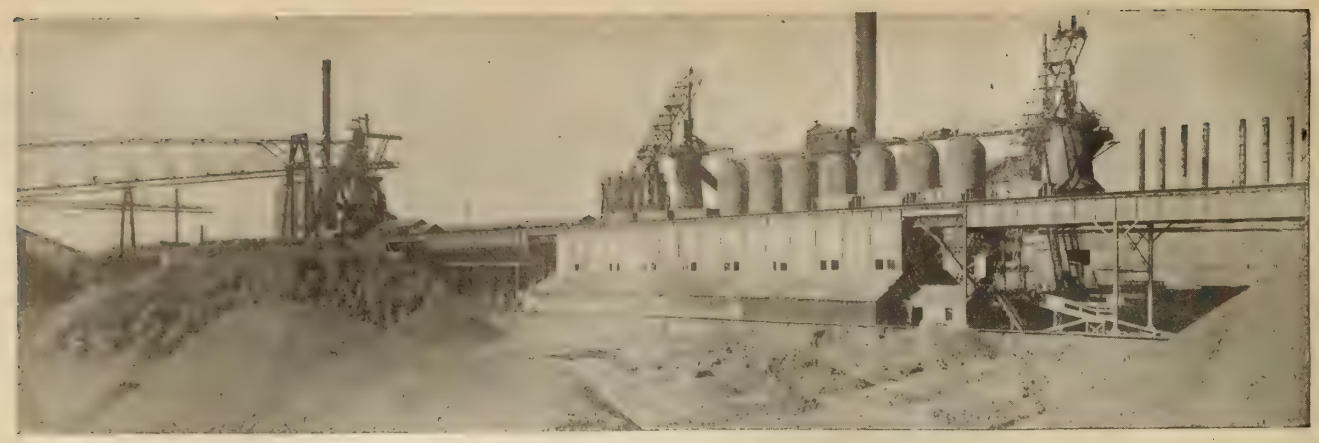
Many other interesting points are explained in our general catalog, "Commercial Gear Cutting," a copy of which we will gladly send to those interested.

THE FELLOWS GEAR SHAPER COMPANY

Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England: Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Ltd., Calcutta, India, and A. B. Galco, Ltd., Stockholm, Sweden.

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Sault Ste. Marie, Ontario.

STEEL RAILS
Open Hearth Quality
(All Sections from 12 lbs to 100 lbs per yard)

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All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.

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GENERAL VIEW OF THE PLANT OF THE ALGOMA STEEL CORPORATION FROM THE WATERFRONT

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HIGH SPEED AND CARBON TWIST DRILLS

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Quality First

The Keystone Upon Which All WILT Products Are Built

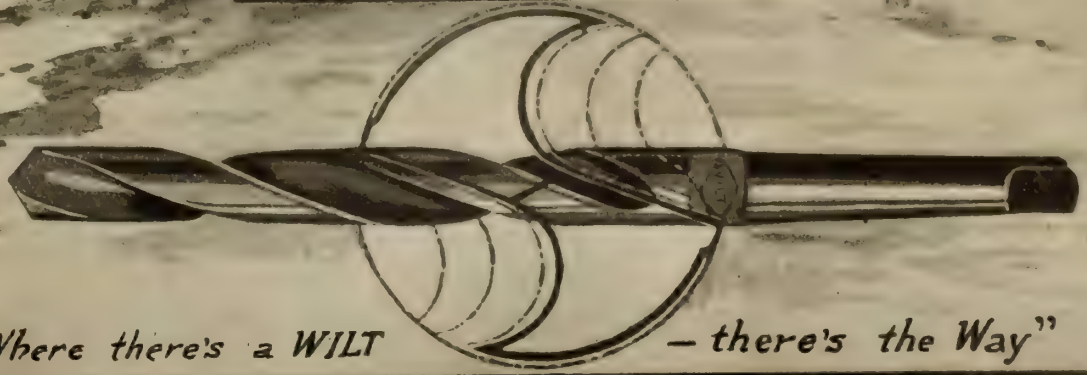
A high standard of perfection is maintained throughout the various processes of manufacturing **WILT High Speed and Carbon Twist Drills, Reamers and Milling Cutters.** **WILT** products improve production! This is no theory, no untested statement, but an established fact backed by many of the largest manufacturers throughout Canada. For steady, reliable output of work that is satisfactory from the standpoint both of quantity and quality there is no better choice than **WILT Products.**

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"Little David" Air Tools are designed with a view to meeting just such conditions as these and are simple in design, sturdy in construction and extremely powerful for their size and weight.

Ball bearing spindle and roller bearing connecting rods reduce friction to a minimum and permit "Little David" drills to operate at high speeds and stand up under tremendous overloads.

Bulletins covering the "Little David" line are yours for a postcard.

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Little David AIR TOOLS



This Advertisement is one of a series based on actual occurrences.

3 Minutes Instead of 15

CLEANING metal parts five times faster is a desirable accomplishment.

One plant *formerly* washed gears with lye and caustic soda. It took 15 minutes to scrub each piece.

Now Oakite materials clean the gears in three minutes. No scrubbing.

Greater production with less labor.

These are the brief facts—but they show vividly what proper cleaning methods and materials can often accomplish.

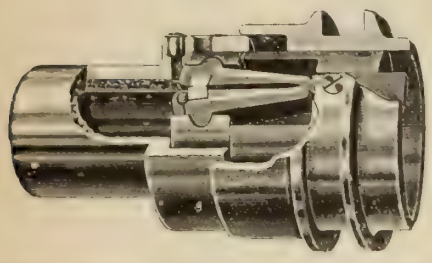
If you have a problem—you may want to clean faster, or better or cheaper—put it up to us. Most likely we can help.

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK

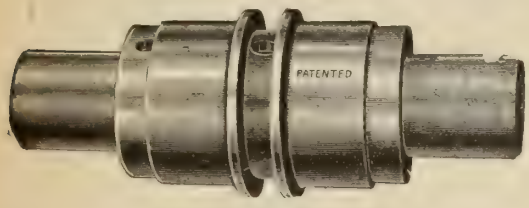
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THE JOHNSON FRICTION CLUTCH

The Clutch for Your Machine Made to Order



Single Clutch—Interior—Clutch Disengaged



Double Clutch

Where space is limited and conditions are exacting, the clutch problem presents difficulties —unless you know about Johnson clutches. We offer you an efficient clutch made in any size or form that your machine requires. When you are designing a new machine, it will be worth while to consult us. Our facilities are at your disposal without any obligation to you.

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FRICTION CLUTCH
THE CLUTCH OF A THOUSAND USES

WRITE TO-DAY FOR OUR YELLOW DATA SHEETS

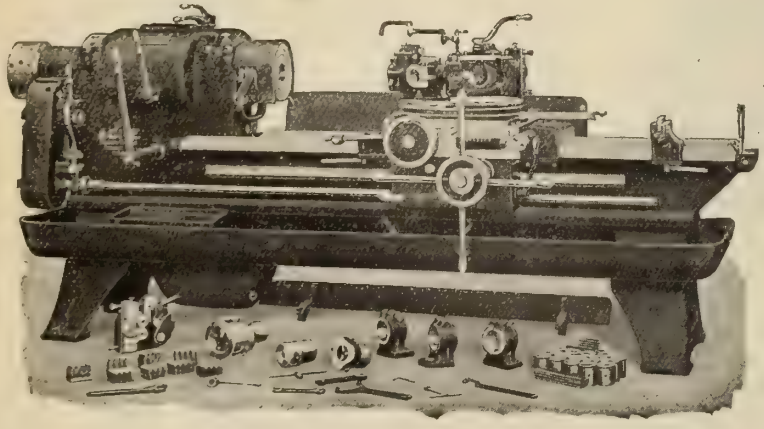
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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Doubly Efficient—Does Both Bar and Chuck Work

This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

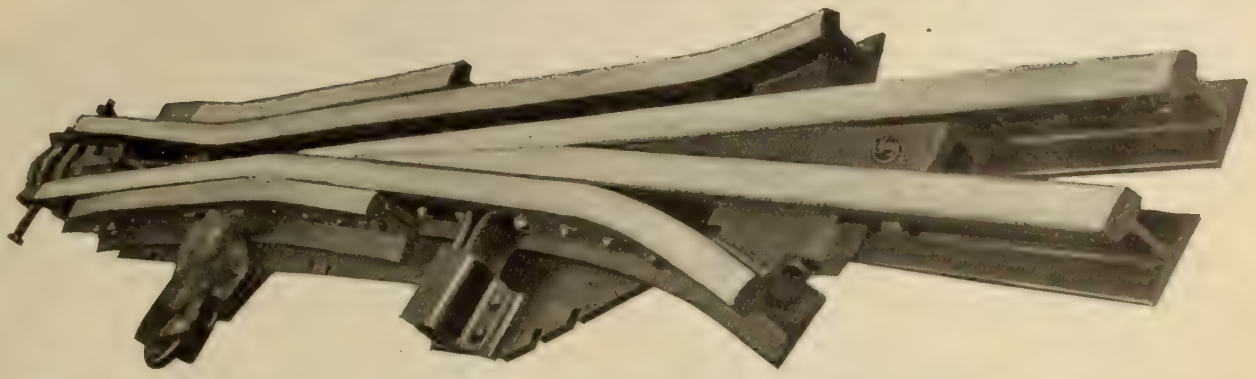
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Insures Maximum Production

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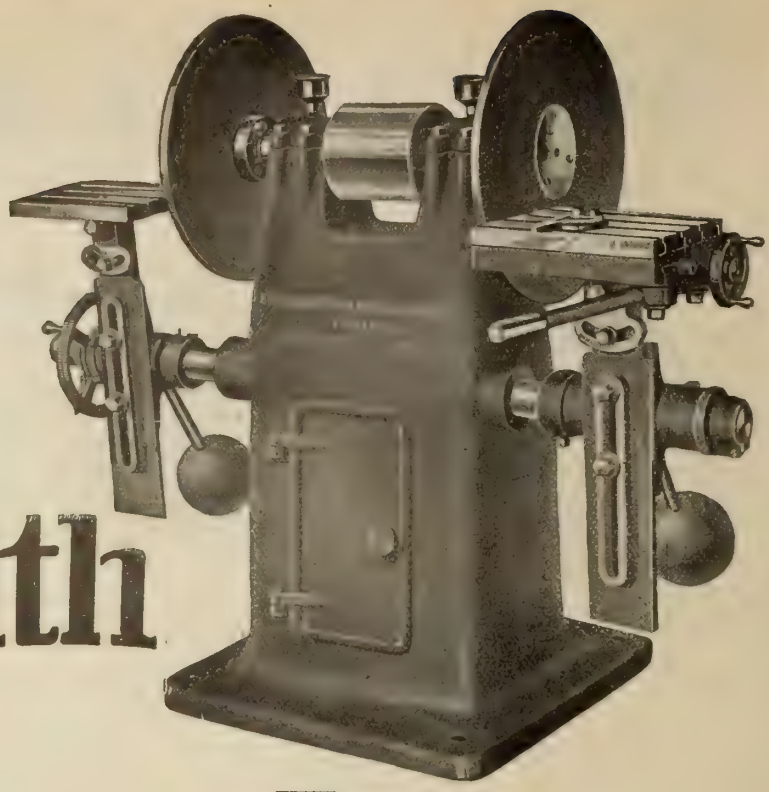
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JOHN J. COLEMAN
Canadian Manager

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Heavy Type Floor Grinders



Ford-Smith Grinders

- Motor Driven Grinders
- Floor Grinders
- Bench Grinders
- Water Tool Grinders
- Swing Grinders
- Buffing and Polishing Machines
- Special Grinding Machinery
- Hack Saws
- Swivel Tables

Large illustration shows our 20-in. "Manufacturing" disc grinder.

The Disc Wheel Grinder (or Ring Wheel Grinder) is indispensable where economical finishing or roughing work is desired.

The abrasive materials on the Disc Circle are to be considered as extra-high-speed cutting tools. This, backed by ample belt power, and a heavy rigid frame, is the secret of the success of this method of metal reduction.

These improved machines will not slow down, glaze, or get dull when correctly set up, even when the work is forced strongly against them.

May we send you catalogue, covering full line?



Swing Grinder



General Purpose Grinder

Manufactured by

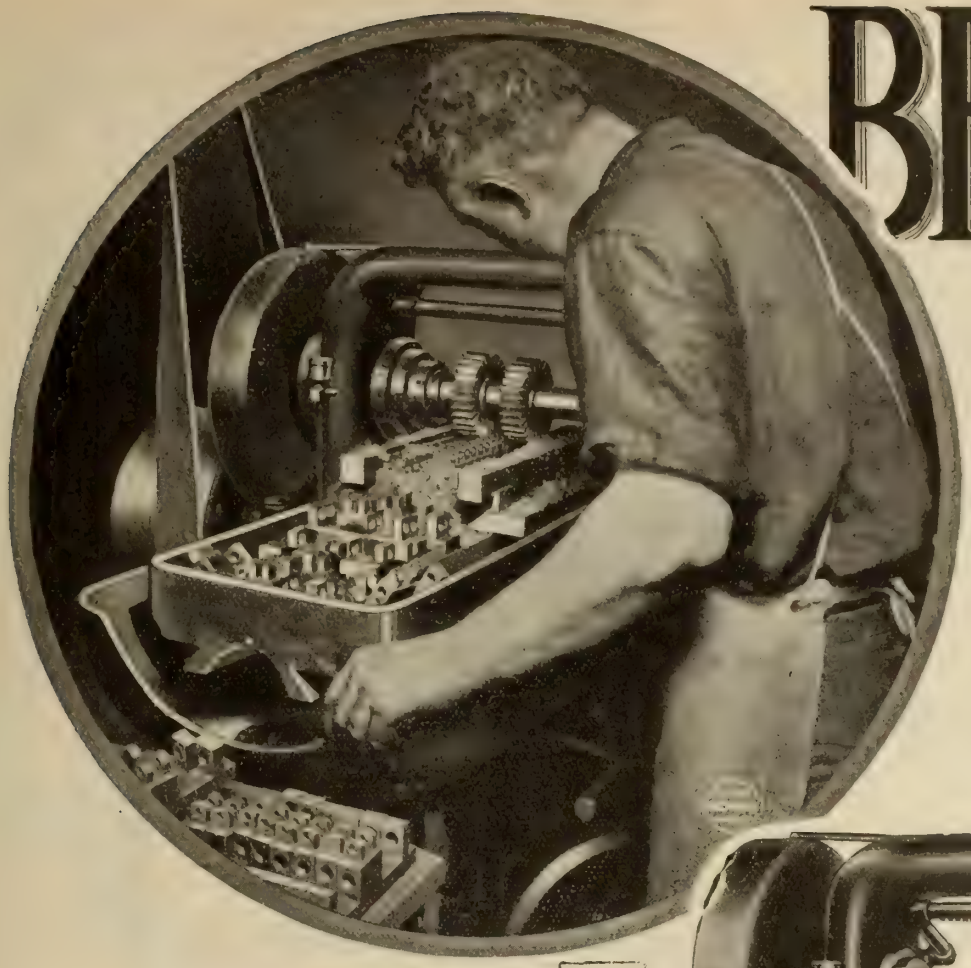
The Ford-Smith Machine Co.

LIMITED

Manufacturers of Milling Machines, Disc Grinders, Polishers and Special Machinery

Hamilton, Canada

FOREIGN AGENTS: W. E. Storey, 3 Arundel St., London, Eng. Gollin & Co., Melbourne, Australia.



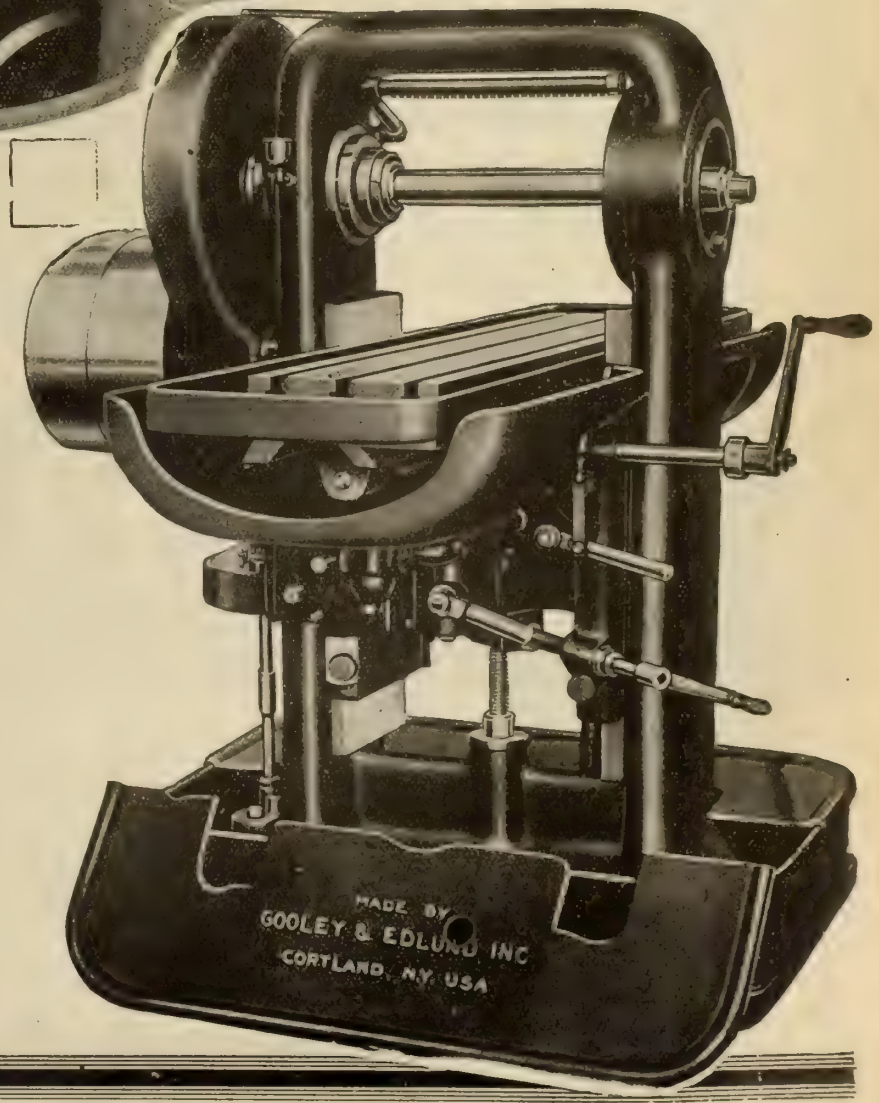
BRIGGS MILLER

Breaking Production Records

Forcing the feed on the "BRIGGS" to an extent impossible on any other machine.

THE photograph shows twelve belt lacer jaws clamped together on the table of a Briggs Milling Machine, where two straddle-mounted cutters mill the channels at one setting, though the stock is cold rolled steel, one inch thick. 15 minutes completes the operation, this speed being attained by forcing the feed to an extent impossible with any other milling machine. There is no chatter—the surface is "finished" when it comes from the machine.

Rigid, powerful and easy to operate. Takes wide, deep cuts without showing least signs of distress, and will produce accurate work when running at a high rate of speed.



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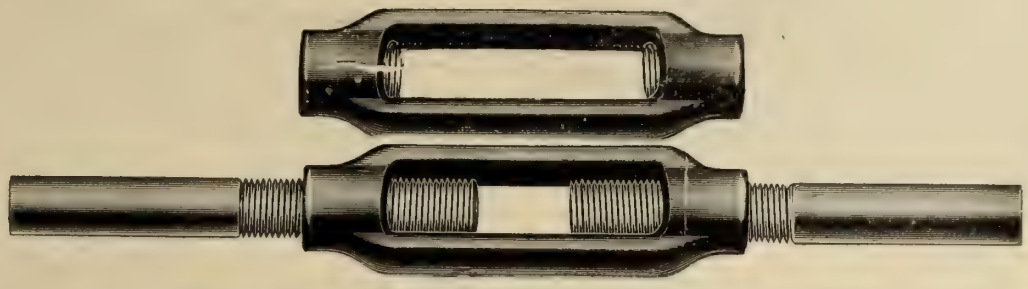
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HIGH-SPEED AND CARBON
TOOL STEEL

MISCELLANEOUS SHOP TOOLS

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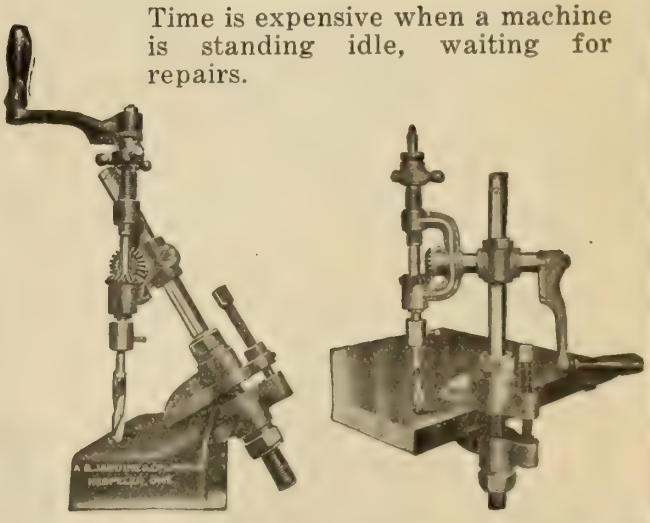
126 Wellington St. W.
TORONTO

27 King William St.
HAMILTON

McArthur Building
WINNIPEG

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



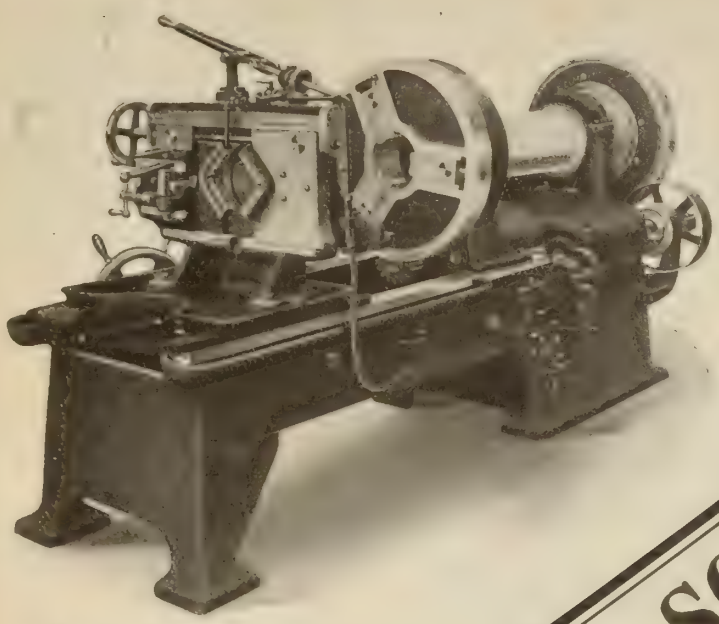
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses

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PIPE MACHINERY

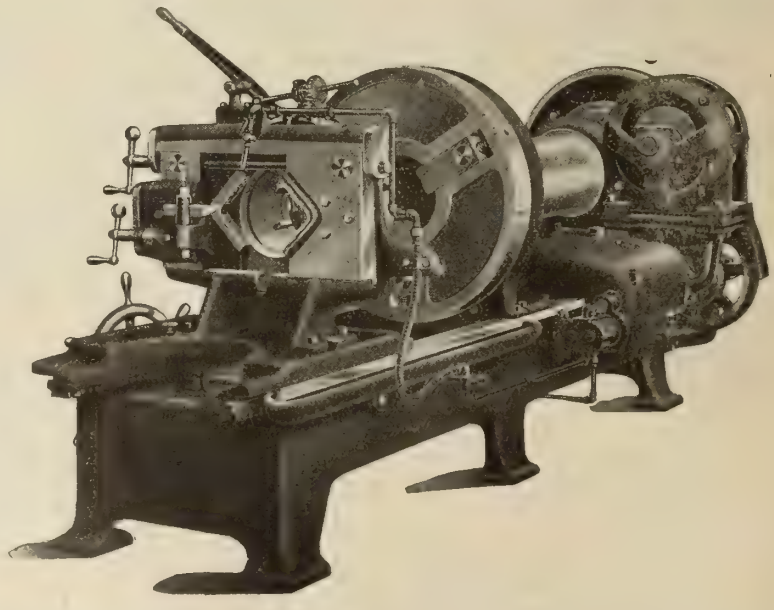
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MANUFACTURERS OF

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No. 6 Belt Drive
Capacity 1 ¼ to 6"
Built to
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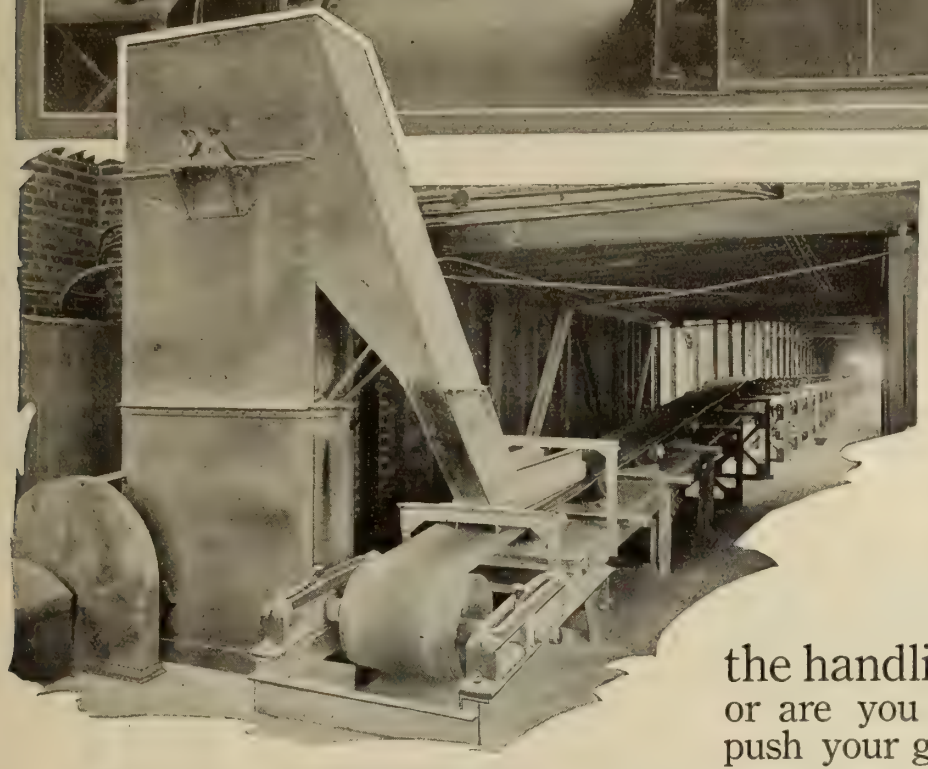
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Sizes
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Capacity 2½ to 8"

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We are specialists in designing and building mechanical conveyors for handling all materials, under practically all conditions. Our equipment can be found in almost every American Industry. Probably we can help you, as we have helped others. Get in touch with our nearest office. Catalog on request.

CANADIAN LINK-BELT CO., LTD.

WELLINGTON AND PETER STS.
TORONTO

LINK-BELT
LABOR-SAVING CONVEYORS

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Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

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by the
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High Grade STEEL Castings
Of Every Description

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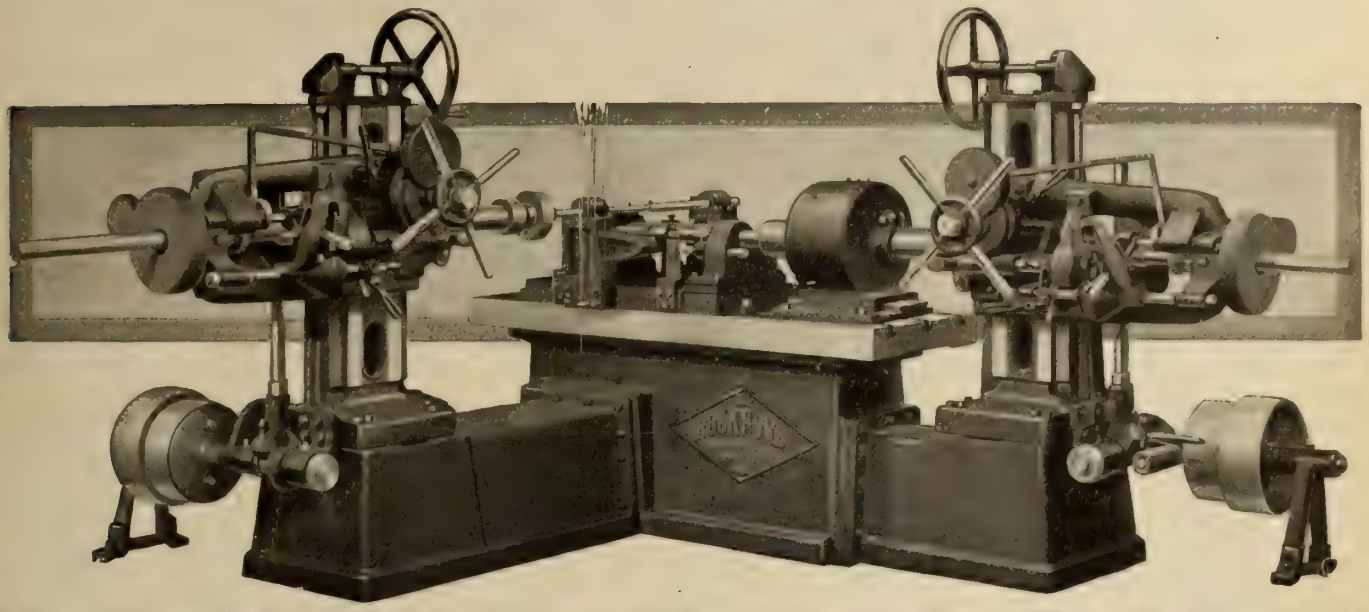
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Rockford Horizontal Boring Machine

For Automobile Manufacture

This tool is unusually rapid and accurate in the boring of crank cases, transmission cases and rear axles. Has two heads at right angles to each other. Spindles bore longitudinal and cross holes in work simultaneously.

Send us blue prints of your boring work and we will give you figures on the "Rockford's" ability on it.



The Rockford Drilling Machine Co., Rockford, Ill.

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STAR

QUICK CHANGE ENGINE

LATHE



12" x 6' STYLE H "STAR" Tool Room Lathe Mounted on Pan

Your operator is handicapped with poor machinery. His wasted effort is consuming your profit, so in order to get the most out of your operator you must get the most out of his machine. The more you get out of the machine, the more profitable is his day's work.

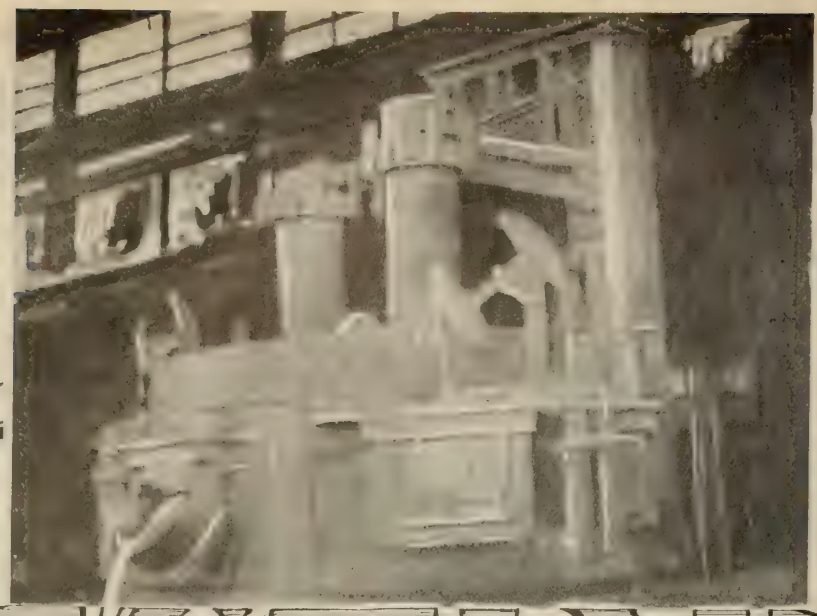
Star Lathes will overcome your deficiencies. They will save space, money and power. 12" x 6' style H Star is of very high grade and suitable for tool room work of most exacting nature.

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High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

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URANIUM

SaBeN ExTrA
HIGH SPEED STEEL

The Highest Achievement
of British Tool Steel
Metallurgy



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MONTREAL TORONTO NEW YORK

Dunbar

Springs *for* Every Use



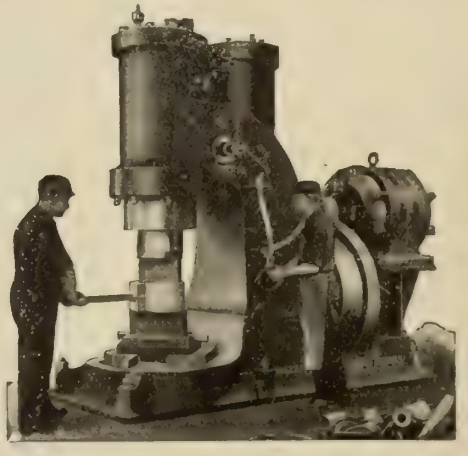
We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.

Tell us the purpose for which the spring is intended, and our experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for accuracy and quality. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
BRISTOL, CONN.

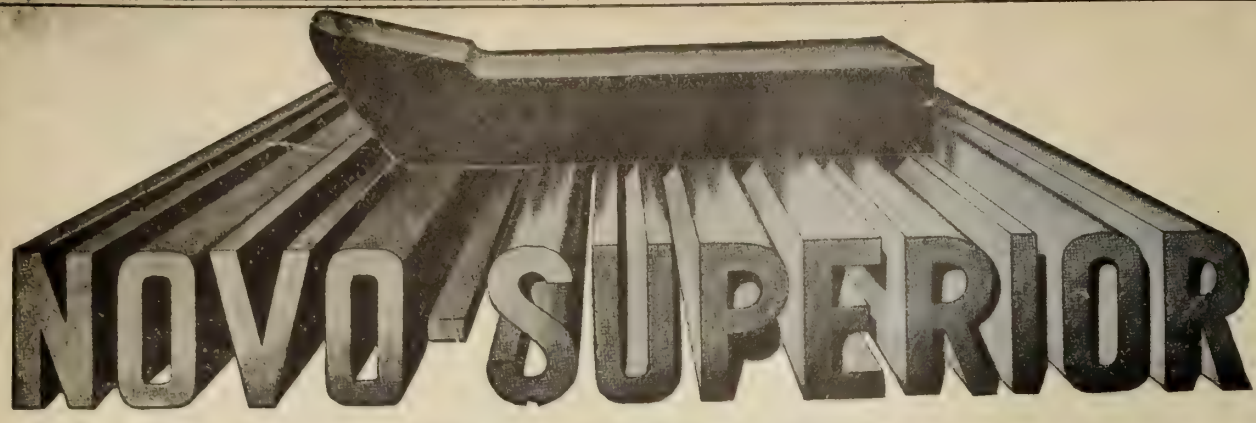
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(A Self-Contained Unit)
Noted for Its Blow and Control



The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

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Tool Steel for Every Purpose

SWEDISH LANCASHIRE IRON.

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
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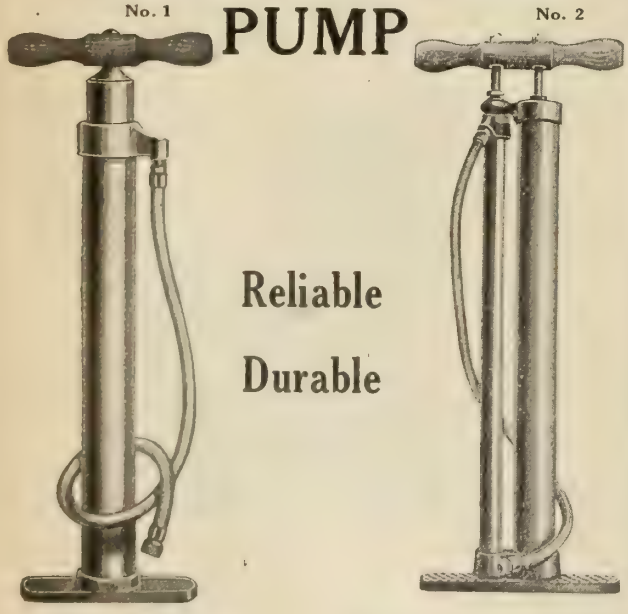
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Circular Saws—for wood and for hot or cold metal cutting
Machine Knives—for cutting wood, paper, tobacco, agricultural.

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Sole Agents for JONAS & COLVER, LIMITED Novo and Continental Steel Works, Sheffield, Eng
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Insist on Getting a

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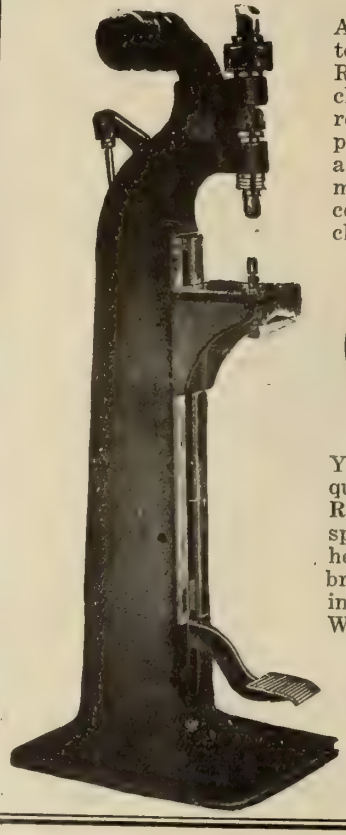
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No Cylinder Double Action

Double Barrel Compound Pump

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No Skill Required



Anybody with ordinary intelligence can operate this Rotary Rivet Spinning Machine. No special skill is required. It is a tool that perfectly fits labor conditions as they exist to-day. A woman could operate as successfully as the skilled mechanic who went to the front

The GRANT is Noiseless

You are assured of perfect quietness wherever the **Grant Rotary** is running. And it spins a perfect polished rivet head every second without breaking or marring the casting. Rivets tight or loose. Write for details.

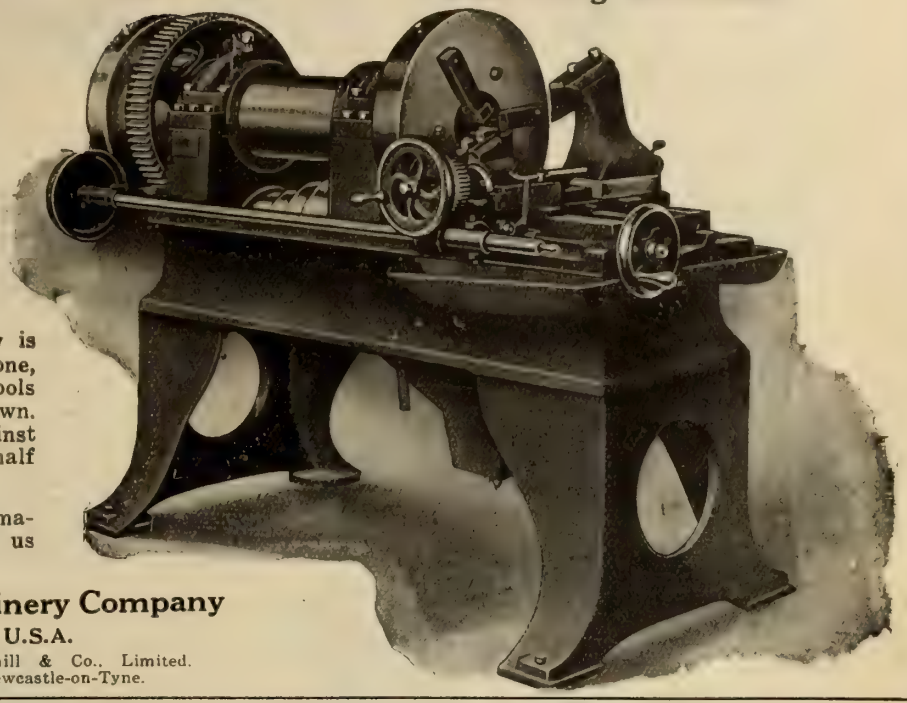
The Grant Mfg. and Machine Company
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Bridgeport, Conn., U.S.A.

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HURLBUT'S

Patent Cutting-off and Centering Machines



TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.

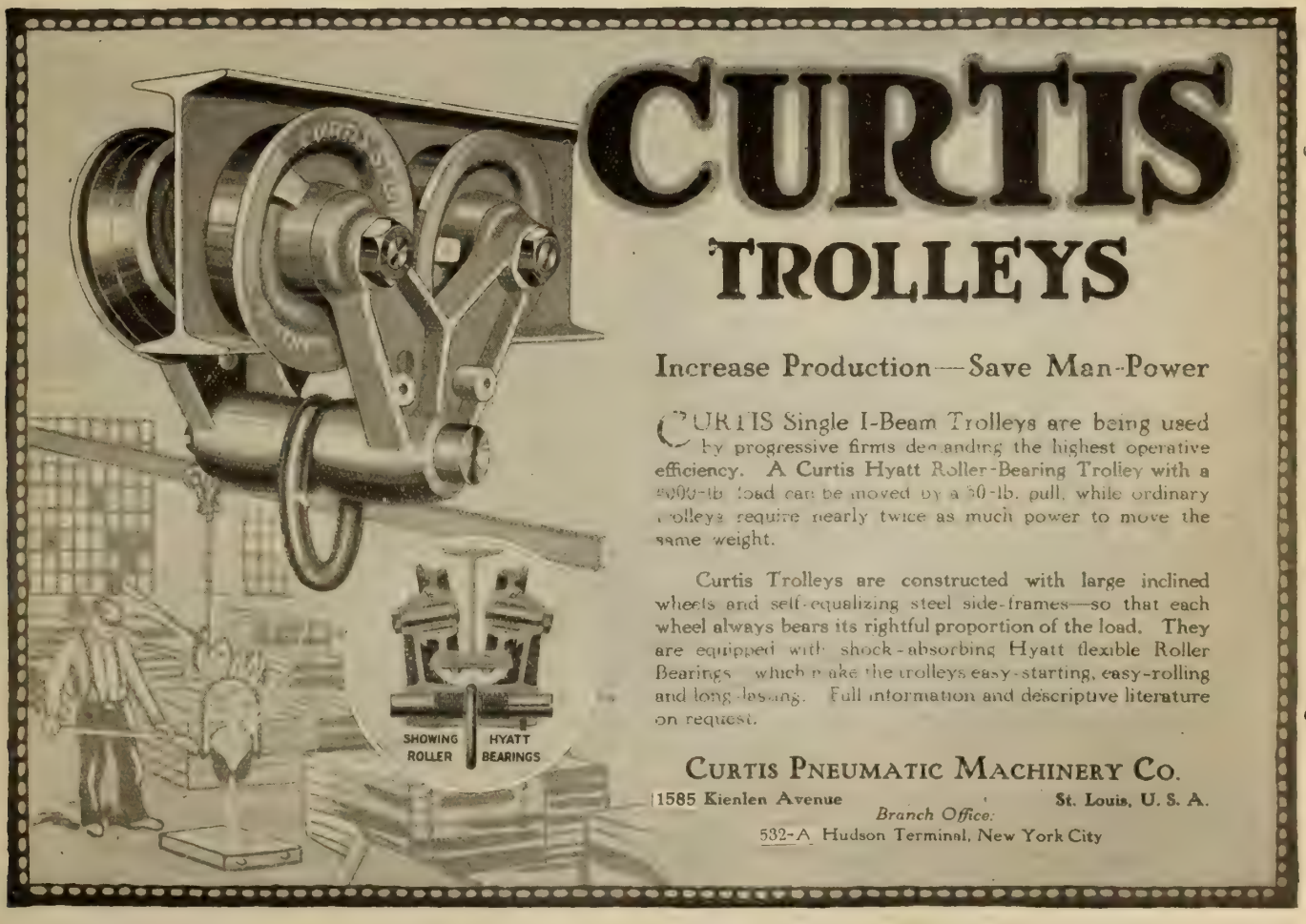
Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and do twice the work.

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South Sudbury, Mass., U.S.A.

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Increase Production—Save Man-Power

CURTIS Single I-Beam Trolleys are being used by progressive firms demanding the highest operative efficiency. A Curtis Hyatt Roller-Bearing Trolley with a 5000-lb. load can be moved by a 50-lb. pull, while ordinary trolleys require nearly twice as much power to move the same weight.

Curtis Trolleys are constructed with large inclined wheels and self-equalizing steel side-frames—so that each wheel always bears its rightful proportion of the load. They are equipped with shock-absorbing Hyatt flexible Roller Bearings which make the trolleys easy-starting, easy-rolling and long-lasting. Full information and descriptive literature on request.

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THE HIGH SPEED STEEL

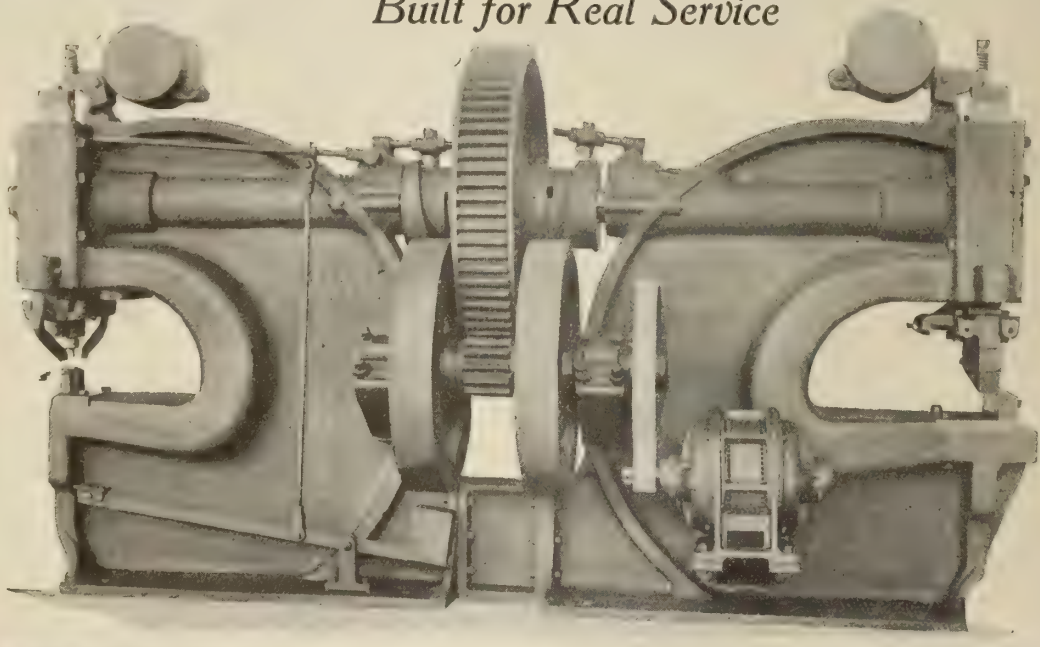
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We also manufacture High Grade Horizontal and Vertical Rolls, Angle Rolls, Single Punches, Shears, Spruce Cutters Radial Wall Drills or Counter-sinking Machines, Flanging Clamps and Heavy Duty Engine Lathes. *Ask for Catalogue.*

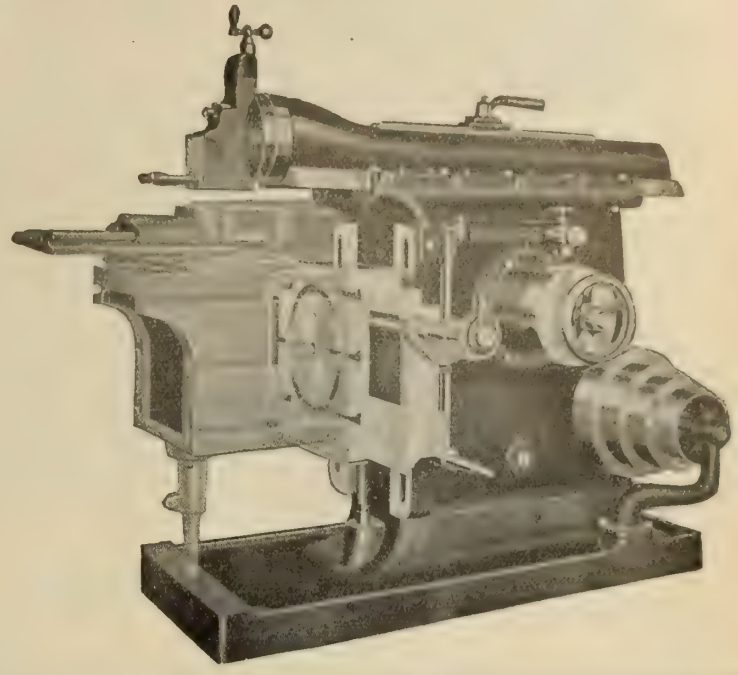
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Are needed in Up-to-date Canadian Shops

Milwaukee simplicity, power and accuracy play an important part in turning overhead expense into profitable production.

Milwaukee Back Geared Crank Shapers are built in 16-inch, 20-inch and 24-inch sizes.



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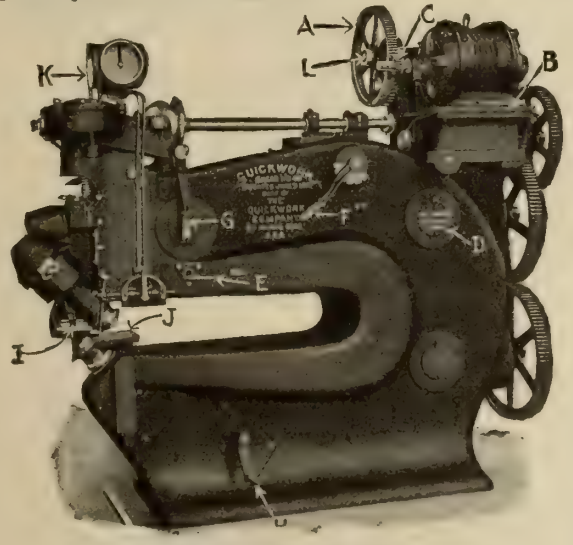
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ROTARY SHEARS

MADE IN 7 SIZES.

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



Patented June 3rd, 1913.

SAVES 50% TO 90%

Eliminates Oxyacetylene Cutting and Plate Planing.
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The Babbitt Metal that's at the Front in Efficiency and Economy



Order a Box from our nearest Factory

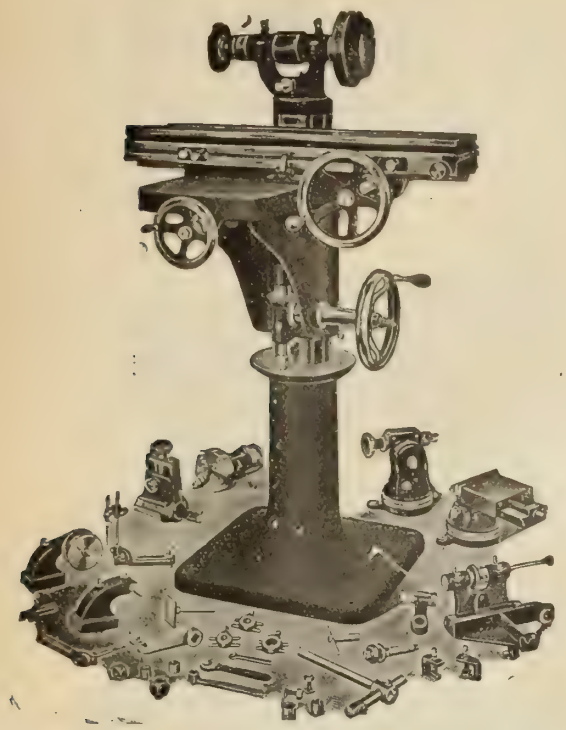
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The Greenfield Universal Grinder

For General Tool Room Work

This grinder is furnished with attachments for grinding all sorts of milling cutters, reamers, counterbores, and other machine shop tools.

It is also suitable for cylindrical, internal and flat work which frequently turns up in the making of tools and jigs.

These attachments are all very simple in design and easily adjusted upon the machine, being graduated so that any desired angles can be at once obtained.

The whole machine is thoroughly well built, well finished, and will be found a dependable, convenient grinder.

Greenfield Machine Company
GREENFIELD, MASS., U.S.A.

The "PINK" Line Logging Tools and Handles



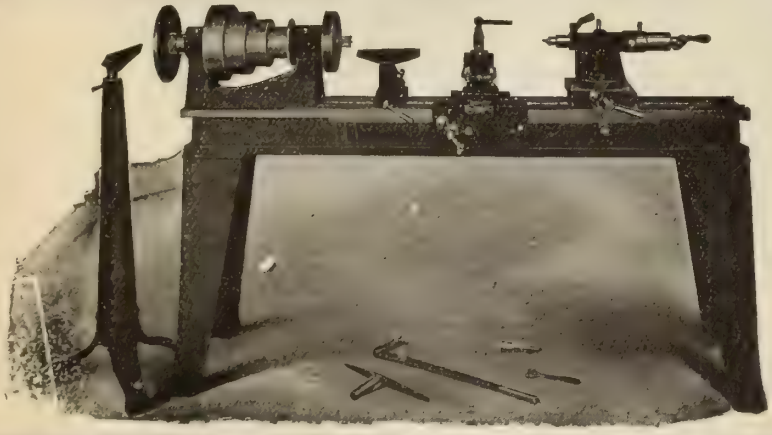
MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

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A Favorite—

Blount Pattern-makers' Lathe

FAST AND ACCURATE—Equipped with set over swivel tailstock and carriage, and outside face plate and tripod. Built in 16" swing with beds 6 or 8 feet in length. Spindle is made of high carbon steel, is hollow and fitted with Morse Taper and runs on self-oiling bronze bearings.

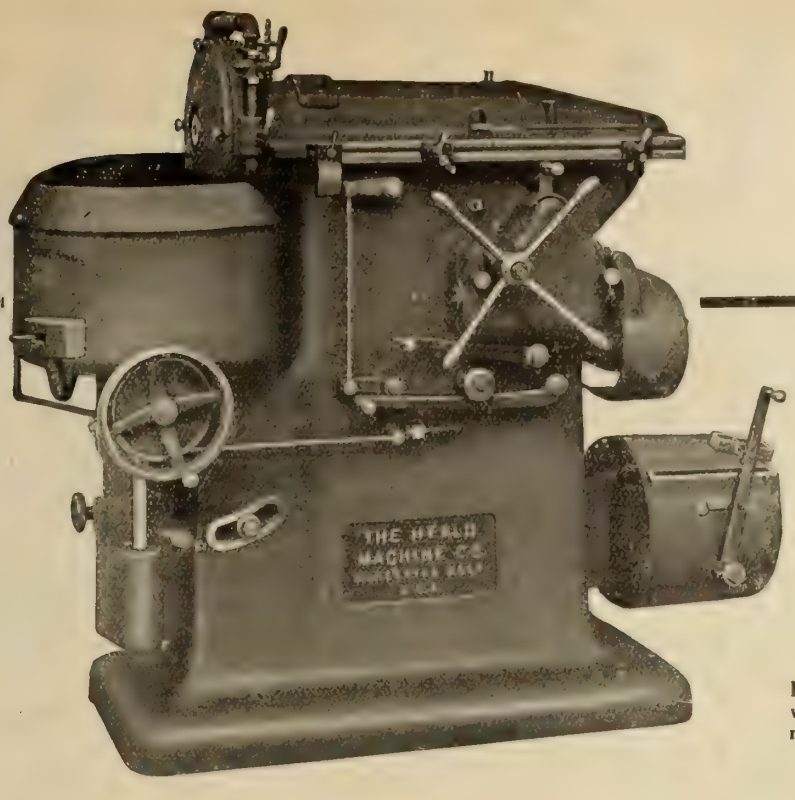
Our catalog gives a full description of this strong and highly efficient machine, also our other quality speed lathes and grinders. Give us your address.

J. G. BLOUNT COMPANY
EVERETT, MASS., U.S.A.

GRIND WITH A

HEALD

AND BE SURE



GRIND WITH A

HEALD

AND BE SURE

Built in two sizes, with 8" and 12" magnetic chucks

THE LAST WORD ON ROTARY SURFACE GRINDERS

The new HEALD No. 20 and No. 21 machine is a simple, productive and accurate rotary surface grinder. That the new machines meet the first requirements can be seen from the photograph above. In regard to production and finish, experiments have proven these new machines have no equal in the field to-day.

The WHEEL SIDE is a massive casting having a flat and "V" way insuring continued alignment. Bearing surfaces are large and well protected. Spindle belt operates with a downward pull; an important factor in rigidity.

The chrome nickel WHEEL SPINDLE is mounted in large bearings, all adjustments of which are made at grinding wheel end through an opening in top of slide.

The MAIN DRIVE UNIT receives power from the main line by tight and loose pulleys, transmitting it directly by belt to main speed box, wheel spindle and pump.

MAIN SPEED BOX, situated on the rear of machine, furnishes power to wheel slide by a 3-step cone, and operates the chuck, which has three speeds, through a bank of gears. Wheel slide and chuck are independent of each other, permitting a large latitude in speeds and feeds.

Chuck spindle is driven by spiral gears, one of which is mounted directly on the spindle. Spindle itself is mounted in a sleeve which has vertical adjustment. Upper portion rests in a taper bearing, lower end being equipped with ball bearings—wear is automatically taken up. All control levers and adjustments are within easy reach of operator.

Complete water apparatus is furnished with each machine; built in two sizes, 8 in. and 12 in., with Motor drive if desired.

Heald Magnetic Chucks are regular equipment.

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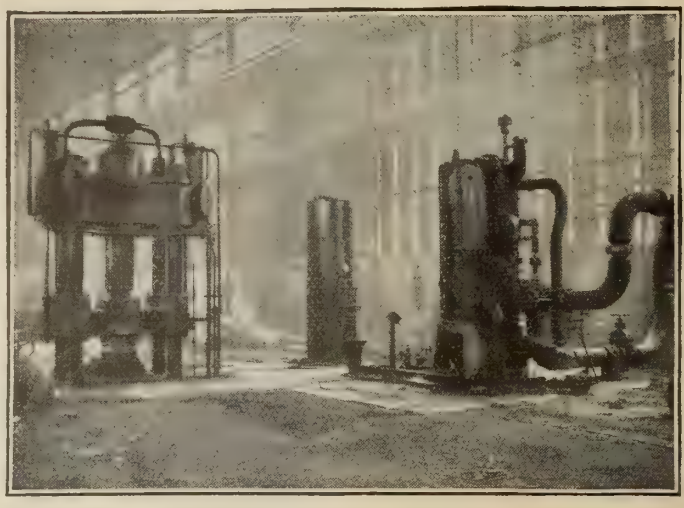
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ROLLING MILLS
FORGING PRESSES
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HOT SAWS
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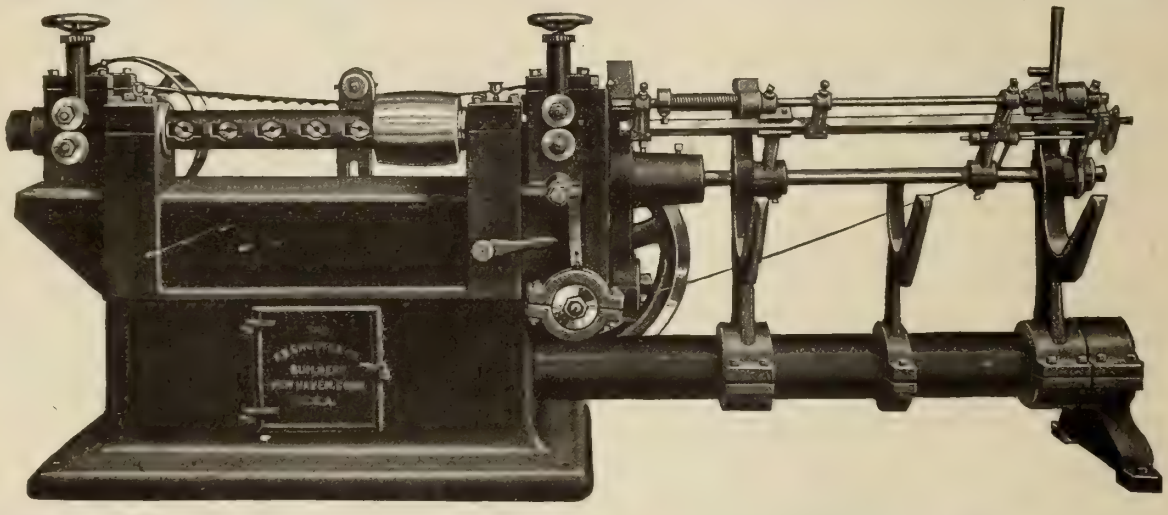


800-Ton Forging Press with Intensifier

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Tel. Address: Stewart, Glasgow. Established 1864



Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

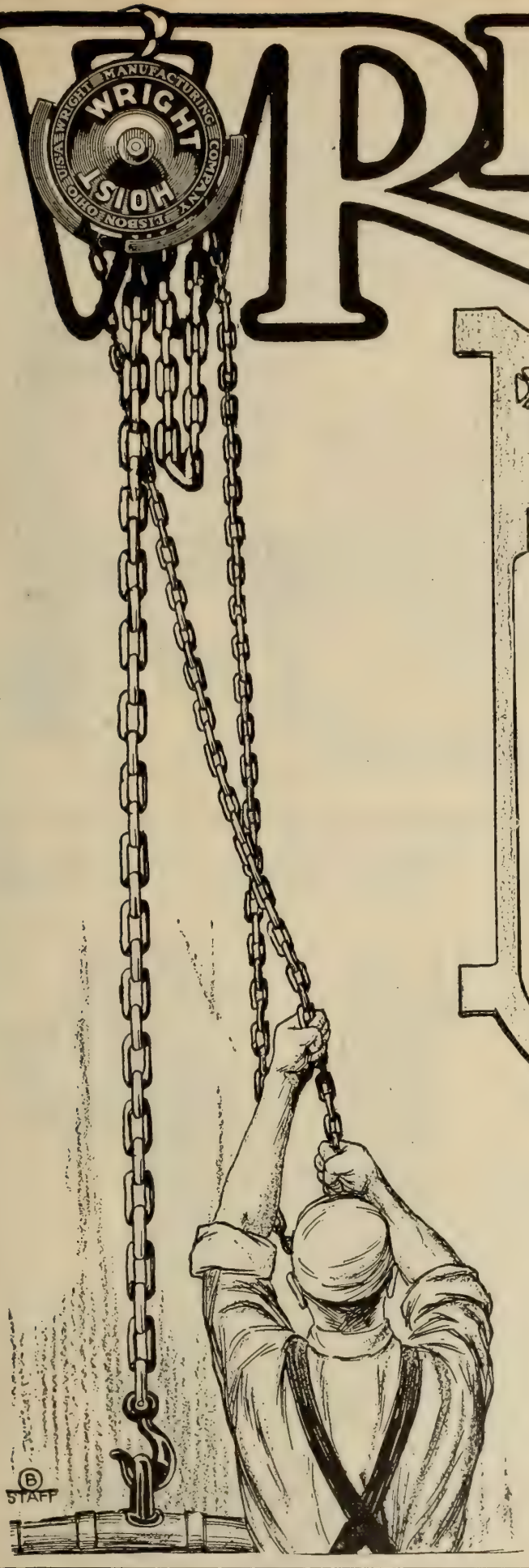
Catalogue tells more about them, and we will be glad to send you a copy.

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FORMERLY JOHN ADT & SON ESTABLISHED 1886

ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

WRIGHT HOIST



When you buy a hoist you want a

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because it is a specialist in strength, dependability and safety.

Made by the company that specializes in hoists.

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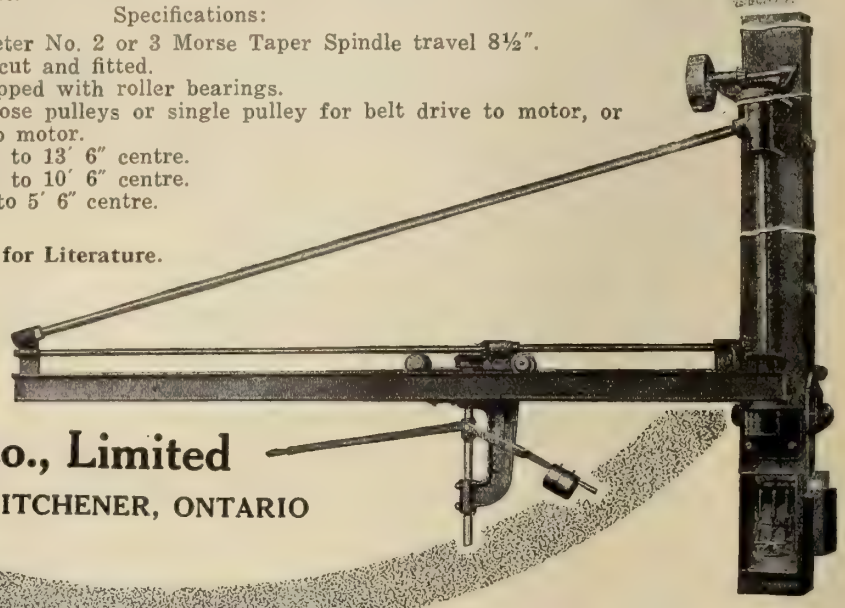
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The Canadian Radial Drill is designed particularly for work in structural shops. For seaming and countersinking large surfaces such as structural shapes, boiler plates, long beams, etc.

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Spindle 2 3/16″ diameter No. 2 or 3 Morse Taper Spindle travel 8½″.
All gears accurately cut and fitted.
Carriage wheels equipped with roller bearings.
14″ x 14″ tight and loose pulleys or single pulley for belt drive to motor, or direct connected to motor.
15 ft. Beam will drill to 13′ 6″ centre.
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Write Dept. 16 for Literature.



Canadian Blower & Forge Co., Limited

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RICKERT - SHAFER TAPPERS

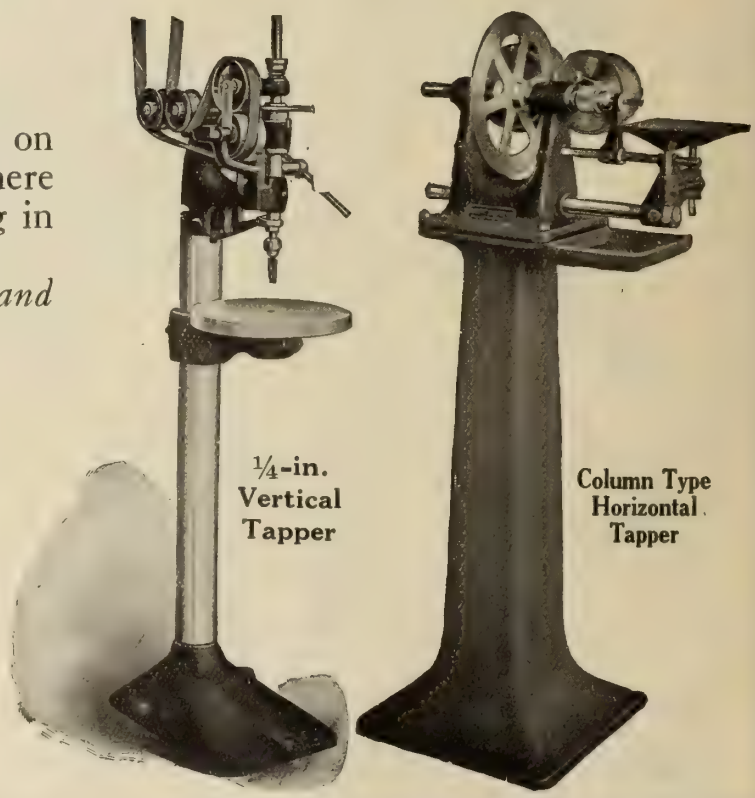
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The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on ⅝-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.

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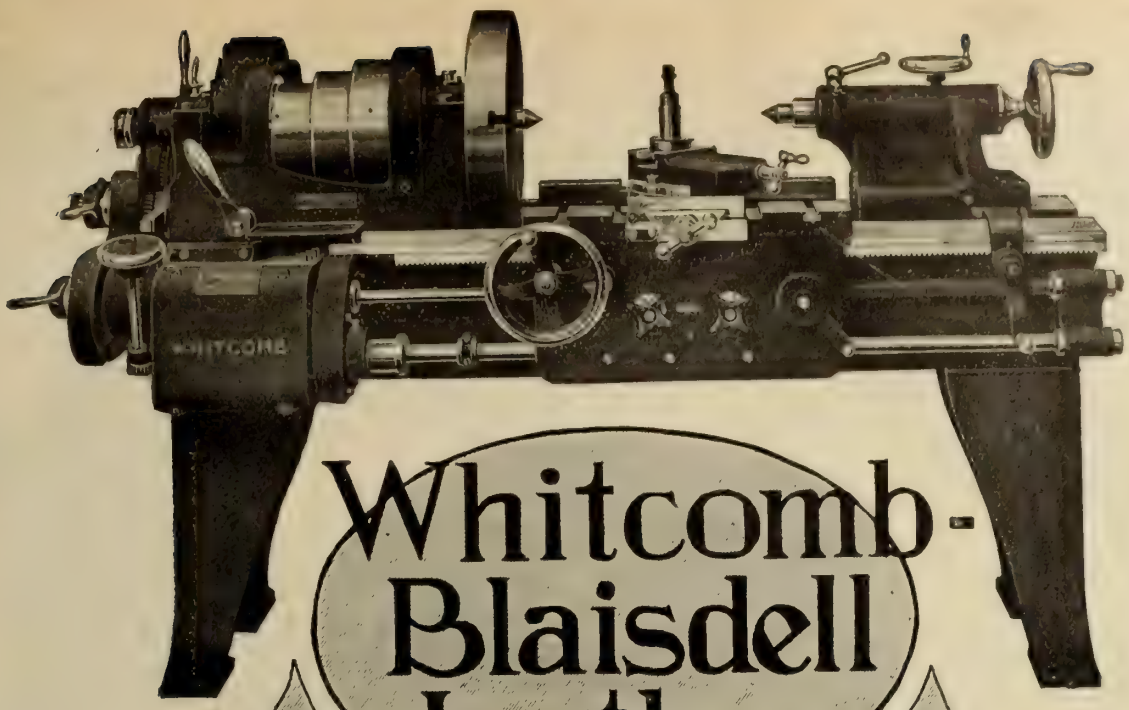
¼-in. Vertical Tapper

Column Type Horizontal Tapper

The Rickert-Shafer Co.

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FRED HERBERT, Foreign Agent, Coventry, England.



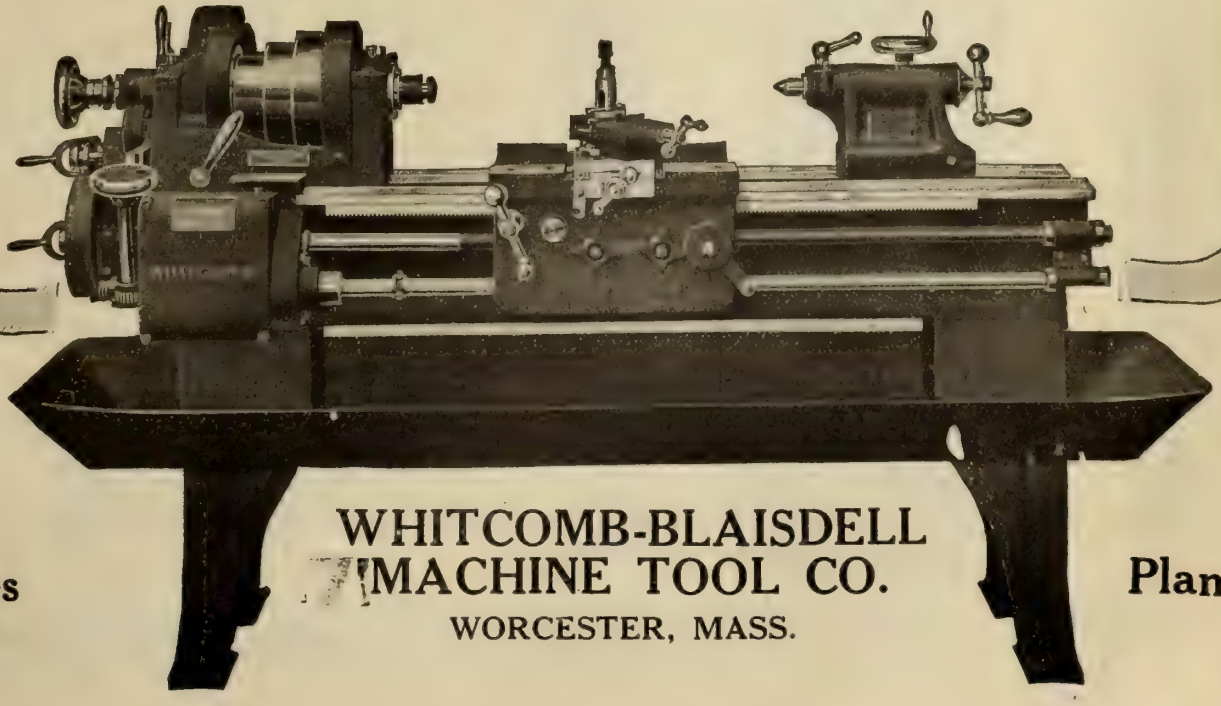
Whitcomb-Blaisdell Lathes

POWERFUL, WELL-BALANCED MACHINES THAT ARE LIGHT-RUNNING AND ADAPTED TO ALL CLASSES OF **RAPID MANUFACTURING.**

Every feature of the W-B Lathe of to-day has been considered from the viewpoint of greatest utility. Materials used embody toughness and durability. Our tests must prove great wearing quality and strength before any material is selected.

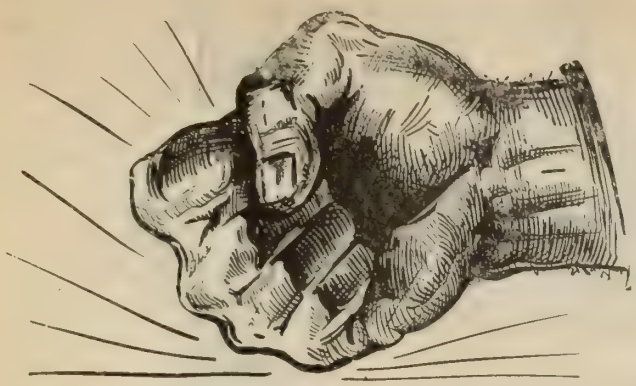
The product of an organization that has for sixty years been distinguished for the superior design, workmanship and material of its product.

Write for our latest catalog describing all of the good features of Whitcomb-Blaisdell Lathes



Lathes **Planers**

WHITCOMB-BLAISDELL MACHINE TOOL CO.
WORCESTER, MASS.



THE "RACINE"

puts PUNCH into Metal Cutting Operations



HAVE you a metal cutting proposition that needs more driving force? The "RACINE" High Speed Metal Cutting Machine is the machine you need! No other machine can approach it for putting **punch** into production. Patented automatic lifting device raises the blade on the return stroke, preventing dragging and strain on the non-cutting stroke. This means greater cutting speed as well as a saving in blades and a saving in power. **Can you afford to operate any other machine?**

With the "RACINE" use H.S. Tungsten Power Blades.

Standard the World Over

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Use "RACINE" H.S. Tungsten Blades



"HUNTER"

PNEUMATIC HAMMER RIVET SETS AND CHISEL BLANKS

The Shanks of our Rivet Sets are faced to a slight radius. This insures the piston coming in contact in line with the axis of set, increasing the effect of piston stroke on rivets, a particular advantage when hammer cylinders are worn, with a marked reduction in shank breakage.

Standard Chisel Blanks are made from $\frac{3}{4}$x9" or $\frac{7}{8}$x8" Octagon Steel. Standard sizes and types carried in stock.

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Hunter Saw & Machine Co.

PITTSBURGH, PA.

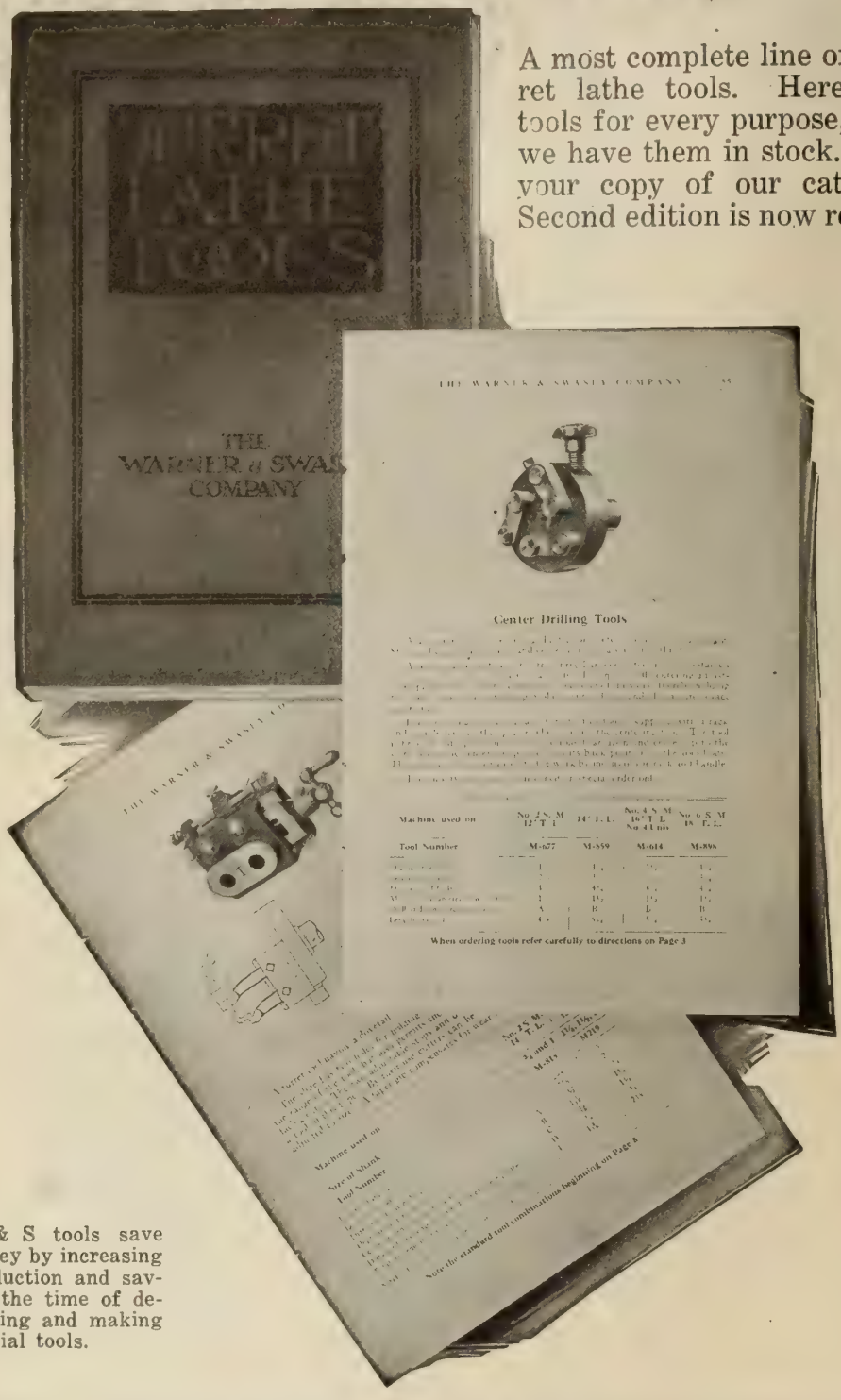


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42—7

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A most complete line of turret lathe tools. Here are tools for every purpose, and we have them in stock. Get your copy of our catalog. Second edition is now ready.

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The Brand That Has The Quality

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Here's a "Landis" that sold twenty-six others "right off the bat." Read the story: At the Camden Heating Co.'s plant, Camden, N.J., there's a shop foreman who knows threading from A to Z. There is also a Double Head Landis Threading Machine that has been handling all kinds of work for the past five years. Not long ago a friend with an order to place dropped in at the shop to ask the foreman which was the best threading machine he could buy. The foreman said "Landis" and explained why. He got out the "Landis" catalogue, pointed out the advantages of "Landis" design and construction, showed the Landis machine in action, and finally put into his friends hands a piece of "Landis" threaded work. **When that order for threading equipment went out, it called for twenty-six Landis machines.**

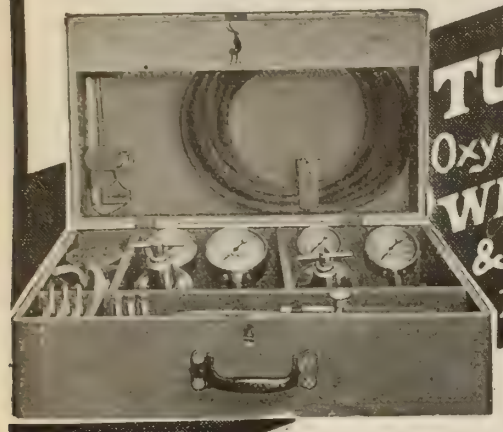
Landis machines are rapid, rigid, durable, dependable. Landis dies cut accurate threads in any material, increase production and reduce threading costs. Write for latest Landis catalogue.

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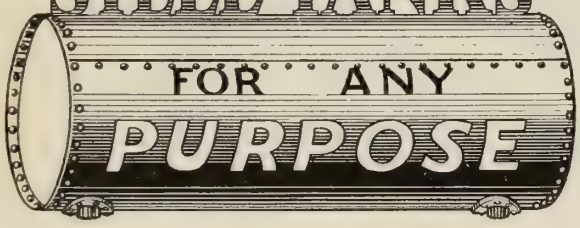
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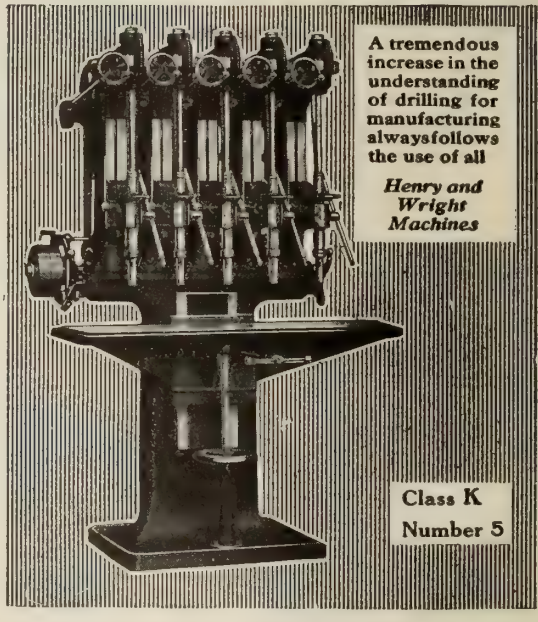
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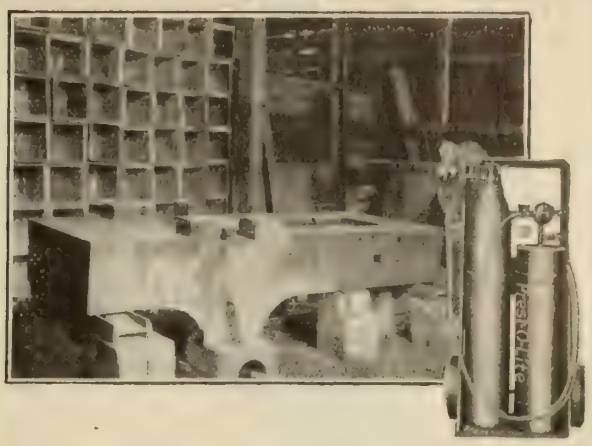
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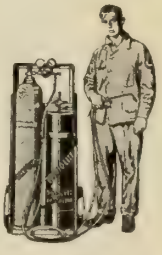
Write for it.

Address Department C-107.

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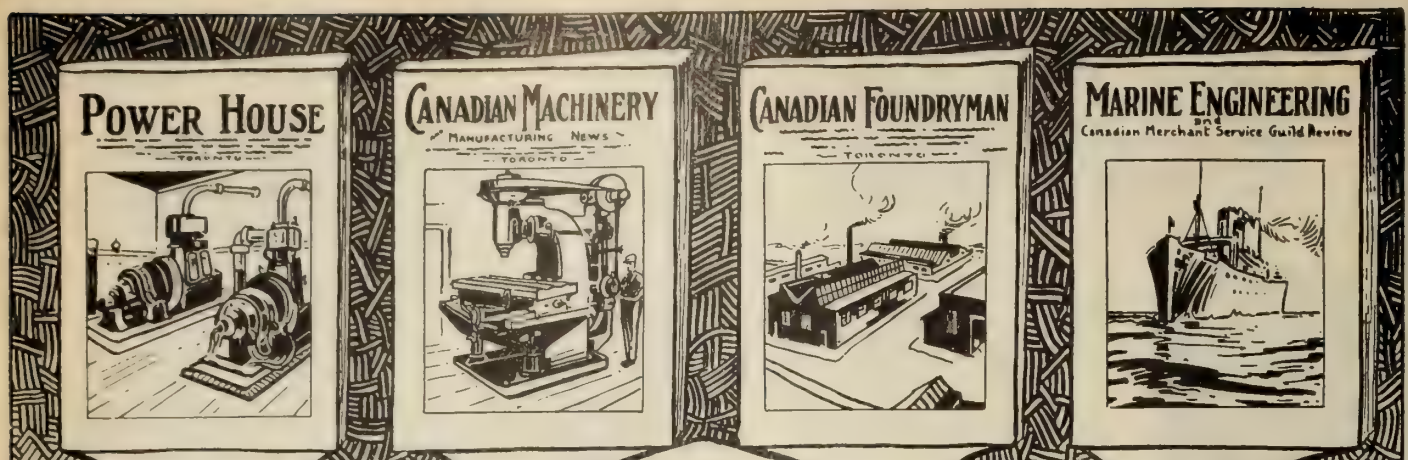
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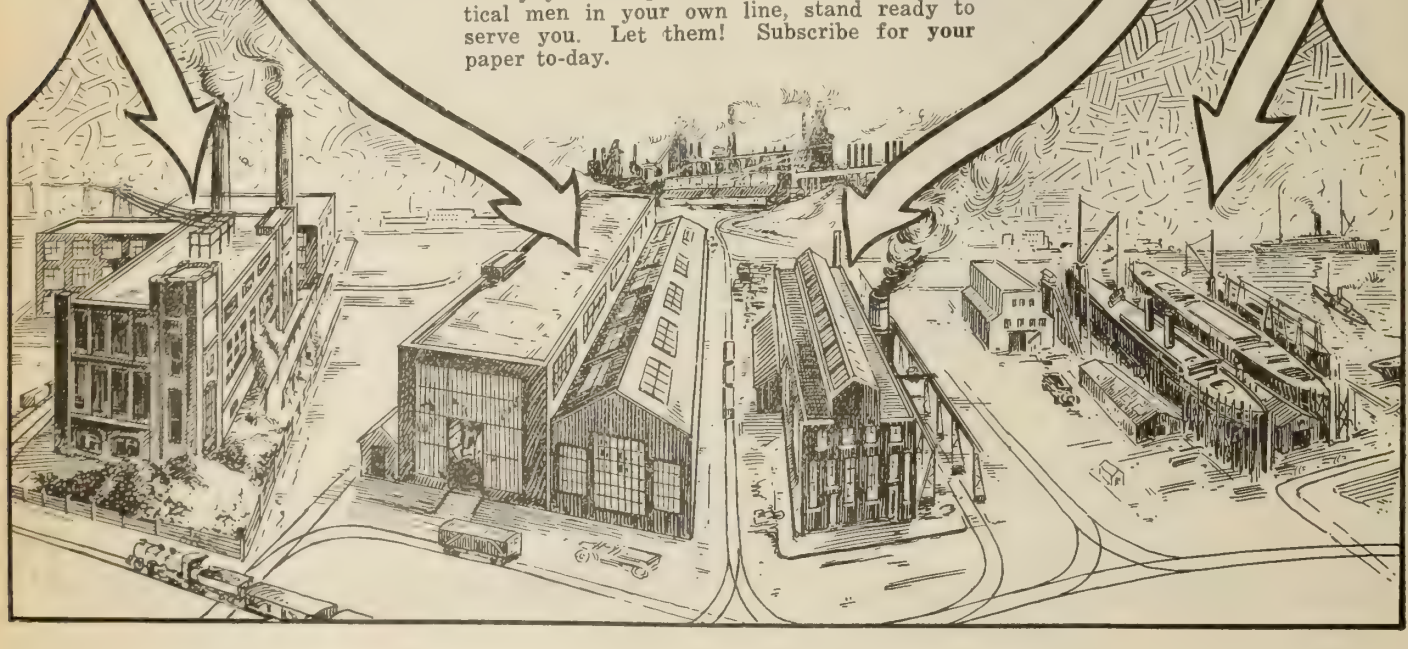
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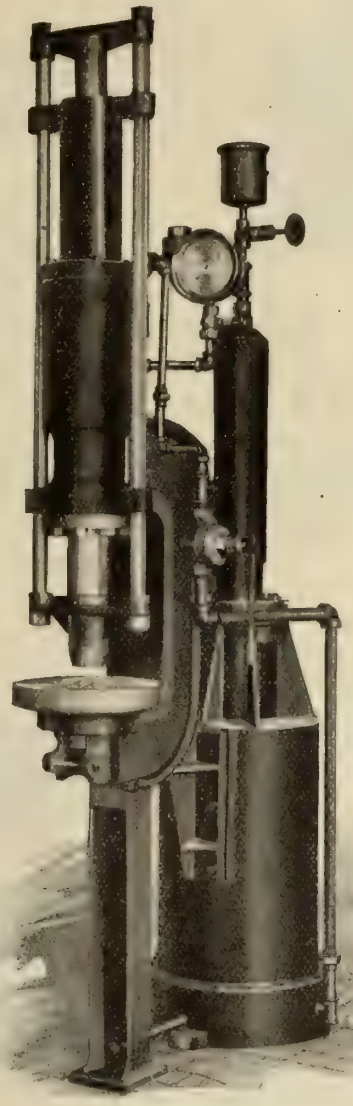


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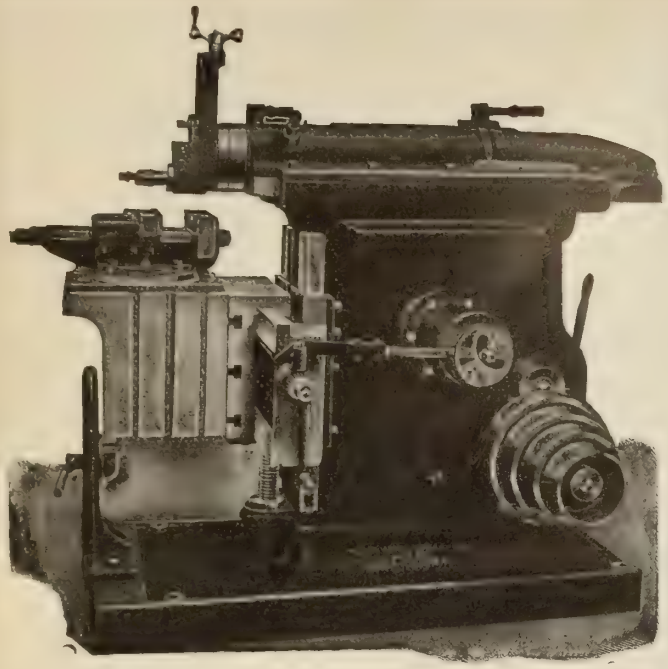
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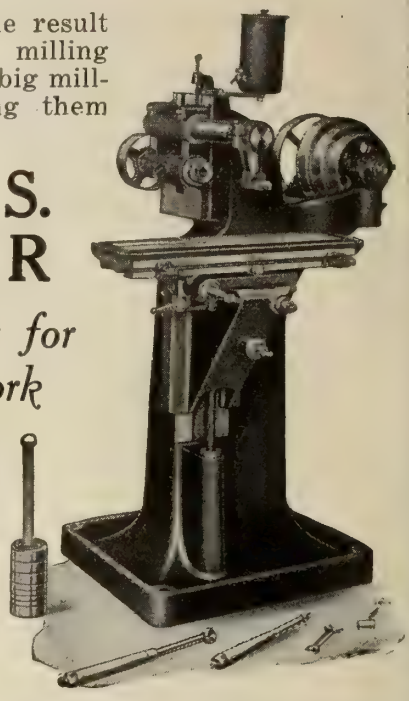
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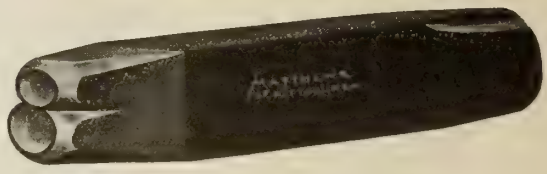
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The compound rest which has no overhang is as stiff as any plain rest. The Saddle Bearings are extra large. These and many other features make the Walcott an unusual Lathe.

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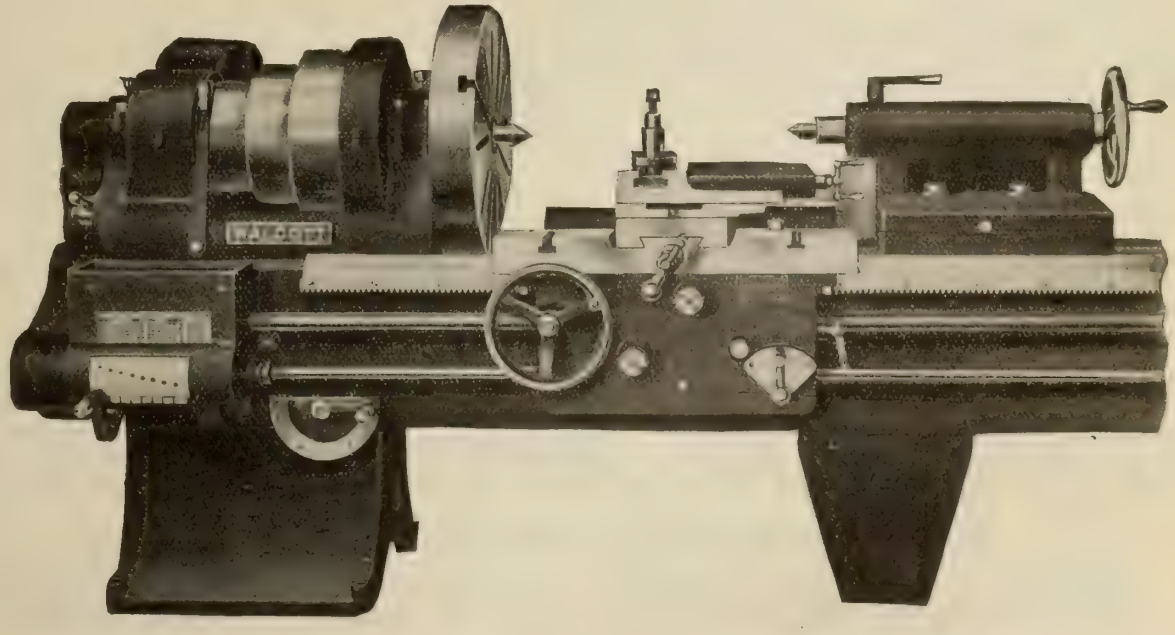
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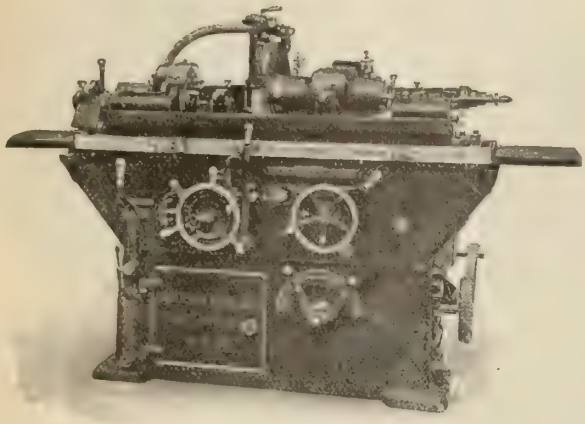
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MODERN PLAIN GRINDERS

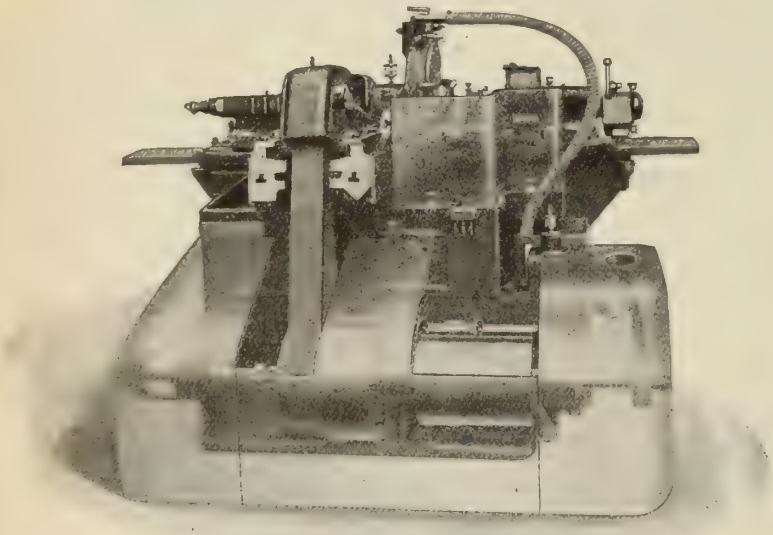


Front View Modern 8" x 30"

Flat Spots Eliminated By Perfect Work Drive

Modern drive is positive. The work cannot stop—cannot even hesitate. Modern work drive is through a Morse Silent Chain, which makes "flat spots" and "spoils" impossible through stopping of the work.

This also does away with renewal and replacement of belts—a very costly item, as some of you may know from experience. This means, too, the elimination of stops for renewal or adjustment of belts, also an occasion of considerable annoyance and expense.



Rear View Modern 8" x 30"

This is but one of the reasons for Modern Superiority. Others may be summarized as follows:—

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All Modern Plain Grinders are full self-contained—ready for single pulley or motor drive as soon as set. They are also fully guarded—no extra expense for installations to conform to safety requirements.

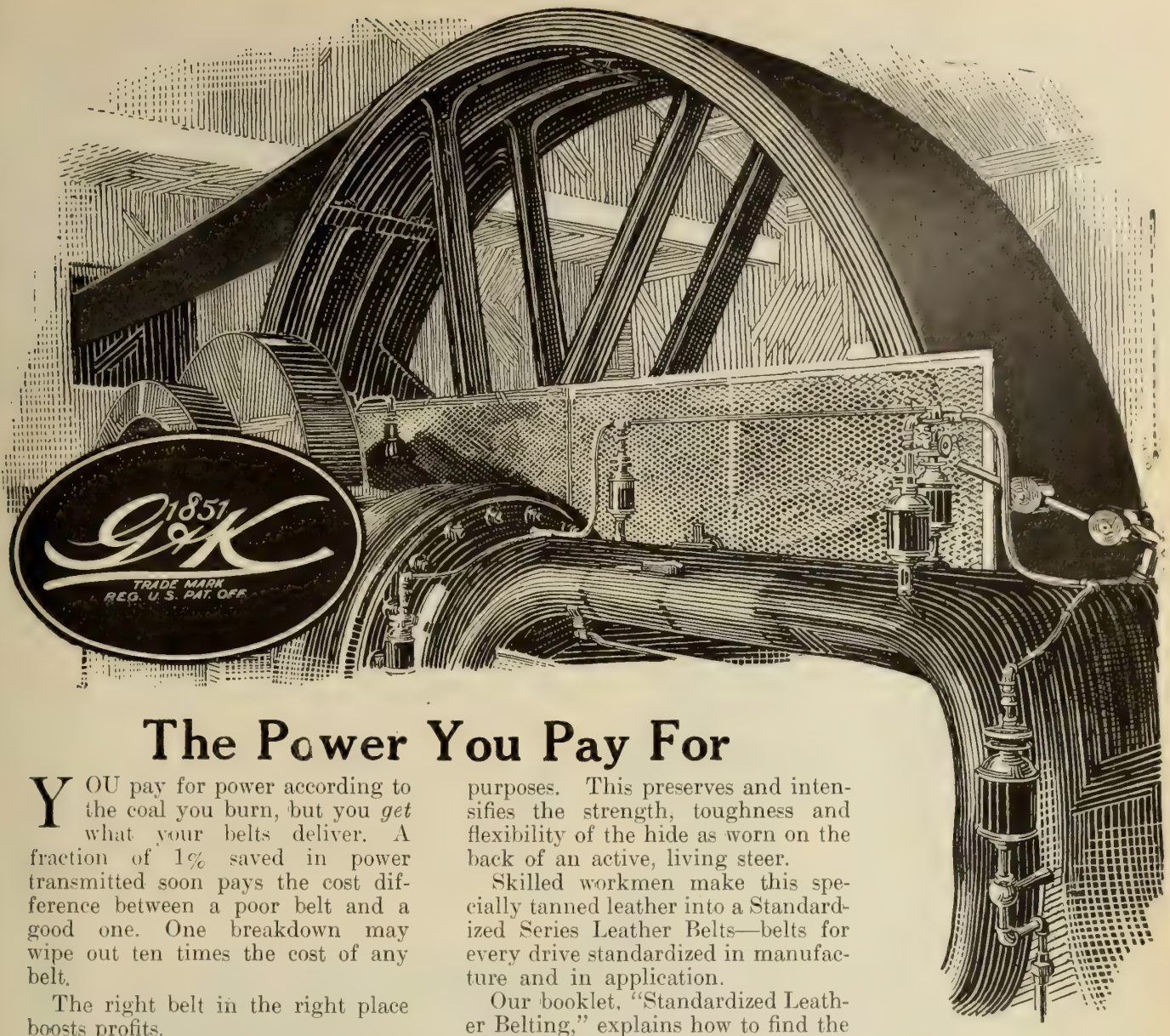
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Among Graton & Knight Leather Belts there are *right belts* for every drive, belts that will deliver maximum power year in and year out without a halt.

They do this because they are made from leather—tanned in our own tannery especially for belting purposes. This preserves and intensifies the strength, toughness and flexibility of the hide as worn on the back of an active, living steer.

Skilled workmen make this specially tanned leather into a Standardized Series Leather Belts—belts for every drive standardized in manufacture and in application.

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Engineering Note

Our Engineering Department is at your service to answer any questions you may have about belting and its use. There is no obligation involved.

Here is a 48" 3-ply Heart Brand belt in the mill of Joseph Bancroft & Sons Co., Reading, Pa. More than 3½ years of steady service. Transmitting 300 horsepower at a cost to date of less than one cent per week and good for many years more.

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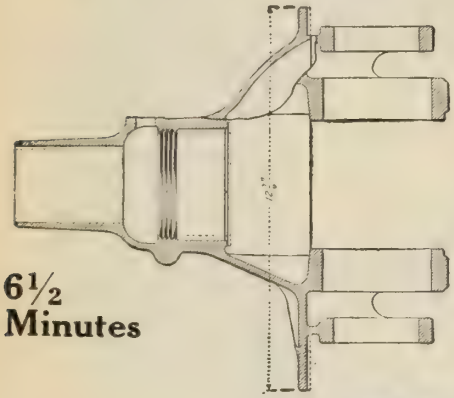
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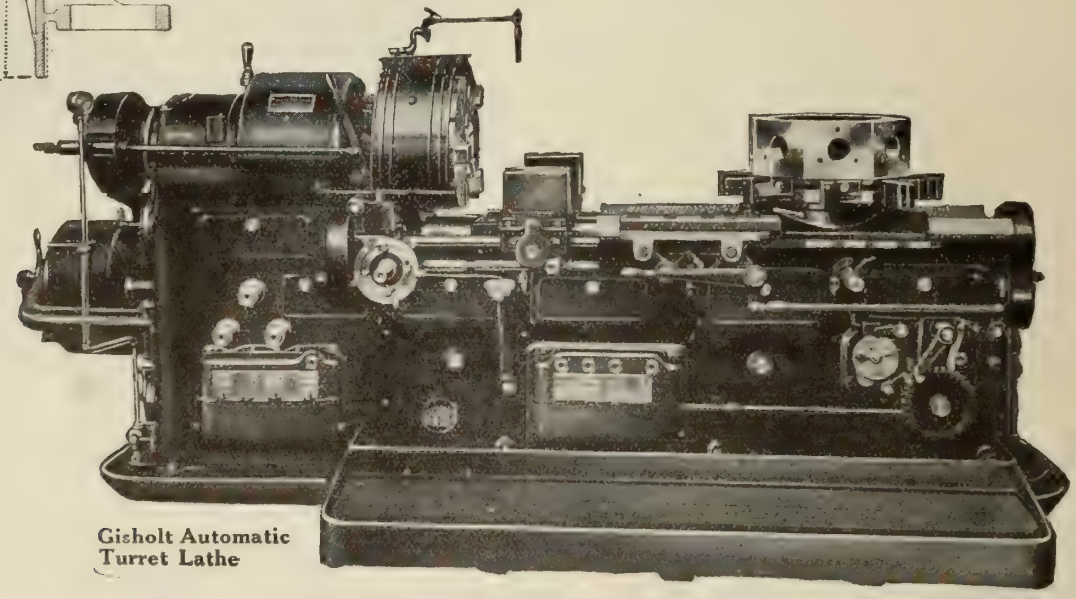


6½ Minutes

This is a typical Gisholt Automatic piece, finished in typical Gisholt time.

Note the amount of work performed in the time named.

Compare this production with your own on all your chucking work and let us tell you how this machine will help you increase your production and reduce your costs.



Gisholt Automatic Turret Lathe

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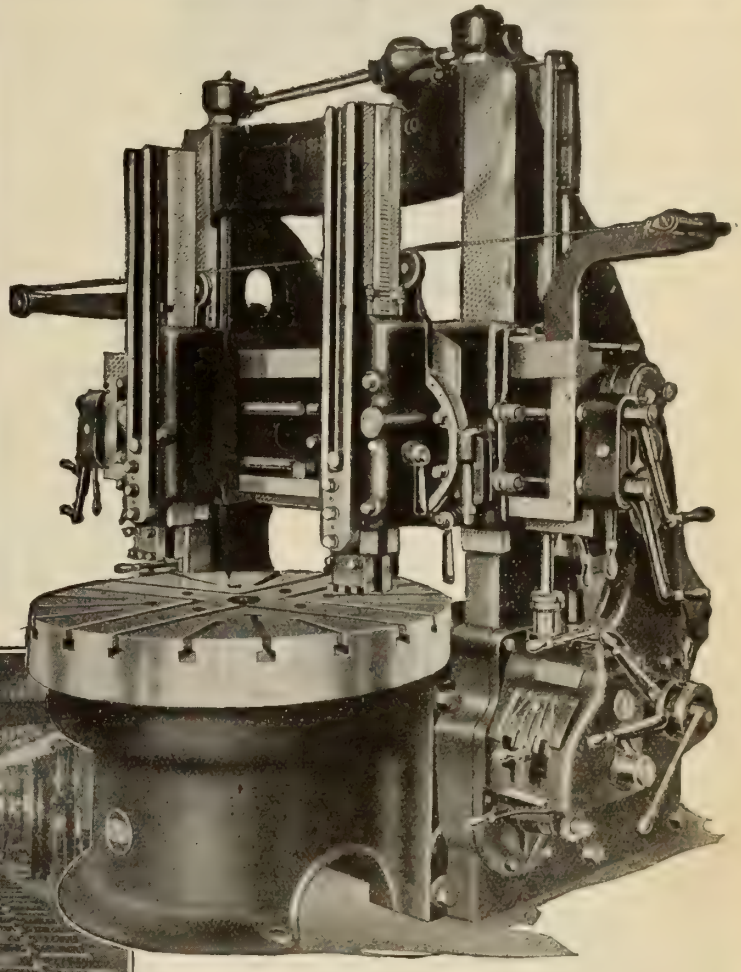
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Come and See
where they are made

Personal inspection of Gisholt facilities and methods will establish confidence in Gisholt Boring Mills.

Machines planned and built the way they are turned out at Madison cannot help but make good, beyond expectation, in your shop.

Gisholt Boring Mills bring big revenue to their users. They yield the greatest returns per dollar of investment.





Gisholt Methods Insure Accuracy and Economy

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII. No. 1 January 1, 1920

Using Compressed Air for Cleaning Purposes

Explaining How Walls, Ceilings, Windows, Shafting, Electric Motors, Generators, Transformers, Machine Tools, Patterns, Core Boxes, Benches, etc., Can be Quickly Cleaned by Compressed Air

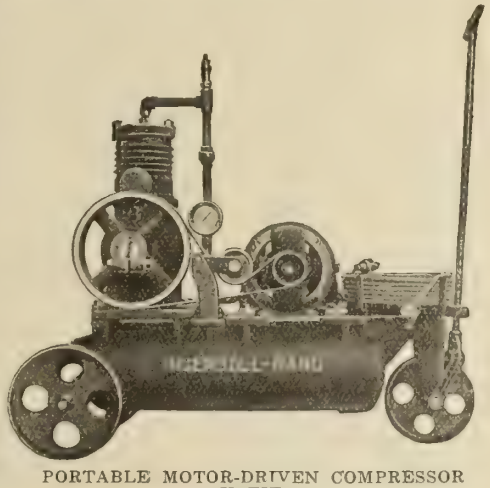
By F. A. McLEAN

THERE are many places in the modern machine shop and industrial plant where compressed air can be appled to considerable advantage for such work as cleaning walls, ceilings, windows, shafting, electric motors, generators, transformers, machine tools, patterns, core boxes work benches etc., as well as for blowing scale from steam hammers, stamping dies, drop presses, etc. One blast of compressed air, properly directed, will instantly clean the cuttings from a bored or drilled hole that would require the expenditure of many minutes' time by the old method of fishing them out with a magnetized file, or a piece of wire, and at the same time the lathe, milling machine, boring mill, or drill press, can be kept entirely free from chips and dirt without the necessity of using a brush or pieces of cotton waste. The equipment is simple and easily installed, and it is usually found that its first cost is quickly absorbed by the reduction in fire hazards and the added convenience and increased efficiency of the plant as a whole.

Most metal working concerns now use electrcity extensively, some operating their own plants, and others using power obtained from central stations or Hydro-electric plants, and it is often found that the motors become clogged up with dust and dirt, causing them to heat up through the reduction of the openings provided by the manufacturer for ventilating purposes, and increasing the liability of burned out coils should they be overloaded at any time, as the additional heat cannot be readily dissipated. Sometimes the motor bearings are oiled too much and the surplus oil gets into the windings, and combines with the dust and dirt to form a mixture whch readily absorbs moisture and shortens the life of the insulation, causing short circuits or grounds to the frame.

While all motors should be cleaned frequently, those installed in foundries and pattern shops, or in places where dust and moisture is always present, should receive more careful attention. Unfortunately, cleaning by hand is often exceedingly difficult, as the ventilation openings are usually too small to admit a brush, and the motors themselves are sometimes located on ceilings or in such cramped places where space in the building is at a premium, that it is almost impossible to get at them without a lot of trouble and inconvenience.

Under such conditions, the air jet has many features which make it of considerable value for this work. In shops where a stationary compressed air power plant is not already in use for operating air hoists, pneumatic tools, sand rammers, etc., a small compressor of the portable, or semi-portable type for belt or electric drive, with a capacity of 3 to 45 cubic feet of free air per minute, at a pressure of 100 pounds per square inch and a receiver holding from 50 to 150 cubic feet, (depending on the amount and frequency of the cleaning to be done), can be purchased at a reasonable price. Where a stationary compressor is already in use it will usually be more convenient to pipe the air about the plant, making suitable openings for hose connections in the various departments where the cleaning is to be done; although in the case of large plants it is sometimes a good plan to use a portable outfit as well. In large plants where there are a considerable number of motors in use, it is a good idea to number them consecutively by means of small brass tags attached to the frames, or by painting the number on the casing. These numbers should then be entered on cards on which a complete record is kept of the date each motor was inspected and cleaned, when it was repaired, and any other information which may seem desirable.

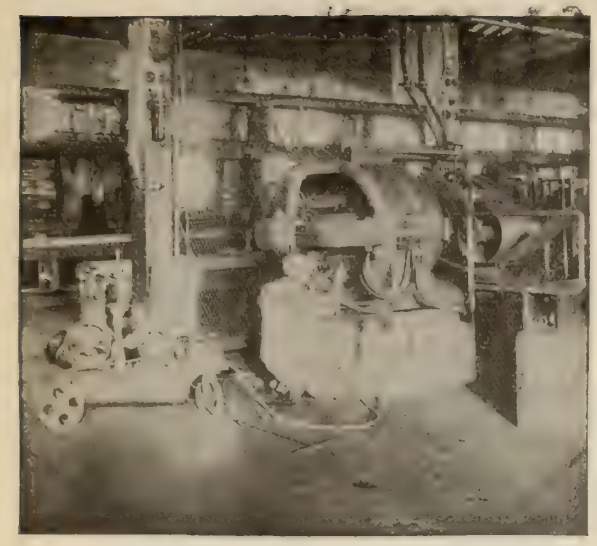


PORTABLE MOTOR-DRIVEN COMPRESSOR OUTFIT.

For blowing out motors and generators, cleaning machine tools, or blowing chips from drilled or bored holes, a nozzle of the blow gun type is the most suitable. The blow gun consists of a solid casting with a metal to metal valve seat, and having no springs, gaskets, or other delicate parts, it is durable, foolproof and not liable to leak. It is shaped in such a way as to lend itself to convenient handling, and the long lever makes it easy to operate, and the short lift ensures prompt closing of the valve when released.

These valves are obtainable with either metal or fibre nozzles of any desired length, the former being suitable for use around machine tools, or general use, while the later is designed for use on electrical machinery. The principal advantage of this type of valve is, that it does away with the necessity of kinking the hose to stop the flow of air, and operates considerably faster than the ordinary globe valve, with consequent saving in air consumption. In addition to the blow gun it is also possible to buy several styles of self-closing nozzles of more elaborate construction, which work on a somewhat similar principle.

After a motor or generator has been thoroughly blown out it is a good practice to spray the winding with a high grade of air drying varnish, at intervals of six months or a year, depending on



CLEANING A D.C. MOTOR WITH AN AIR JET.

the conditions under which the machine is forced to operate. Before putting on the varnish, which should be applied by a compressed air plant sprayer, it will be found preferable to thoroughly clean the windings with gasoline applied with the paint sprayer, or with a double-barrelled or atomizing nozzle. There are a number of different sizes and styles of paint spraying outfits on the market, and as they can often be used for finishing parts of the product as well as on many other painting jobs around the plant in addition to this work, they usually pay for themselves within a very short time, as the following examples tend to show: From tests made by a large stove manufacturer, it was found that one man with an air brush could paint 100 standard kitchen ranges with air-drying enamel while 30 or 40 were being done by hand. In an electrical equipment factory, a single air brush operator lacquers 3,000 electric light sockets per day, instead of 500 or 600 by hand. With 10 air brushes a maker of brass bedsteads finishes 400 beds daily. An expert hand-painter will enamel from 150 to 200 lamp shades in a day, while, with an air brush, an average workman will turn out from 800 to 1,000 pieces per day.

The outfit illustrated in figure 5 is known as the "Spraco" and has proved very satisfactory in the service of the N.Y.N.H. & H.R.R. for spraying electrical machinery, as well as painting with cold water paints, etc.

The grade and composition of the varnish to be used will depend on whether the motor operates under normal conditions, or is exposed to chemical fumes of either an acid or an alkaline nature. In any case it is best to get in touch with the manufacturer of the motor, giving him an idea of the conditions under which it is used, and then rely on his recommendations in this respect.

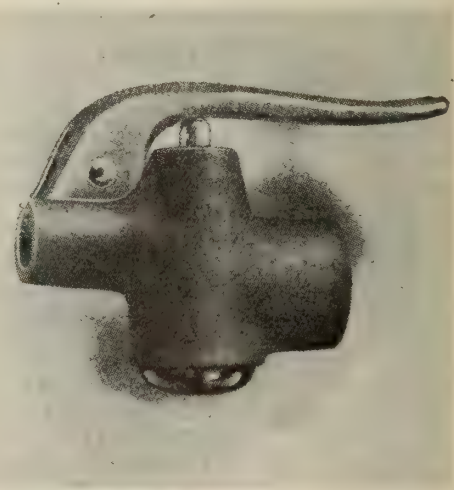
For cleaning motors mounted overhead, ceilings, shaftings, pieces of brass or iron tubing as long as required, may be attached to the blow gun, and since the volume of the air required is not great, the tubing should be of small diameter for ease in handling and economy in air consumption. The end of the tubing may be bent to any desired shape which experience shows to be best suited for a particular purpose. When surfaces of considerable area, such as walls, ceilings, windows, etc, are to be cleaned, a suitable nozzle may be made by bending three or four inches of the tubing at right angles and plugging the open end after a number of small holes have been drilled in the short leg of the ell to form an "air brush." Before using a nozzle of this type, the air pipes should be blown out before attaching the hose in order to prevent dirt or scale in the pipes from clogging the small holes. Nozzles of this style may often be advantageously applied to certain types of annealing and hardening furnace doors, where the men in attendance are exposed to intense heat each time it is necessary to inspect the interior of the furnace. The nozzles are usually placed below the furnace door in such a way that the streams of air rising upward form an air curtain or screen, which effectively protects the operators against the intense heat and prevents the escape of flames each time the door is opened. When used for this purpose the air jet is superior to both water-cooled doors, which only afford protection as long as they are closed, and to exhaust blowers, which subject the workmen to too sudden changes of temperature.

One of the advantages which the air jet has over practically all other methods of cleaning, and which makes it of particular value to a manufacturing concern, is its ability to dislodge dirt and dust while machinery is running, thus keeping the machinery clean, while in no way interfering with its rate of production. While this feature is of considerable value in the metal working plant, it is of even greater importance in some industries, such as textile and paper mills, where the machinery is generally operated 24 hours a day and a few minutes' shutdown every few hours in order to clean the machinery, results in a material reduction in the output per day.

The air pressure required will depend on the nature of the work to be done, 10 to 35 pounds being suitable for blowing light particles or painting motors, etc., while for heavy, oil-laden dust and dirt, pressures of 60 to 100 pounds are more effective. Cleaning is accomplished by the sharp impact of the air upon the material to be removed, and with a suitable pressure this is accomplished as effectively with a small jet as with one of larger diameter. Nothing will be gained by using a large volume of air when a small one will do, as a heavy blast may scatter the dirt instead of merely dislodging it. When cleaning machinery it is advisable to start at the top of the machine and work downward, thus avoiding the necessity of going over any part a second time. It will sometimes be found necessary to instruct the operator how to manipulate the nozzle to the best advantage, so as to avoid blowing the dirt into the bearings of the machine. Should this trouble occur, it may be overcome by employing a lower air pressure. In attaching an air-cleaning nozzle over a machine permanently, care should be taken to suspend it in such a manner that it will not be in the operator's way. It is often possible to hang the hose from a point overhead and toward the rear of the machine, so that it will fall back out of the way when released. The hose should be long enough to reach to the lowest part of the machine to be cleaned, and as it is subjected to considerable wear, it is best to use either the wire wound or armored type, in the 3-8 of an inch size, as this is amply large for most cleaning purposes and is very easily handled.

It sometimes happens that employees who have not been properly instructed, remove the cleaning nozzles, thinking that they will be able to do better cleaning. Others will enlarge the opening in the nozzle by filing, with consequent increase in the air consumption, as may be readily understood by reference to the accompanying table. These troubles may be prevented by placing a reducer in the air supply line, or inserting a hardened steel bushing in the tip of the nozzle. The most effective way of combating these abuses, however, is to instruct the operators carefully and then see that these instructions are carried out.

The air as taken from the ordinary receiver is usually in satisfactory condition for ordinary cleaning purposes. Where some of the older types of com-



A CLEANING NOZZLE OF THE BLOW GUN TYPE.

too copiously in the air cylinder, resulting in small particles of oil being blown from the nozzle. For ordinary cleaning around the shop this is not objectionable, but for use on fine work, or when cleaning surfaces which are to be painted or varnished, and in textile and paper mills, it is necessary to have the air absolutely free from oil. An oil separator placed in the supply line will remove practically all of this oil, and when it is desirable to thoroughly clean the air, it may be passed through muslin or other light cotton cloths as well.

When cleaning motors before varnishing, and on some other classes of machinery, it is best to use a double-barrelled nozzle, the upper tube of which is connected to the air supply, and the lower by a piece of flexible tubing to a tank containing gasoline, oakite, or some other form of cleaning solution, thus effectively cleaning parts of a machine which could not otherwise be properly cleaned by either method alone.

In factories operating on steam power, compressed air may be readily used for blowing soot and dirt from the boiler flues, etc., for which purpose it will be found much more convenient than steam. The necessity of keeping the heating surfaces of the boiler free from soot is of especial importance when the present high cost of fuel is taken into consideration, as a layer of soot 1-32 of an inch in thickness will reduce the efficiency about 9½ per cent., while, if this accumulation reaches a depth of as much as ¼ inch, the reduction in efficiency will be 80 per cent. or more. When steam is used for cleaning the boilers the water of condensation is usually an objectionable feature, and it is necessary to use heat-proof hose, or insulate the nozzle in some way, so that the operator will have no difficulty in holding it. The ease with which an air hose may be handled, and the absence of moisture in the jet, makes the job much cleaner, and as it facilitates quick work, the men responsible for the care of the boilers feel more inclined to clean them frequently, with consequent increase in the amount of steam produced from each pound of coal consumed.



"SPRACO" PNEUMATIC PAINT SPRAYING OUTFIT.

When at first glance the cost of installing a pneumatic cleaning system may seem unwarranted, this is, however, not the case, as the correct basis for figuring the relative cost and value of the equipment should be the saving that can be effected by its use rather than the actual amount of money involved in its installation and maintenance.

The increase in production which results from the ability to keep the machinery in the plant thoroughly cleaned while it is in operation, will often pay the cost of supplying the air, and at the same time pay a good rate of return on the money invested in the necessary equipment. In many plants where compressed air cleaning systems have been installed, new uses for the equipment have been discovered, which were not thought of at the time the installation was made, and larger outfits have been purchased, as a result of the good service rendered by the smaller units. The greatest benefit to be derived from the use of compressed air as a cleaning agent in the shop, however, probably lies in the fact that through its use it is possible to maintain a clean shop and contented, healthy workmen.

FLOW OF AIR FROM A RESERVOIR THROUGH AN ORIFICE

IN CUBIC FEET OF FREE AIR PER MINUTE FOR VARYING DIAMETERS OF ORIFICE AND GAUGE PRESSURES

Diameter of Orifice Inches.	Receiver Gauge Pressure.								
	2 lbs.	5 lbs.	10 lbs.	15 lbs.	20 lbs.	25 lbs.	30 lbs.	35 lbs.	40 lbs.
1/64	.038	.0597	.0842	.103	.119	.133	.156	.173	.19
1/32	.153	.242	.342	.418	.485	.54	.632	.71	.77
1/16	.647	.965	1.36	1.67	1.93	2.16	2.52	2 80	3.07
1/8	2.435	3 86	5.45	6.65	7.7	8.6	10.	11.2	12.27
1/4	9.74	15.40	21.8	26.70	30.8	34.5	40.	44.7	49 09
3/8	21.95	34.60	49.	60.	69.	77.	90.	100.	110.45
1/2	39.00	61 60	87.	107.	123.	138.	161.	179.	196.35
5/8	61.00	96.50	136.	167.	193.	216.	252.	280	306.80
3/4	87.60	133.	196.	240.	277.	310.	362.	400.	441.79
7/8	119.50	189.	267.	326.	378.	422.	493.	550.	601.32
1	156.	247.	350.	427.	494.	550.	645.	715.	785.40
1 1/4	242.	384.	543.	665.	770.	860.	1000.		
1 1/2	350.	550.	780.	960.					
2	625.	985.							

	45 lbs.	50 lbs.	60 lbs.	70 lbs.	80 lbs.	90 lbs.	100 lbs.	125 lbs.	
1/64	.208	.225	.26	.295	.33	.364	.40	.486	
1/32	.843	.914	1.05	1.19	1.33	1.47	1.61	1.97	
1/16	3 36	3.64	4.2	4 76	5.32	5.87	6.45	7.85	
1/8	13.4	14.50	16 8	19.0	21.2	23.50	25.8	31.4	
1/4	53 8	58.2	67.	76.	85.	94.	103.	125	
3/8	121.	130.	151.	171.	191.	211.	231.	282.	
1/2	215.	232.	268.	304.	340.	376.	412.	502.	
5/8	336.	364.	420.	476.	532.	587.	645.	785.	
3/4	482.	522.	604.	685.	765.	843.	925.		
7/8	658.	710.	622.	930.	1004.				
1	860.	930.							

TABLE SHOWING FLOW OF AIR.

Our readers should be by this time quite familiar with the use of compressde air for the actual operation of painting. A writer in a recent issue of "Factory" calls attention to another important use of air in large paint shops.

Nearly all large plants, he says, have paint rooms of their own. Here is stored the paint supply of the whole factory. Because of the tendency of the paint to settle, it must be stirred up each time any quantity is withdrawn. As a rule, the stirring of paints by hand is done to the accompaniment of aching muscles and breaking backs. One good-sized factory, however, performs the whole operation by the turn of an air-cock. There happens to be a high-pressure air supply handy to the paint room. Paint is kept in barrels each containing a double wooden paddle. When the paint requires stirring, a pneumatic reaming tool is slipped over the end of the paddle shaft which projects above the barrel top. This shaft is held in place by two crossed pieces placed across the barrel head. By using the shaft in place of a reamer shank, the paddle is whirled rapidly and the paint mixed in a surprisingly short time. After one barrel of paint is mixed thoroughly the reaming tool is slipped over the paddle shaft in the next barrel. Thus the whole job is done quickly and with little labor.

There are nearly 35,000 fewer horses in service in New York City than there were two years ago, a reduction of more than 30 per cent.

The Use of the Pyrometer in Steel Industry*

A Continuation of a Paper Discussing the Progress Made in the Accurate Measurement and Control of High Temperatures in the Heat Treatment of Steel of All Kinds

By R. P. BROWN

A GALVANOMETER indicates the point at which no current is flowing, and when the pointer on the galvanometer indicates zero, the voltage of the dry cell equals that of the thermo-couple. The line resistance from the dry cell to the galvanometer is exceedingly small and constant. When the thermo-couple voltage has been opposed to the voltage of the dry cell and balanced, the actual measurement is that of the dry cell circuit. Hence this measurement is entirely independent of the resistance of the circuit, including the thermo-couple, lead wires and galvanometer.

The potentiometer can be used with any length of leads desired, and the indications are entirely independent of line-resistance or changes in resistance due to atmospheric changes in temperature along the leads. The potentiometer has a disadvantage as compared with the milli-voltmeter method of temperature measurement in that some outside source of current, a dry cell and standard cell, for example, are necessary as a source of current and the dry cell must be replaced from time to time. The standard cell likewise is liable to injury if subjected to temperatures below 40° or above 104° Fahr. and the standard cells must be checked occasionally.

The claim is made that the sticking of the movable element of the milli-voltmeter may cause erroneous readings and that the potentiometer eliminates this. This statement is a fallacy in that the potentiometer also incorporates a galvanometer, and provided the galvanometer sticks, an erroneous reading is secured.

I recently developed and have been granted two patents on a type of portable precision potentiometer in which we use a spiral resistance winding for our slide wire. The total length of this spiral resistance on a cylinder 4 in. in diameter and 6 in. long is 8 feet. On a corresponding cylinder in the instrument the scale is in spiral form 8 feet long, in which the temperature can be read.

The operating mechanism moves the spiral wound resistance equivalent to the motion of the temperature scale and an index is designed to travel across this temperature scale dependent on the spiral line on which the temperature is read. Naturally with the 8 foot scale, exceedingly fine temperature indications can be secured. Our standard instrument graduated to 2000° Fahr., with base metal thermo-couple, is graduated to 2° Fahr. and can be easily read to a half in degrees Fahrenheit up to a total range of 2000° Fahr.

Potentiometer pyrometers are available in recording form, in which the mechanism automatically balances the voltage of the cell against that of the thermo-couples, and in this instrument the records are automatic and no hand balancing is required.

In either the milli-voltmeter or in the potentiometer type, recording pyrometers are available to plot a continuous record of the temperatures on a chart daily, weekly or monthly, as desired. The recording pyrometers are supplied either to make a single record on a chart, or with two or more galvanometers side by side making individual records on one recording sheet. Multiple recording pyrometers are also available incorporating a switching mechanism, which alternately connects the various thermo-couples to the galvanometer or milli-voltmeter in a recording instrument, and many records can be secured on one chart.

There are numerous methods of producing a record on the chart. The most common form is to use different colors for these individual multiple records, or by using for one record a single dot, for another two dots, the number of records can be multiplied. The records are made distinguishable also by dots, dashes and stars, corresponding to each record. In some instances the record is produced by jumping an electric spark through the record paper, and in others by a printing mechanism with numbers beside each individual record dot, corresponding to the particular thermo-couple recorded.

Where a recording instrument operates on the milli-voltmeter method the frictionless type of recorder is required and the pointer is depressed only momentarily at intervals on the recording chart. In the potentiometer type of recorder sufficient power is available from the motor operating the instrument to imprint a record directly on the chart.

Automatic signaling pyrometers have been used for some years in the larger heat-treating plants where it is desirable that the operator should not decide whether the temperature is correct or not, but should be signaled by lights, as to whether the temperature is within the correct limits. For some years it has been common practice to install a central indicating pyrometer with switchboard, and by means of three colored lights at each furnace, usually red, white and green, to signal from the central station whether the temperature is too low, correct, or too high. Usually 25° is considered a limit within which the temperature should be maintained.

The white light burns when the temperature is correct. If the temperature drops below, the green light glows, or if it rises above the desired temperature the red light burns. The operator of the furnace does not have to know how to read a temperature scale; all he need be instructed is to keep the white light burning and what he is to do when the red or green light burns.

Incorporated with this system is usually a signaling system to indicate when the steel is to be removed from the furnace, where a definite time interval for heat-treatment has been determined.

A step farther is the automatic signaling of the temperature by an automatic signaling pyrometer which can be incorporated in the standard form of milli-voltmeter pyrometer. Instead of the pointer being depressed on a record chart as in the recording instrument, it may be depressed on to contact plates representing the correct temperature, too high or too low. By incorporating with such an instrument a switching mechanism, a number of thermo-couples can be connected to a single indicating instrument and as many as twelve or more thermo-couples can be connected to one signaling pyrometer, which will automatically operate the lights at the furnace, eliminating the operator who is now required to flash the lights from the central station.

Automatic Temperature Control Pyrometers

The day when the furnace temperatures will be accurately controlled automatically is coming very rapidly and notable progress has been made in this respect during the last few years.

The application of automatic control pyrometers to electric furnaces is a comparatively easy problem, as automatic switches can be easily operated by a solenoid which can in turn be operated by the same contact device in the pyrometer as used in the signaling instrument. We have applied automatic temperature control to electric furnaces most successfully, and some 100 electric furnaces to my knowledge are being controlled automatically at present.

This control may be secured by the opening and closing of the main circuit or line, or by cutting in and out a small portion of the available current, which is possible through cutting and out of rheostats. In this way the fluctuation in current is materially reduced as compared with opening and closing the main circuit.

Automatic control of gas-fired furnaces is a little more difficult, as a gas valve to be tight and not leak under continual operation must be well packed and considerable power is required to operate the valve. We have, however, by the use of powerful solenoids, or by motor-operated valves, been able to overcome this, and we have a number of gas-fired furnaces of large dimensions which are automatically controlled.

There is no question in my mind but

*Read before the American Steel Treaters' Society.

that within the next year or two the automatic control of furnace temperatures will be very generally adopted wherever a constant temperature is to be maintained and it is desirable to eliminate the human element and hand control.

I have developed a special type of automatic control pyrometer which can be connected to almost any number of furnaces. It was necessary to add the required switching mechanism to connect the various thermo-couples to the instrument and also connect simultaneously the various electrically-operated valves or switches.

Another step and we have already developed an instrument of this character, for which patents have been applied for, is an instrument in which the contact table carrying the high and low contacts is moved along the temperature scale by clock mechanism at any desired rate of speed so that where a furnace must heat up at any given rate, this can be accomplished automatically.

Assuming, for example, that a large annealing furnace should have to attain a temperature of 1600° Fahr. in twenty-four hours. The clock mechanism advances the contact table across the scale to 1600° Fahr. in the period of twenty-four hours, and when this temperature is attained the current can be automatically shut off if desired, opening the switches to an electric furnace or closing the alves if a gas furnace is used.

The problem which has offered a little difficulty, but which we seem to be rapidly solving, is the automatic control of oil-fired furnaces, as the oil burners usually operate under high pressure and the burner may become clogged, which will be noticed if an operator is available, but offers difficulty with automatic temperature control. I feel that we are rapidly reaching a point when this difficulty will be solved by securing an automatically-operated burner which is fool-proof and will not clog.

Pyrometers in Steel Treatment

I think many are not aware of the part pyrometers play in steel treatment from the smelting of the iron until the finished product. Let us take a part made from high-grade alloy steel. First in the blast furnace where the iron is smelted; the hot blast temperatures and the temperature of the escaping gas from the furnace are accurately controlled by thermo-electric pyrometers.

Next, the open hearth furnace where the steel is refined. Temperatures are very largely controlled in these furnaces by installing a platinum thermo-couple in the slag pocket or the gases from the checker brick. A very satisfactory record can be secured on a recording pyrometer of the working of the open hearth furnaces in this indirect manner. Optical pyrometers are also used to focus on the molten steel in the furnace or on the steel in pouring.

The forging of steel carried on in forging furnaces at a temperature of around 2000° Fahr. is accurately controlled with the aid of thermo-electric pyrometers, using platinum thermo-couples with special Durax tubes.

The annealing, hardening, re-heating and the quenching temperatures are realized by everyone to be of the utmost importance and should be accurately controlled with pyrometers. Where oil or water is used for quenching, recording thermometers or resistance thermometers are applied to advantage.

This will give some idea of the part pyrometers play from iron in pig form to the finished steel part, the recent improvements in pyrometry, and the outlook for the next few years. I want to make one point clear, however, that while we are continually striving to improve the pyrometers which we manufacture and design these instruments to better meet each requirement, our efforts are a failure provided we cannot educate the users of pyrometers in how to use and care for them.

I have seen the best of pyrometer installations give unsatisfactory results simply because it was assumed that when pyrometers were installed that the steel in some miraculous manner would come out perfectly heat-treated without any attention whatsoever. The pyrometers were apparently supposed to be infallible, and that while a watch has to be wound and adjusted occasionally, the pyrometer should require no such attention. There are no pyrometers produced to-day which do not require some attention, and if you are told by any pyrometer salesman that his instrument will work year in and year out without the slightest attention, you can put it down that he has too vivid an imagination.

If you instal pyrometers, take the time to make a little study of how the instruments operate, how they can be best installed, and how they are to be cared for after they are in use in your plant. If you have quite a number of furnaces and a considerable pyrometer installation, place a man in charge of the instruments who has been first instructed in the information, anyone should have to handle such a job. Do not take an office boy to look after your pyrometer equipment as I have seen so often done. A first-class pyrometer equipment will pay for itself time after time during the year, and will be of infinite benefit to the user provided, first, it is properly designed to meet the conditions; second, it is properly installed; third, it is properly understood and cared for.

We are struggling every day to make pyrometers better. Can we not count on the users of pyrometers to endeavor every day to make the care of the pyrometers better? If this can be accomplished, then the troubles with pyrometers will very rapidly disappear.

PACKING BOXES WITHOUT NAILS

Arrangements are being made in Great Britain for increasing the output of a novel and ingenious form of packing crate or box. It requires no nails, no screws, no hinges, no wires; it is collapsible, and when put together, is capable of holding any kind of merchandise. Rigidity is obtained by a system of interlocking parts. A special method of scaling the cases has been adopted to render the work of the pilferer more difficult. With the ordinary nailed-up box it is any easy job for the railway thief to apply a jimmy or a nail lifter, and restore the original outward appearance of the package after he has extracted the contents. With this new crate, it is impossible to extract any goods without leaving obvious signs that the package has been tampered with. Another advantage in these days of congested transport is that "returned empties" take only one-fifth of the space occupied by the non-collapsible box.

Probably the slowest work in wood shipbuilding is that of planing the woodwork, quantities of which have had to be done by hand as the ship goes together. A skilled woodworker at St. Helens, Oregon, set about to invent a planer that would work by means of compressed air. He finally made one that worked fairly well, but was cumbersome, weighing about 150 pounds.

Then some one at Portland took up this problem. He could see no reason why, if a small machine could be made powerful enough to drive great rivets by air, an equally small machine could not be made for planing. The result of his labors is a power planer operated by compressed air through a pipe, just as the "guns," or pneumatic riveters, work, and this weighs only ten pounds, and is but sixteen inches over all. It can be used in almost any place on the ship, taken anywhere and after being tested for more than ten months, shows that it needs no changes or repairing other than the customary sharpening of the blades.

One of these planers will now do more work and better work than twenty men with hand planes can do in a day—a fine record for a simple device.

Cut out and send with drawing

Name .....

Address .....

Position .....

Firm's name.....

Canadian Machinery Drafting Course, Part 10

The Definition of a Surface, Straight Line Development, Curved Line Development and Other Details in the Art of Development of Surfaces Are Explained in This Section

By J. H. MOORE, Associate Editor Canadian Machinery

IN this last portion of our elementary study, before entering the strictly mechanical field, we will consider the subject of the development of surfaces. The subject is a very important one and the various explanatory sketches should be studied carefully before proceeding with the plate itself.

What is a Surface?

A surface may be described as follows:

A surface is that formed by the motion of a line. Any length of line moved sidewise in any direction will form a surface, of a width equal to the length of that line, and of a length equal to the distance over which it has been moved.

There are, roughly speaking, two different types of surfaces, namely, those formed by, first, a moving straight line, and secondly, those formed by a moving curved line.

In some classes of work, patterns of the complete or partial surface must be made, as in sheet metal work, stonecutting work, etc., etc. Where there is some irregular surface, there must be a pattern made, giving the shape of the developed surface, so that when a sheet is cut (in sheet metal work for example) it can be so formed that it will be of the same shape as the original.

It is this templet, or pattern making, namely, the laying out of the complete surface on one plane, that is termed developing the surface. Any surface which can be smoothly wrapped about by a sheet of paper can be developed. Figures made up of planes and single curved faces only, can be included in this section. Double curved surfaces and warped surfaces cannot be developed, and patterns of such surfaces, if desired, must be made by an approximate method which requires two or more pieces to complete the pattern.

By ascertaining the true size of all the faces of an object made up of planes and joining them in proper sequence at their common edges, the completed developed surface will be found. The best method of accomplishing this is to find the true length of the edges of the object.

Straight Line Development

At Fig. 1 we show an object of very plain nature in the shape of a rectangular block of steel, which has a similar shaped hole through it in central location. Now, the question is as follows:

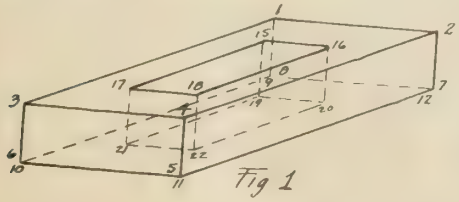


Fig 1

How would this object look if developed on a single plane?

Referring to Fig. 2, first let us consider the mechanical drawing, showing how this piece would appear. You will notice that we have marked the various edges, Nos. 1, 2, 3, etc., etc.

Following closely these views, and looking on the developed figure at Fig. 3, the reader should have no trouble in grasping the idea.

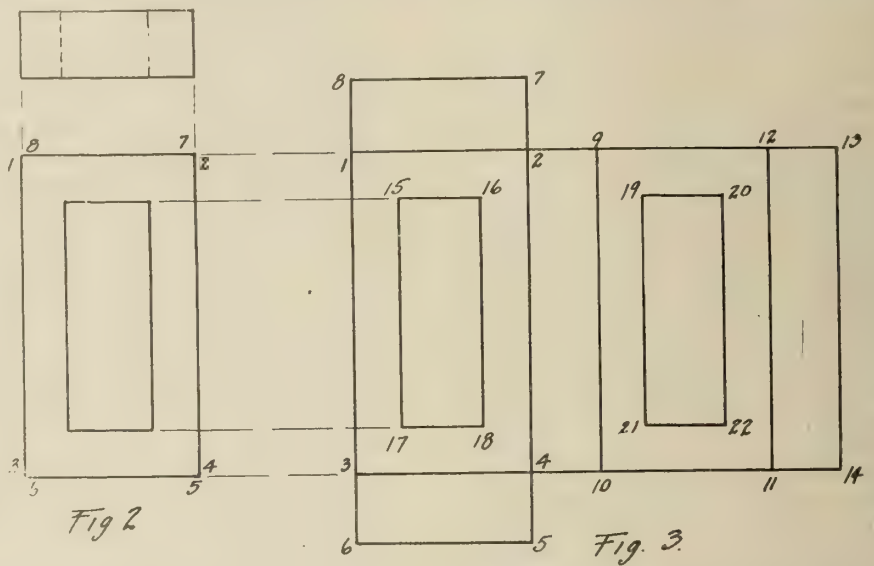


Fig 2 Fig. 3.

Briefly the idea is to take the complete object and place it on one plane, in other words, all four faces of the object are placed on the same plane.

The developed rectangle, 1, 2, 3, 4, shows the top of the rectangle, 3, 4, 5, 6, illustrates one end 1, 2, 7, 8, the other end, while 2, 4, 9 and 10 illustrates one side. In like manner 9, 10, 11 and 12 shows the bottom, while last, but not least, 11, 12, 13 and 14, illustrates the other side.

This development is then the exact size and shape of a covering for the prism or original object. In other words, if the development as shown, was made in sheet metal and bent up to shape, the result would be a prism of correct shape. Of course, as readers can understand, such a prism made of sheet metal would be hollow, and not of solid material, as the object shows, otherwise the shape would be exactly the same.

The rectangular hole through the object is illustrated by the lines 15, 16, 17 and 18 in one view, and with lines 19, 20, 21 and 22 in the other.

As a summary, we might add these words: The development of a right prism consists of as many rectangles joined together as the prism or object has sides, those rectangles being the exact size of the faces of the prism, together with two polygons the exact size of the bases.

In every case it will be found a great help to number all corners on the object and projected views, as shown in our illustrative sketch.

The Curved Line Development

Let us now take a case of curved line development in this example, a cylinder as shown at Fig. 4. To develop this surface is a comparatively simple matter and for illustrative purposes we have considered an imaginary line, 1, 2, as a starting point, developing from there.

The result is shown at Fig. 5. In other words, the development is a resultant surface on a flat plane of a width equal to the length of the cylinder, and a length equal to the perimeter, or all around distance of the curved line of the cylinder. This problem is so self-apparent that we dwell no further upon it.

The Principle Applied to the Cone

We will now go a little deeper into the

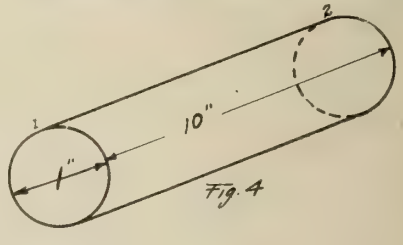


Fig. 4

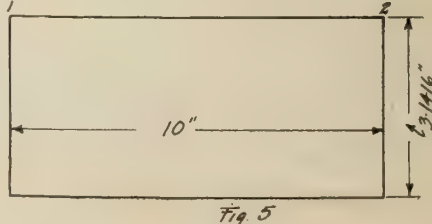


Fig. 5

problem of development, and consider the cone shown at Fig. 6.

Here we see a mechanical drawing of a cone cut by a plane parallel to the

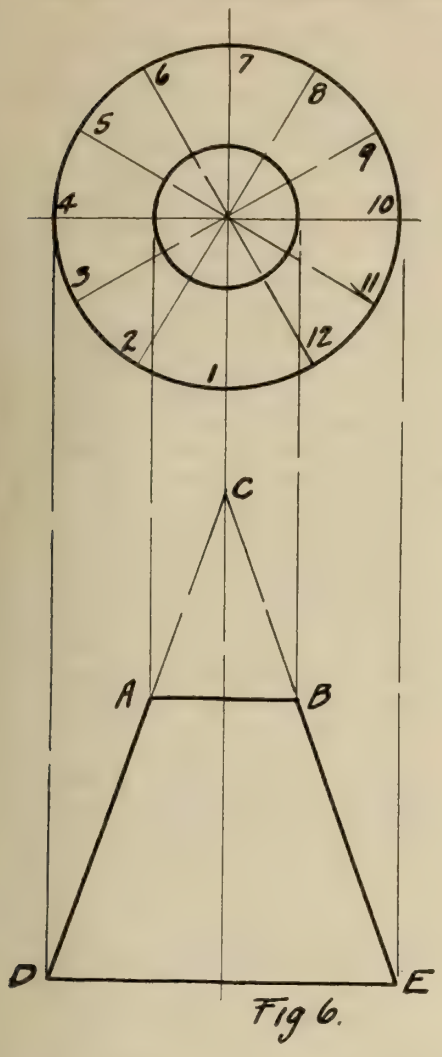


Fig 6.

base, by the line A B, considering for illustrative purposes that the vertex C still exists.

To make a true development, proceed in the following manner:

We will now suppose we are about to roll the cone on a flat plane, the vertex remaining stationary until the same element is in contact again, the space rolled over representing the development of the convex surface of the cone. Now look at Fig. 7.

Let C, as before, represent the vertex. C F will, of course, be equal in length to either contour element of the cone. This distance is taken from the elevation view. For example, C E is equal in length to the radius C F. Next, work on the plan view at Fig. 6. Divide this circumference into some convenient number of equal parts, 12 for this case in point, and transfer these spaces to the radius formed on the partially developed view, namely, F 1, 2, 3, etc., up to point 12. This point is the end of the arc, or developed surface. From here draw a line to the vertex, as shown.

Next, space your compass to the distance C A or C B on elevation view, Fig. 6, and draw an arc of this radius on the developed view, Fig. 7. The result is, the developed surface of the cone shown at Fig. 6.

A Final Example

As a last example we will consider a cylinder of the shape shown at Fig. 8.

This object if developed (or rolled, if you prefer), upon a plane, the various elements being parallel, will appear as parallel lines, and the base line being perpendicular to the elements will appear as a straight line of length equal to the circumference of the base. The base of the cylinder shown will be for illustrative purposes divided into 12 equal parts.

Let us first follow the procedure on Fig. 8. Divide the plan view into 12 parts, then project down in the matter illustrated to the elevation.

As a next step, let us look over the developed view, Fig. 9. On the base line of the view, step off the distances as marked on the plan view, 1, 12, 11, 10, 9, and so on the result being the completed base line 1 to 1, which is equal to the distance around the circumference of plan view. This gives the total width of developed view.

Project lines up from these points as shown, and lines across from elevation view. Where these points intersect are the development points. It will be seen that the curve formed is symmetrical, the half on the left of point 7 being the same as that to the right. The development of any similar surface may be found in the same manner.

While we have not attempted to go into this subject of development very deeply, we have at least skimmed the surface and given readers sufficient information regarding the principles involved. As we have already stated in other portions of our course, this is not supposed to be a detailed course in the art of mechanical drawing, but rather a general talk on the subject to familiarize the average reader with the underlying fundamental principles.

To give, in this form, a detailed course would take years, but by touching to some extent on each subject the reader

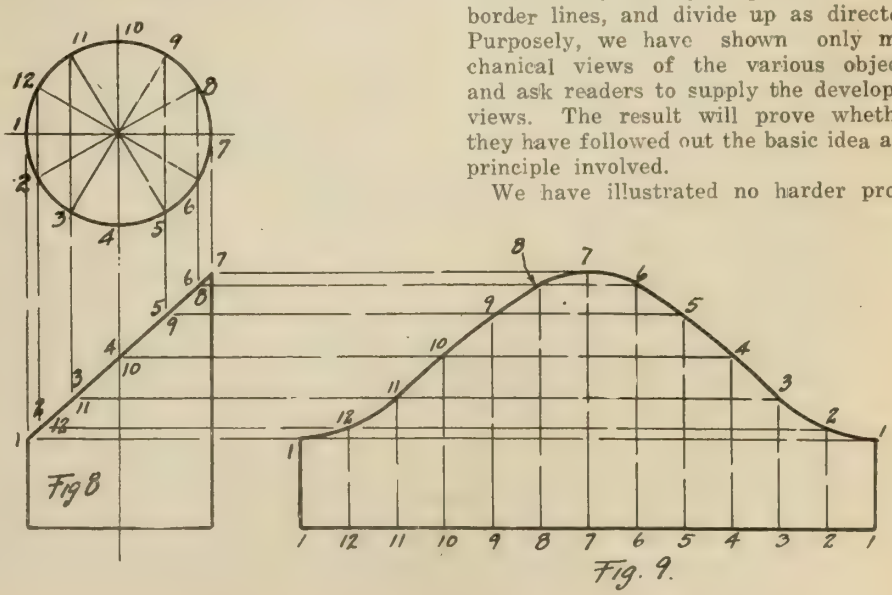


Fig 8 Fig. 9.

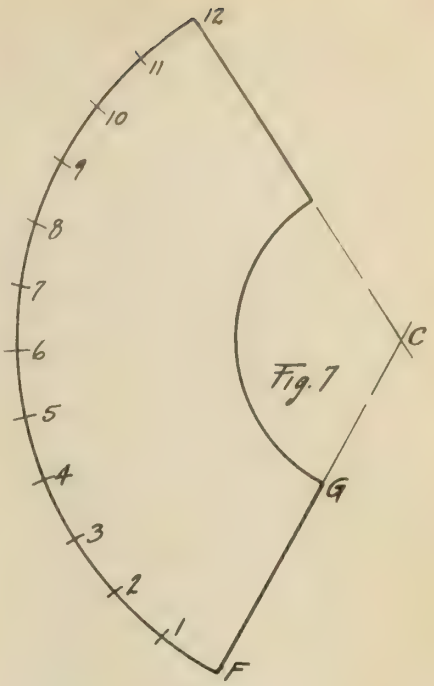


Fig. 7

at least gets some value out of it, which enables him to follow up the later plates, which will deal purely and simply with the subject of mechanical drawing. For this reason out studies are of equal value to the man on the bench and the man in the drafting office, for we aim to appeal to apprentices, machinists and apprentice draftsmen alike.

Upon the completion of our studies we will, more than likely, appeal still more to the man in the machine shop, for he will see objects which he will be more familiar with, and the drawings will be more practical than theoretical as at present. We would therefore suggest that those readers, machinists or otherwise, who so far have said, "This course is not for me," look out for the next issue, and follow it up from the start of the subject of mechanical drawing proper.

In conclusion to this portion, let us consider plate No. 10.

As before, make your plate 9 x 13 to border lines, and divide up as directed. Purposely, we have shown only mechanical views of the various objects and ask readers to supply the developed views. The result will prove whether they have followed out the basic idea and principle involved.

We have illustrated no harder prob-

lems than we described, and have marked all necessary dimensions on the plate. Do not be discouraged if this subject proves a little difficult to start with, but plug along and work out these four problems. Above all, be neat in your work, space off your distances accurately, and take pains with your inking in.

As heretofore, we offer three prizes for the best three results sent in, so let us see your work as soon as possible.

To readers in general we can only once more add, Watch for Part II on this course, which should prove of special interest to all.

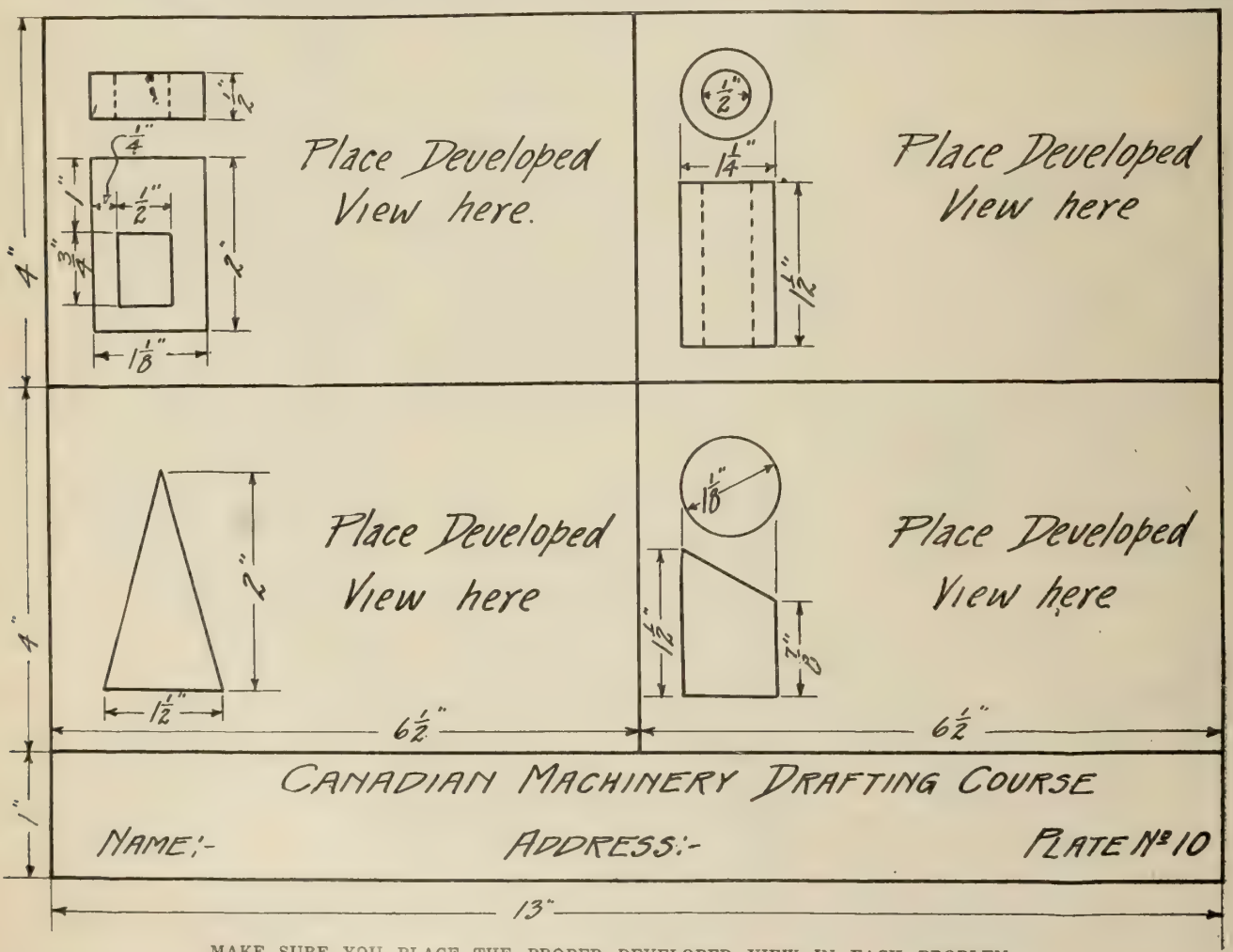
Excavation work in the north tube of the 14th St. rapid-transit tunnel under the East River, New York City, was completed Aug. 7, when the last piece of rock between the tunnel headings between Brooklyn and Manhattan was shot away. The river section of the tunnel is 3,437 ft. between shafts. The top of the tunnel is 97 ft. below mean high water at the lowest point, while the bottom is 115 ft. The maximum pressure used in driving the tunnel was 39 lb.

The head of the firm, when walking round the works, spies a young apprentice holding his hammer close up to the head. "Look here, my boy, that is not the way to hold a hammer. When I see a man holding a hammer properly by the end of the shaft I pay him $15 a week; when he holds it half-way along I pay him $10 a week, and when he holds it higher up still I only pay him $5 a week; do you understand?" "Yes, sir," says the boy, "will you please say where I am to hold it? I get $1.25 a week."

HERE IS GOOD NEWS FOR OUR READERS

CANADIAN MACHINERY is pleased to make the following announcement relative to their drawing course: Owing to the great interest taken in the course by our readers, we felt that some special effort on our part should be made to secure plates for our course, some practical and proven parts of a machine tool. This has been accomplished, and, starting with Part II, which enters into mechanical drawing proper, we will go through the following subjects: Milling machine, vise, important parts to a well-known miller, also various details on an up-to-date disc grinder. These subjects will be gone into in detail, gear problems, etc., discussed and figured out. We will take the student carefully and by easy stages from one detail to another, not by quick jumps which would only tend to confuse. All dimensions will be given and, as stated before, these are actual parts now in operation.

The value of this announcement is easily realized, so our only comment is as follows: Your opportunity to dig in and obtain results is here. The winter months are upon us, therefore it is easier to stay in and study. Send your plates promptly. In our January 15th issue we intend publishing a list of prize winners on the various plates. Watch for your name.



MAKE SURE YOU PLACE THE PROPER DEVELOPED VIEW IN EACH PROBLEM.

Tools and Plant from the User's Point of View

By "UBIQUITOUS"*

I have been asked whether in view of a possible permanent reduction in the calorific value of coal gas it will have a deteriorating effect upon the power development of gas engines, and whether if gas is supplied less rich in heating value it can be converted into power without an equivalent loss in efficiency and economy. I am not sure that I can explain this matter within so restricted a scope as this, but at any rate I will try. Let me then first of all say that I don't think it will, and then I will tell you why I think so. To obtain the best results within the cylinder of a gas engine richness of gas is of less importance than mixture, the correct proportion of air to gas being the all-determining factor. In other words, the relative calorific value of a gas is subsidiary to its chemical composition. Two examples prove the truth of this. Town's gas of a quality of 600 B.Thu.U. per cubic foot might be used as against producer gas of from 110 to 130 B.Th.U. per cubic foot, and yet the ultimate difference in the matter of efficiency would not, relatively, be anything approaching the difference in heating value per cubic foot. Then, again, many gas engines are working very efficiently and economically on blast-furnace gas having a heat value as low as from 80 to 90 B.Th.U. per cubic foot—which goes to suggest that it is much more a question of air dilution than quality of gas.

The Importance of Chemical Composition

It has been said that the chemical composition of a gas is all-important. I will show you why this is so. Take, for example, coal gas of, say, a standard value of 500 B.Th.U. per cubic foot. This would be composed of hydrogen, marsh gas, ethylene, and carbon monoxide as the principal combustible constituents. Now each of these elements possesses a different and definite calorific value, yet while these four ingredients may be of any relation or proportion to the others, their combined heat value would still remain 500 B.Th.U. per cubic foot of composite gasses. But as each separate element will require more or less air to furnish necessary oxygen to support combustion, it must follow that according to their relative proportions so the amount of air required will be greater or less. This again suggests that air dilution is important. Take a gas engine using coal gas of a value of 500 B.Th.U. We knew that this must be diluted with air to the extent of about 90 per cent. in order to obtain the best effects from combustion within the cylinder; consequently the mean calorific value of such a mixture would be, say, 500 ÷ 10 = 50 B.Th.U. per cubic foot. We should get practically the same effect in an engine using producer gas having a ter amlvlaue of say, 110-120 B.Th.U. per cubic foot, tne difference being made up in the reduced quantity of air required. Thus assuming this value for the gas, and about equal quantities of gas and air to form the explosive mixture, its mean value would be therefore roughly equivalent to that of the previous example. In other words, more gas but of a lower heating value must be admitted to the cylinder in order to make up in quantity what it lacks in quality. And the extra consumption involved will not so much matter if, as it is suggested, we pay for calorific value in B.hH.U. and not in cubic feet passing the meter.

*From "Hardware Trade Journal."

A Belt Calculation for Electrical Machinery

Just recently I came acros an extremely simple ana reliable rule for calculating the width of belting required to drive electrical machinery when the output in watts of such machinery is known. It is as follows:—One foot per minute of belt speed per inch of width will transmit one watt of electrical energy. Therefore if the belt speed in feet per minute is mutiplied by belt width in inches the result will be total energy delivered in watts. If divided by 1,000 the result will be kilo-watts. This rule holds good for single belting; if light double belting, then from 30 to 35 per cent. additional energy may be expected. So that from this rule we can obtain the width of belt required as follows:

$$\frac{\text{Amps} \times \text{Valts}}{\text{Velocity}} = \frac{\text{Watts}}{\text{V}} = = \text{width of belt in inches.}$$

The Value of a Gas Blow-pipe to the Ironmonger

One of the most useful as well as profitable items in the equipment of an ironmonger's workshop is undoubtedly a gas blow-pipe. Its uses are really too numerous and comprehensive to fully enumerate. It can be employed with equal success in the soldering, brazing and annealing of small articles, hardening and tempering drills, taps, dies, reamers, cuters, lathe and shaper tools, for burning old paint off machinery, for melting lead and tin, besides a whole host of minor unremembered operations. In conjunctions with a blow-pipe a double-action foot bellows, operated by the foot is a necessity. The blow-pipe should be so constructed that the air passes through the middle of the flame, not around it. Equalising and adjusting taps should be provided both for the gas and the air. If the proportion of air to gas is correctly adjusted the greatest economy is effected, and all the gas will be properly consumed; but if too much air is used the flames loses its heat. Most workers in a desire for economy use too much air. The quantity delivered by an aperture, say, 3-16 in. diameter will required practically all the gas supplied by a ½ in. pipe. Indications of smoke or soot on the work denotes an insufficiency of air. Always use flexible metallic tubing in preference to rubber, as the latter possesses a provoking habit of kinking and stopping supplies.

Haw to Use a Hack Saw

A deal of skill is erquired in the use of a hack saw, that is if saw breakage is to be avoided. In the first place the saw requires to be set quite firmly in its frame, given a fair amount of tension, and so held that twisting is prevented. In its use it must be remembered that the teeth are given a certain amount of rake or inclination in order to cut one way only, that is in a forward direction. Therefore, cutting pressure should be applied only on the forward stroke, the saw being eased slightly out of the cut on each return stroke. As a rule, a hack saw frame is so arranged that the saw can be fixed in four positions, this being often a great convenience. Always use the full length of the blade if it is at all possible, the general inclination among workers being to devote all their energies to the middle thre or four inches, hence a saw is often scrapped as worn out when only about half its length is unfit for further service, the other half been practically as god as ever. When putting a new saw to work on hard metal, tool steel, or the like, use very litle downward pressure, otherwise the danger of ripping off three or four consecutive teeth, and so uttterly spoiling the saw, is always present. Use a dry saw for cast iron, bras or gunmetal, but slightly grease it when sawing mild or teel steel. When a saw chokes withdraw it from the cut and rub it downwards with the finger and thumb pressed tightly against the teth. Present-day hack saws are invariably too hard to be re-sharpened when becoming dull; and it is questionable if it would be a paying policy to do so, wer it possible.

Coiling a Band Saw

Mention of saws reminds me of a little knack of coiling a band saw when I saw done the other day. This is termed the "three-fold coil," and, I was assured, is the only safe way of coiling a band saw without risk of distorting it. Place the saw in a single loop as it goes on the machine, standing on the floor with the foot holding down the lower part of it. Now grasp the upper part with the two hands about 2 ft. apart, and level with the face. Give the saw three distinct twists and the nstoop lowering the saw to the floor, when it will fall naturally into the three-coil fold.

Revivifying "Perished" Brass

It may not be generally known that

brass wire, brass strip, or brass stamped articles that have been stored for any length of time, and subjected to varying atmospheric influences, loses its strength and ductility, and shows signs of "perishing." Such injurious effects may almost entirely be eliminated by heating the metal for a few minutes to a temperature of between 500° and 600° C., then cooling the metal either slowly or quickly. A useful hint to those of my readers who have to store such lines for any length of time is to keep all brass goods tightly and securely wrapped up in plenty of clean dry paper, and well tied to exclude the outside air.

Color of Oil Engine Exhaust

I learnt a wrinkle the other day that is worth knowing. An expert was overhauling an oil engine, and he had got it running for the first time. After making the usual examinations as to smooth and quiet running, the condition of the bearings, and so on, he went outside the engine house and critically watched the exhaust gases leaving the exhaust pipe. Being abnormally curious, I questioned him as to the reason for such a procedure. Said he: "The color of the exhaust from an oil engine is always a sure indication as to the manner in which it is working. Under medium or full-rated loads this should be almost invisible, which goes to show perfect vaporisation and combustion; under light loads the exhaust should be just perceptible as a white or whitish-blue vapor. Corrections, if these conditions are not being fulfilled, would be the adjustment of the oil fuel, air supply, and water injection."

. . . Something more learnt.

Two Styles of Handy Trays for Finished Parts

By ROBERT MAWSON

TWO styles of holding and carrying trays for finished parts of a cylindrical shape are shown in accompanying illustration.

The one designated Style A was made to hold elements such as gears and pulleys, in which a hole had been bored in a previous operation.

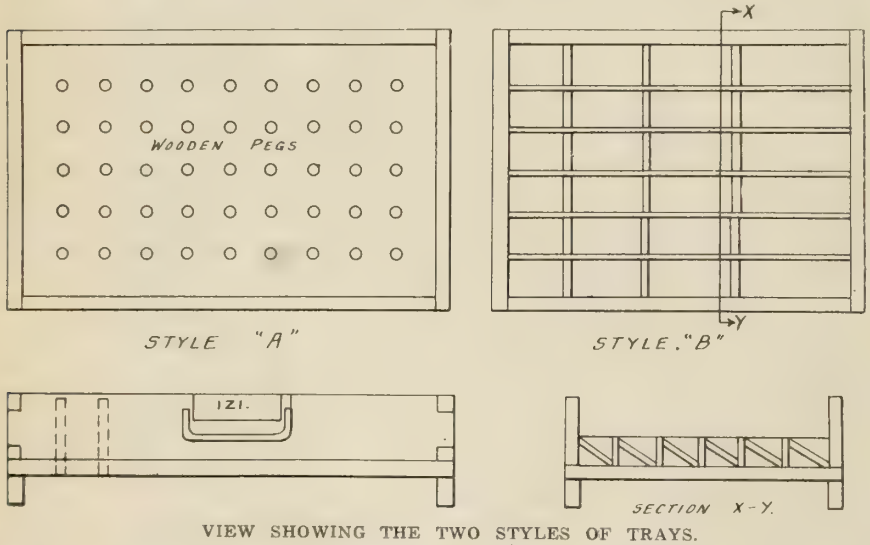
The last operation on these gears was cutting the teeth, the pieces being just turned, faced and bored. The blanks were then taken to the gear cutting department, but it was often found that some of the parts were damaged after the teeth had been cut, by the operator allowing them to drop against other gears.

In some cases the teeth were broken away, which meant that these gears were only good for scrap. To overcome such trouble, the trays as illustrated was made.

A wooden frame provided with legs of sufficient height was made so that a whereabouts of any certain part could be readily ascertained by the routing department. The second type marked B was made to hold circular discs, in which no holes were machined.

In this case the pieces were turned and faced all over by being held in a universal chuck. The last operation was grinding the faces and bevelling one edge almost to a sharp corner. It is easy to imagine how these elements could be injured even by the best of care if the sharp corner came in contact with another disc.

To avoid this the tray illustrated was designed. This tray is also made of wood with legs for the purpose previously noted. Slanting partitions were fastened inside the framework with cross divisions or partitions at right angles. The finest ground discs were then slid into the spaces. Their inclined positions made them easy to remove when desired. The cross partitions prevented any two discs coming in contact with each other



VIEW SHOWING THE TWO STYLES OF TRAYS.

light truck could be used to transfer the loaded tray from one department to another. Wooden pegs were driven into the tray at sufficient distance apart so that the gears would not touch each other on their periphery.

In front of the tray was fastened a metal part-card holder, so that the and thus avoided injury.

It might be added that these trays are not only cheap to make, but that they also tend to keep the machining departments much neater in appearance. Production is also likely to increase as the operator, foreman or scheduling department can tell at all times the condition or progress of the various elements through the shop.

A PRACTICAL BLUE-PRINT PROTECTOR

Blue-prints are always getting dirty, wet, greasy or torn while being handled by workmen using them.

An inventive genius has designed a very practical blue-print protector of simple construction and low cost.

A sheet of transparent sheeting—the same material used for lights in auto curtains—is cut to desired size. A piece of lightweight leather substitute is then cut about a half inch larger all around than the piece of sheating. This extra half inch allows for a lap-over on all but the top side of the protector. A sewing machine stitches the lap down to the sheeting forming a large flat pocket, open at the top for the insertion of the blue prints.

Both the transparent front and the coated fabric back are waterproof and grease-proof. Dirt or grease may easily be wiped or washed off either without injury to the material. Both materials are flexible and the holder may be rolled up if desired in the same way an unprotected blue print is usually handled by a workman.

A further development of welding in American shipyards is anticipated from the recent approval by the American bureau of shipping of the thermit process for welding stern frames, rudder frames, and other heavy sections on ships registered under its classification. The only qualification is that this bureau be notified sufficiently in advance to have a surveyor in attendance during the welding operation as well as to inspect and test the weld when completed.

The man who adapts familiar equipment to new and useful ends is many times more valuable to his employer than the one who calls for a special machine for each new job that develops. Compressed air is a valuable and easily adaptable power around a plant.



WELDING AND CUTTING



Electric Arc Welding

By F. A. ANDERSON,* San Francisco, Cal.

IT IS only a few years ago that the subject of electric arc welding would have aroused but little interest, and yet to-day the art is engaging the attention of many men standing high in the engineering profession.

At the present time electric welding may be divided into two general classes, resistance welding and arc welding. The former had its inception some thirty years ago, and has been practised more or less continuously ever since, gaining in popularity as its many applications have proved themselves valuable.

In this process the necessary heat is produced by current flow through the high resistance of metals in contact, and when the proper heat is obtained the completion of the weld is accomplished by the application of pressure sufficient to unite the molten masses into one. This is the fundamental principle of the many spot and butt welding processes in use to-day.

Arc welding is about twenty years old, and was probably first introduced by Zerener, who devised the means of holding two carbons of opposite polarity in a V form and employing an electric magnet for forcing the arc toward the work. The desired heat was thus obtained directly on the metal to be welded, and welding wire was fed into the arc, filling the void and completing the work. This early process resembled that of the acetylene torch and is rarely used to-day.

The next improvement in the art was due to Bernardos, who dispensed with the electromagnet and one carbon, using instead the work as one side of the circuit and a carbon as the other. The arc was struck directly on the work, immediately producing the desired heat, and at the same time the welding wire was fed into the work. This process is still extensively used and lends itself most advantageously to many phases of modern practice. It is generally referred to as carbon welding.

A further development was made by Slavianoff who introduced the method of using the welding wire for both striking the arc and feeding it into the work. As a result the welding wire became known as the electrode, and the process as metal-electrode welding. It is one of the most generally used to-day, and whenever discussing it the term "electrode" refers to the metal added in the operation and the term "parent metal" to the metal to be welded. In recent years the term "arc welding" has been understood to mean metal-electrode welding, and it is generally customary to qualify the phrase when referring to carbon welding.

In the past a great many failures of welds have been largely due to the operator, who did not manipulate the electrode so as to bring the parent metal to a molten state. This resulted in the electrode being deposited on but not uniting with the parent metal, since no pressure is added to complete the union.

As an example of one such failure, the following may be of interest. A short time ago the writer was connected with an enterprise where difficulty had been experienced in successfully expanding 6 in. extra heavy pipe into steel flanges.

This method, however, proved unsatisfactory. Both the screwed flange and the Van Stone or flanged joint had also been disapproved, and when arc welding was suggested the writer was asked to make a sample for test.

It is still generally believed that the metal, in passing through the arc loses all its ductility and elasticity and assumes characteristics wholly those of cast iron or steel. The turnings of this weld, however, presented an appearance similar to good machine steel, and when analyzed showed the following: Silicon, a trace; sulphur, 0.075; manganese, 0.23; phosphorus, 0.0018; carbon, 0.25.

While it was essential that this weld be able to stand a steam pressure of 200 lbs., the sample was tested first at 500 lb., then at 800 lb., next at 1,000 lb., and finally the pressure allowed to go the available limit of 1,400 lb.

This test was witnessed by a number of interested parties, but one skeptical member asked that the specimen be given a hammer blow with the full pressure on. This was readily agreed to, and, since the workmen refused to strike the blow, the writer secured a 14 lb. hammer and struck twelve blows on the face of the flange, after which examination was made and no damage whatsoever was apparent. Six blows in the reverse direction were also given without producing any failure of the weld.

The weld was then tested. It was believed the weld was not more than 25 per cent. efficient, for the operator had not given his best efforts to the work, and as the welding material was only of about 50,000 lb. tensile strength, the effective area of welded material would probably show about 250,000 lb. This, however, was greater than the strength of the twelve ¾-inch flange bolts, which was perhaps 150,000 lb. The weld was then pulled in an ordinary testing machine at 119,000 lb.

Although the test had proved the weld capable of sustaining a strain greater than ever likely to be met in service, it was completed by breaking the weld. To do this the flanges were enlarged, and when the piece was again pulled the weld gave way at 208,000 lb., but before this the flange on each end had dished about ½ in.

The results of these tests, while showing that such a weld might be serviceable, nevertheless justify the statement that the weld was a failure, for the broken specimen showed that only about one-fifth of the welded material united with the pipe and flange. This was the most apparent from the specimen itself, which thus justified the previous estimate, since 208,000 lb. is practically 20 per cent. of the amount which it was assumed the weld would hold when figuring the 25 per cent. weld at 250,000 lb.

In passing, it is of interest to note that in one of the large manufacturing plants near Philadelphia, Pa., there is a 2,000 lb. hydraulic pipe system installed, every joint of which is arc-welded, and although it has been in service a year and a half, no joint has developed a leak or given any trouble. There are a number of firms to-day who are using electric arc welding for securing flanges to pipes and making T and other connections on steam lines, and their excellent records testify to the ability of arc welding to withstand the many strains of time and service.

Many other examples could be presented. The following is one of particular interest as it shows the service to be expected under severe conditions.

On the large 16-wheel articulated locomotive it is necessary to have a ball joint in the steam pipe between the two trucks, and one manufacturer has, for about six years, used the arc welding

Abstract of a paper presented at a meeting of the San Francisco Section of the American Society of Mechanical Engineers.

*Electric Inspector, U.S. Shipping Board.

process to fasten in place the ball of this joint. This weld must stand vibration from the jar of the locomotive over track and joints, tension and compression from the forward and backward movement of the train, reverse strain as the curves from right to left are made, and an internal steam pressure of about 100 lb. Six years' service has brought no reports of failure.

As an illustration of the saving in time and money often resulting from arc welding the following incidents are typical: The Italian ship "Titania" had a badly damaged rudder, but it was successfully repaired by arc welding at a saving of $10,000 and 4 months and 2 weeks of time. One part of the weld was completely through the 6 in. by 9 in. rudder post. This vessel was repaired in August, 1916, and has since seen constant service.

A report of the electrical engineer of one of the great middle-western railroad systems accredits to arc welding a saving of about $200,000 in one year. This saving was computed from economy in this method over others previously used on the same class of work, and also from the saving effected by the restoration to service of otherwise useless apparatus. Since that report this road has increased its number of welding unit about 300 per cent.

Among the great lessons which the recent war has taught us are economy and the conservation of our time, energy and raw material, and arc welding presents a veritable storehouse of opportunities ready for the engineer who will adapt them to his own requirements.

In the course of the discussion which followed Mr. Anderson's paper the following interesting facts were brought out. Since 1906, the Pelton Water Wheel Co. has used arc welding for very heavy work in building up large steel castings. In making these castings the shrinkage stresses are so severe that the reinforcing ribs are often pulled apart and ruined. The reinforcing ribs are therefore cut to allow for this shrinkage and then welded.

In discussing the relative merits of alternating and direct current, the consensus of opinion seemed to be that direct current is the more suitable for arc welding. Alternating current can of course be used, but it takes a more experienced man to maintain the arc, and in practice there are very few that are able to weld with any degree of satisfaction.

In discussing the question, What, in general, is the effect of the weld on the character of the metal? it was brought out that metallurgists and chemists are trying to arrive at some standard for electrodes. It must be remembered, however, that the parent metal has certain constituents that become molten. The electrode also becomes molten and it has certain constituents. These two commingle and form other elements which disappear in the heat of the arc, are carried off in the oxide, and sometimes, strange to say, form a new composition. The advocates of the covered electrodes claim one thing, others use use fluxes, and still others metals in various proportions, and every one is claiming certain results for the particular method he uses.

MULES IN A CHINA SHOP

The old saying in regard to the consternation brought along by a "Bull in a China Shop," has probably been easily paralleled by the recent shipment to Indo-China of 30 Bates "Steel Mule" Crawling-Grip Tractors, by the Automotive Products Corporation of New York.

This shipment is interesting to the American manufacturer and exporter from more than one point of view. In the first place selection was made after careful investigation by representatives of the buyers in this country. The tractors also had to be specially prepared for shipment so that they could upon their arrival, without any unnecessary delay, be put into running condition as they were to be driven under their own power a long distance into the interior.

Saigon, the shipping point, is the capital of the province of Cochin China, one of the sections of that great far Eastern territory controlled by France and comprising Indo-China. This area includes the great tracts of Annam, Cochin China, Tonkin and Cambodia, covering some 250,000 square miles and having a population of 20,000,000. Saigon itself, a city of some 50,000 population and about 30 miles from the sea, is one of the finest modern cities of the Far East and possesses many of the features that might be considered lacking in an area that for hundreds of years was controlled by the great but nomadic and warlike race of Mongols.

The tractors were packed and equipped not only for their journey half-way across the American continent and then across the Pacific and China Seas to Saigon, but also for their long inland journey. They will burn kerosene as fuel, on account of the high price and difficulty in securing gasoline. While the coasts of Indo-China are swampy, marshy and low-lying, the interior is rough and mountainous and, unlike vast areas of China, is heavily clad with forests. Many sections of the country are extremely fertile and grow crops of sugarcane, rice, cotton and even tobacco. The tractors are to be used in opening up new areas to intensive cultivation and some day we may be sweetening our coffee with sugar, eating the rice and wearing the cotton clothing that has been cultivated by these tractors sent from our own country.

PEAT, ITS EMPLOYMENT DURING THE WAR, AND ITS FUTURE

Mr. P. Willems, after giving a short history of the peat industry, remarks that the composition of peat varies greatly even in the same bog. He points out that in such countries as Norway, Sweden, and Denmark, where there is little or no coal, the peat industry is assisted by a Government subvention and by expert advice. In France, 70 years ago, about 500,000 tons of peat were raised annually; but this gradually decreased, until in 1913 it was only about 60,000 tons, and the industry received no aid from the Government.

When, during the war, the scarcity of coal became pronounced, the French Government decided to encourage peat-digging, but only small hand tools were generally available. The old mechanical diggers worked by hand power through gearing were able to raise a block of peat 0.30 m. x 0.30 m. x 6 m. deep (say 12 in. x 12 in. x 19 ft. 8 in. deep). Some of these were found and repaired, and it is hoped to obtain very soon, simple machines driven by a motor of 4 or 5 h.p. which will be able to raise 100 cubic metres of peat per day of 8 hours. Peat-mixing machines are now made which will treat 8 to 10 cubic metres per hour, and make it into cylinders pierced with holes; these, after drying, are ready for use.

In 1918, about 500,000 tons of wet peat were extracted, producing 100,000 tons dried, so as to contain 35 per cent. of water. It has been proved that steam boilers can be worked satisfactorily with a mixture by weight of one of coal to three of peat; 1½ tons of peat are equal to 1 ton of coal. Domestic closed stoves can be fed with anthracite (or coke) and peat in equal parts. When coal falls to the normal price the use of peat as fuel will no doubt decrease, but then will be the time to distil the peat and obtain combustible gas and by-products.

The author describes some of the minor uses of peat, such as that of bedding for animals, paper and textile making, but these would scarcely find a use except during such circumstances as were produced by the war.—Procesverbal de la Societe des Ingenieurs Civils de France.

A company at Elizabeth, N. J., is plating iron sheets with copper by a new process. The plating metal is applied to the sheet in the form of a soft sixture by means of rolls, such as inking rolls. The sheet, after being coated with this mixture, is automatically carried forward and deposited on a link-belt conveyor, which carries it through a furnace maintained at a temperature well above that of molten copper. The basic principle involved in this method lies in the application of the plating metal to the sheet while the sheet is cold and then melting the metal in place on the sheet under conditions which are favorable to the formation of the plating.

Because of the law prohibiting the employment of boys in the anthracite mines of Pennsylvania, the operating companies are employing old men in their places, as slate pickers, jig operators, chute tenders and oilers in the breakers.

The potential output of petroleum from the wells of Mexico is, according to information furnished by the Secretary of Indutsry and Commerce, equivalent to over 250,000 cubic metres daily but the actual output is only about one-tenth of this amount.



DEVELOPMENTS IN SHOP EQUIPMENT



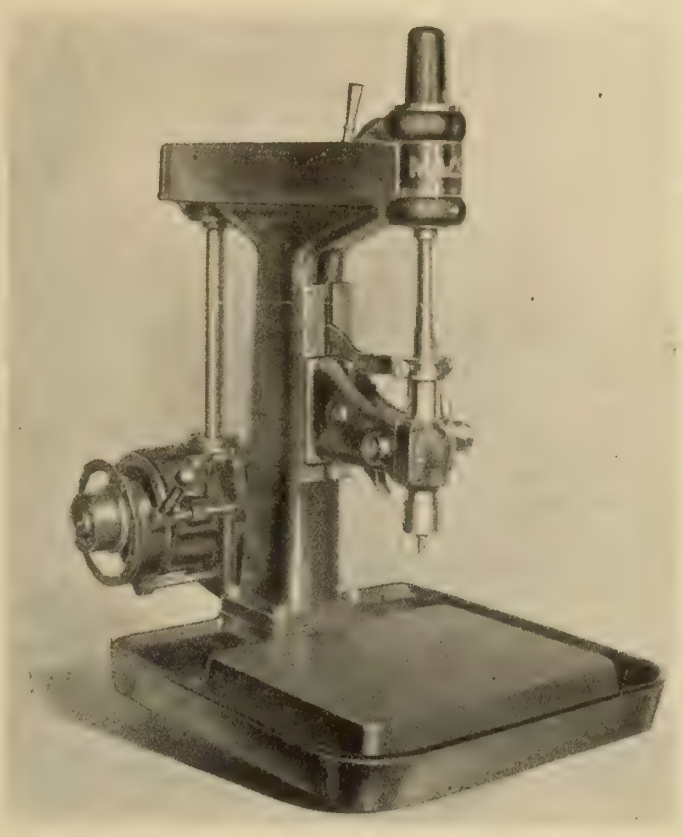
MASON DRILLING MACHINE

The Arthur C. Mason Inc., of Hawthorne, N.J., have recently placed on the market a high-speed, sensitive, ball-bearing, drilling machine.

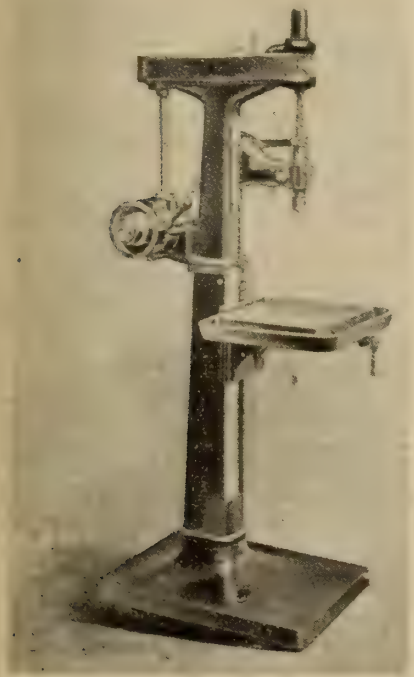
Three prime factors have been incorporated in this quick change machine, namely:

Efficiency, lasting accuracy, and ease of operation. Further improvements have been made to bring out a machine of unit construction which permits ease of adjustment for wear and replacements. The total elimination of frictional bearings, the entire absence of belt trouble and the directness of drive, induced positive and instant speed changes with ball-bearings throughout. All danger from exposed moving parts is entirely eliminated.

The design is somewhat heavier than usual, which makes for greater rigidity under highest speeds. All moving parts have been covered, with the idea of "safety-first" in view. The nose of the chuck is the only visible moving part on the whole machine. Operating levers have been placed within easy reach, and all speed changes can be made instantly without stopping the machine. There are no belt idler adjustments to be made whatever. Four spindle speeds from 3,000 to 10,000 are arranged for, and lower speeds in proportion. The machine is lubricated for six months from the date of installation, with the single exception of the spindle. An endless belt and a suitable chuck are furnished with the machine.



MASON DRILL BENCH TYPE.



MASON SENSITIVE DRILL.

The Drive

Power is applied through a pair of tight and loose pulleys, to a specially designed silent gear driving a vertical back shaft in connection with a straight horizontal endless belt, to the spindle.

A woven belt is furnished with the machine; all stretch is automatically taken up by an idler under-spring tension. The belt requires no attention for a period of from six months to one year. Belt slippage and wear is reduced to a minimum by the use of a special fabric composition spindle pulley.

The spindle is made of high-grade spindle steel, accurately ground, and is arranged with a double ball-bearing so that the thrust can be taken up in both directions; by this method all end play can be eliminated. Provision has been made for retaining a supply of oil to continuously lubricate spindle bearing, preventing its rapid wear at high speeds. The spindle balance has been arranged so as not to lessen the extreme sensitiveness.

The spindle sleeve is made of steel accurately ground, and requires no oiling. A convenient adjustment has been developed for quickly taking up the lost motion between the teeth of the sleeve and the pinion. A positive non-slipping depth gauge has been provided.

The spindle sleeve bracket is well proportioned and rigid; the spindle sleeve is guided by a feather; the clamping device is new and effective and quickly operated.

The table is heavy and of larger capacity than usual, and has a generous channel for catching oil or chips. In the column type the table is counterbalanced and is quickly adjustable to any position. The binder handle is always in the correct position.

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Killing Patronage Again

THE Farmers' party in Ontario is reported as having a bit of a flare-up over a $3,500 per annum job in London.

The patronage system, of course, has been killed. It's been killed before, but generally keeps in pretty fair shape in spite of all the assassinations.

Will the politicians from lot 10, concession four, be any less keen to run in and take the Government jobs than the city and town type? We shall see.

Of course we are all ready to hoot and shout at the funeral of friend Patronage. We will walk through the moral cemetery and smile approval at the slabs they may weave to decorate his resting place.

And after all this has been accomplished, we turn home only to find old man Patronage standing on the main corner of the town, right across from the post office.

It has yet to be demonstrated that any political party can survive without the patronage system being on hand to haul grist to the mill.

Why Not Settle the Strike?

FOR months past a strike of moulders in this district has dragged along. Some shops have signed up, but many of the larger ones have not. As far as we can learn the chief trouble is with the 44-hour week, the foundrymen holding that they cannot grant this, as they are in competition with 48-hour shops all over.

Many good moulders have left this city and district. Some of them are working in places where the hours are longer than those they were working here before the strike.

There is a disposition on both sides, as far as CANADIAN MACHINERY can learn, to have this strike settled.

Why not make the effort? Is there a better way to start the New Year than by wiping out the scores that have made 1919 an industrial nightmare in many spots?

It is time that reasonable and sensible men realized that limiting production and talking about lower living costs are not reconcilable.

The less we produce, the less we have to sell. The less we sell the less money in circulation, and the less able we are to batter down the smothering exchange rate against us in United States markets.

The fag ends of 1919 strikes should be wiped out. Get together on this proposition on a reasonable and sane basis. There are no insurmountable objects in the way. A little common sense, moderation and sincerity on both sides would start 1920 off on a good industrial basis in the Toronto district.

An Undesirable Condition

WRITING in the Toronto *Globe* of recent date in regard to the way the Government runs its railroads, a correspondent says:—

"I had occasion to visit Prince Edward county, where the only line of railway serving that prosperous farming community is the old C.N.R. line running between Trenton and Picton, now, of course, under Government control. I was obliged to take an early morning train in returning to Toronto from one of the points on the line between Trenton and Picton, and was surprised upon reaching the railway station to find it in complete darkness save for the warm glow of a coal fire which shone from the interior of the waiting room. My friend who accompanied me to the train apologized for the state of darkness surrounding the station-house and explained that it was never open at that time in the morning, and also was rarely open when the eastbound train arrived late at night. People who had come to the station either to meet friends or to see them off, he said, were obliged usually to stand outside in the cold. He also added that freight service had been very bad along that line, he personally having waited over three weeks for a shipment of tin roofing material from the town of Oshawa, and had had no notice up till that time, of the date of its arrival. After entering the train the conductor, upon punching my ticket, inquired if the station at the point where I had boarded the train had been open. When I said "No," he informed me that this condition prevailed all the way along the line between Trenton and Picton, and he said that it involved much extra work for him in issuing tickets to passengers after they had come aboard. I asked him if this state of affairs had existed since the Government had taken over the road, and he admitted, rather hesitatingly, that this was the case."

Now it may not be a fair thing at all to take this case and hold it up as a specimen of the way the Government runs its railways. At the same time there is the germ there that has done much to bring the phrase "civil service" into meaning anything except efficiency and competence.

The Government in the past has been an easy mark to work for in many cases. Salaries were not high, but duties were not very exacting.

It has led to the belief that taking money from the Government was like picking it out of the air, or waving King Midas' magic wand.

Why can't we face this thing as it is, and realize that the people themselves constitute the Government? When they take money and do not give a service commensurate with the amount expended, they are simply taking their own money to plug up the gap and piling up a liability that they must liquidate.

It may be poor management on the part of the Government, and again it may be a lack of real, wholesome honesty and sincerity on the part of the people. The two together make a combination sufficient to hang like a millstone around the financial neck of any national service the Government may undertake to operate.

Chalk production of England is between 4,000,000 and 5,000,000 tons, with an approximate value of 10½ cents per ton. The output for 1913 was 4,458,126 tons, worth £213,479, of which 2,796,857 tons came from the county of Kent.

The New Year Resolution

DID you make any new resolutions for 1920? Perhaps you have made them before, only to break them, but the very fact that you consider it necessary to make a few resolutions is fairly good proof that you've got enough common-sense to see where you fall short of being the man you want to be.

The first of the year is a good time to take stock of yourself. You may imagine you're a dandy. But are you? Be honest. Take a good look at yourself.

It's no trick at all to stand up beside a foot-rule and imagine you're a pretty big man. Neither is it much of a trick to put yourself up against a very average standard of things in general, and juggle yourself into believing that you're not such a bad sort after all.

But get a good, big stick—ten feet long—and stand beside it. Get a high standard of all-round excellence and measure up to it. Then be honest, and if you're a runt, admit it.

Sit down some night, and think the whole thing over. Have you got any particular objective in life? Is the old world better or worse because you have lived in it? Don't hedge or dodge. If you are the man you ought to be you can weigh yourself and see where you fall down.

Remember, the world accepts you largely at your own valuation. In 1920, if you're a dub, the world will accept you at that rating. If you want to be rated as a real man, then play the part.

A Much-Misunderstood Term

TERMS of a semi-technical and semi-commercial nature are in current use, which are very imperfectly understood, even by those who should be absolutely clear on the matter. A typical example of this is much in evidence of late in connection with the Ontario Government's Stationary Engineers' Act. For the purpose of grading certificates of competence, and also of grading the relative importance of different plants, a basic unit of power must be adopted. The natural factor to use is the capacity of the boiler, and this is expressed in terms of boiler horse-power. It is this latter expression which leads to so much confusion.

To the general public, horse-power is a familiar term. They know it as a measurement of their car's capacity. They have heard it spoken of in connection with the locomotive that draws them from town to town, the ship that carries them across the lakes and oceans, the aeroplane, etc. The stationary engineer knows it as a measurement of his engine's capacity. The technical engineer, when he thinks of horse-power, recognizes it as a measurement of the rate of doing work. That is 33,000 foot lbs. of work per minute. When the term is applied to a boiler nobody seems to be very clear as to what it means, and long misuse has clouded the meaning more than necessary.

Both engine and boiler makers found it necessary, when marketing their wares, to have a simple way of explaining their rating to prospective buyers. Engine builders for some time used a rating based on the circular inches in the engine cylinder, and called this nominal horse-power. This was so far from being a measure of the engine's capacity for doing work that it was soon discontinued, and the indicated horse-power rating was adopted. The boiler-maker needing a rating for his wares, designated his boiler as being of so many horse-power. To determine this, a certain number of square feet of heating surface were allotted to produce one horse-power, this number of feet divided into the total heating surface being the boiler rating. This was a step towards a standard, but unfortunately every maker used a different divisor, usually taking one that would give the highest rating to the boiler. Apart from this, the rating did not, and does not convey much meaning to the average commercial user. For instance, two users may have each a 100 H.P. engine. One is compound condensing, and uses 18 lbs. steam per horse-power per hour. The second is an automatic slide-valve and uses 30 to 35 lbs. steam per horse-power per hour. Now, if they go out and ask for a 100 H.P. boiler in the open market one will get a boiler inadequate to his needs. Recognizing this, experiments were made by the American Society of Mechanical Engineers, who determined that a boiler horse-power should be the capacity to evaporate 34½ pounds of water at 212° F. to steam at 212° F. per hour. This is a definite performance, involving the expenditure of a definite amount of heat, which gives a definite amount of energy available, and horse-power is energy expended at a certain rate. Now, obviously as fuel is the medium to supply the heat, the evaporation depends on the amount of fuel burnt per hour. Therefore, if a prospective buyer knows the grate surface he can form a fair idea of the evaporative capacity of the boiler. A very closely approximate rule is to take the area of the grate and multiply it by three. For instance, a 60-inch boiler will have a fire grate 5 x 5, and multiplying by 3, gives 75 H.P. The Ontario Government standard is 34 pounds of water from and at 212° F. per hour. They also give 15 square feet of heating surface per horse-power for a horizontal boiler, and variations from this for other types. However, horse-power, based on heating surface, is only useful as a commercial term. It is the evaporative capacity of the boiler that counts, and, while the heating surface has something to do with this, the amount of fuel that can be burnt per square foot grate per hour is the real governing condition.

A Real Mechanic For a Day

OH, I like a-hangin' round the house the week past Christmas time: the feelin' that camps in my chest is powerful nigh divine. I love that season of the year, by gum, I surely do—it makes me be a kid once more and makes old things come new.

In that there season of the year I get my saw and file, I get my hammer and the glue, I hatch also a smile, and then I gather spikes and tacks, a daub of paint what's red, and tell the kids to come along, I'm fit to go ahead.

And that procesh then starts to come in anguish and in woe; I have to put a spine in new and straighten out a toe—and put a neck beneath a head, and sprout a brand new leg, and make a hen look like as though she'd squat and mold an egg.

And what are all these wondrous things I operate on now—to chase the wrinkle and the scowl from out the childish brow? Why, just the Christmas stream of junk that's built for hours of play—the elephants that thrive an hour, the dolls that live a day.

I put new ears upon the horse, new wheels upon the carts, the Noah's Ark calls forth in grief for sixteen brand new parts.

Oh, in them hours I do rare tricks that sawbones wouldn't try—I carve a leg from out a slab, of beads I mold an eye. Ah, yes, I am a man of parts, smart lookin' to the child; he glories in my stone age craft and in my art so wild. I am a genius for a day, real wheat without the chaff, as I plan new noses for the pigs, new legs for the giraffe.—ARK.

The Italo-American Union, a new trade organization of Italians interested in America, has recently come into existence. It is designed to furnish a centre for all Italo-American committees, and comprises economic, intellectual, art, legislative, and press sections. The National Foreign Trade Council learns that behind it are the big financiers and commercial men of Italy, who hope to encourage commercial and economic relations between the two countries.

The association has obtained the beautiful mediaeval Palazzo Salviati on the Corso Umberto, and will provide there an information office for American business men, a library of American industry, and a central meeting place combining both business and social features.



MARKET DEVELOPMENTS



The Prices Going Up in Some Lines of Steel

Hard Matter to Get Enough to Satisfy the Trade—Scrap Markets Dull Through the Holiday, With Coppers Weak—Large Amount of Business Waiting to be Looked After as Soon as It Can be Handled

AS might be expected, trading is dull during the Christmas season in some lines, but in the main the volume of business that is ready to be taken care of in the machinery, iron and steel markets is large and promising for the coming year.

Probably the most serious problem for the moment is the supplying of the wants of manufacturers who are insistently in the market for sheets, black and galvanized; for plate, bars, tubes, etc. The improvement in the way this material is coming through is very little, if any at all, and it is hard to see where help is coming from. Pittsburgh, according to very reliable reports, looks for nothing like real production until well on in March of 1920. Meanwhile prices continue to rise, not necessarily with the mills, but with the jobbers. Many lines are getting back to where they were when Government control was on, and others are higher than at that time. Mills do not want to take on business. They cannot trust the future sufficiently in regard to production costs, etc., and then there is the desire, perhaps not openly expressed, that the mills shall be in shape to take on business when the prices increase, as they figure they must in some lines at least.

United States Ordnance Department is putting a big list of machine tools on the market here. These were taken from the munition plants in Canada where contracts were held for the U.S. Government. For instance, one Toronto shop and one Montreal shop had between them 600 lathes. Much of the equipment that was strictly single-purpose has been already scrapped. In fact, there is not much war scrap left in the country.

The scrap metal market remains dull. Steel items are the most interesting, and higher prices may be necessary to bring material from those who are holding it. The coppers are weak and may continue so. The companies are going ahead with production, while the export business is not taking anything like the usual amount of material out of United States. The result is that there is too much copper in the market for higher values. This condition is very quickly reflected in the Canadian market.

A YEAR OF UNCERTAINTIES AND OF MEN CHANGING THEIR MINDS

Special to CANADIAN MACHINERY.

PITTSBURGH, December 31.—The pig iron and steel markets have been very quiet the past week, as indeed they have been for a fortnight, thus reflecting the dullness the holiday season always brings. Pig iron prices are stationary, while small lots of some descriptions of finished steel products for early deliveries have brought larger premiums than were ruling. The total tonnage sold at fancy prices is very small in proportion to the large tonnages that have been sold for late deliveries, particularly the second quarter, at either the March 21 prices—the "stabilized" prices—or at slight advances above them.

Indications point to a steadier market in both pig iron and steel products in future. The holiday dullness has given buyers an opportunity to reflect, and in large measure they have gotten over their scare, so that they are not likely to continue the process of bidding the market up on themselves.

The Year 1919

The quietness in the market leaves opportunity for a brief consideration of the year now ended. It was a year of uncertainties and of men changing their minds.

The thought at the beginning of the year, only seven weeks after the armistice had been signed, was that there was a great deal of work for everybody to do, and that conditions would have to be developed whereby they would be in a position to do the work. Necessarily, it seemed, the work left undone was chiefly of a construction character, thus representing investment, and for an investment there must be assurance to the investor that the investment will prove profitable. The investor would not put up a building or factory or power plant if he foresaw that a year or two later he could build the same thing at considerably less cost.

As prices for commodities and rates of wages were vastly higher than before the war, the common thought was that everything would have to be "deflated," just as everything had previously been "inflated" before business in large volume could proceed. The iron and steel industry, fearing that eventually the bottom might drop out of the market, had already made some price reductions, $3 a ton on pig iron and various reductions on finished steel products, which represent an average of a trifle over $4 a net ton on the whole list. It was prepared to make further slight reductions at intervals. There were some in the trade who advocated maintaining the full Government war-control prices on the theory that there would not be much buying in any event.

In February the Government took up the price deflation subject, and Secretary Redfield, of the Department of Commerce, appointed the "Industrial Board," which would deflate and stabilize prices. The board began with the iron and steel industry, arranging for a reduction of $4.25 a ton in pig iron and reductions in finished steel averaging nearly $7 a net ton. The new prices became effective March 21 and are still referred to as "March 21" or "stabilized" or "regular" prices, in the case of unfinished and finished steel, but in pig iron those prices are forgotten since pig iron declined in some instances during

the second quarter, while in all districts it advanced sharply in the second half of the year, being now nearly $3 a ton higher than the war-control prices.

The Industrial Board struck a collection of snags. The iron and steel prices were criticized in some quarters on the ground that the reductions were insufficient. The controversy waged largely in the public press between Chairman Peek of the Industrial Board and Director-General of Railroads Hines as to whether or not the deflated prices were low enough, may be passed over in this review for the reason that the gentlemen were simply trying a moot case, because after all the railroad administration had no occasion to make any purchases of steel, at Mr. Peek's prices or any other, that would count for anything.

Another snag the Industrial Board encountered was that other industries would not reduce prices as the iron and steel industry had done. Another, which it ignored for more than a month, was that the Attorney-General had rendered a positive opinion that the whole procedure was illegal.

The Dearth of Orders

Production of steel decreased, until, by the middle of May the iron and steel industry was operating at only about 50 per cent. of its capacity, this comparing with an 87 per cent. operation in January. There was surprise, not that the operating rate dropped to 50 per cent., but that it was so high early in the year that the low point in production was not found until six months after the armistice was signed. The common view before the armistice had been that when hostilities ceased everything would stop.

Many attempts were made to explain why the mills operated as well as they did in the early months of the year. One was that at the time of the armistice there was a great deal of work in progress that was good for peace times as well as war times, even though inaugurated in connection with the war. Another was that certain large steel interests had quietly "reinstated" a large quantity of relatively low-priced business, this being regarded as quite different from cutting the market openly.

Turn in the Tide

It is undesirable to attempt to analyze the complicated economic influences that molded affairs. Suffice it to point out that there was a general swing downwards and then upwards, and the iron and steel industry had to be carried with it. Commodity prices in general, as shown by Bradstreet's index number, declined continuously to about May 1, and then began to advance. Wages did much the same. There were no wholesale wage reductions in the early months of the year, but there were some. Beginning in April or May, wages tended rather to rise than to fall.

Eventually people came to realize that whatever theories or notions they had entertained, prices and wages were not going to fall. Confidence was thereby established, not to a great extent if one consider carefully, but to a sufficient extent to make the country busy. It would have been very unfortunate if "confidence" had been completely restored, for that would have meant the country attempting to do several years of work in a few months. The attempt could not succeed and confusion ruinous to everybody would have resulted.

At the annual convention of the American Federation of Labor held in St. Paul, in June, 1918, it was recognized that the great "open shop" iron and steel industry stood as a bar to any further great progress of the union movement. The convention did not put itself on record as saying so, but the chief consideration, doubtless, was the spectacle presented by the industry of its ability to get along on the open shop principle, and if so, why could not other industries? Accordingly steps were taken to organize the industry. By August, 1919, after some 14 months of work, the organizers found they had done about as much as they could expect. While they had not organized anything like the majority of the men, they had gotten to a point where they could not keep up the excitement except by a strike, for they stood to lose the adherents they had more rapidly than they could expect to gather fresh adherents. Accordingly, the strike was called for September 22 with no demands at all having been made upon the independents, and none upon the Steel Corporation except a request, on the part of the strike leaders, for a "conference" with the chairman of the Steel Corporation.

The strike proved to be chiefly one of common labor, and chiefly the ignorant foreign born labor. It did not touch the ore fields or the Connellsville coke region. As to the remainder of the industry, it rendered idle about 40 per cent. of the men, many of those rendered idle being intimidated rather than being actual strikers. Production was cut about 50 per cent. After the first few days production began to increase by men returning to work, and by the first week in December the strike was practically over except in the Wheeling district. Then came closing of some mills on account of coal shortage, and when coal supplies became available again even the Wheeling district was willing to work.

On the basis of the rate of production just before the strike, a rate of about 83 per cent. of capacity against the 50 per cent. rate at the middle of May and the 87 per cent. rate in January, the strike caused a curtailment of finished rolled steel output of nearly 3,000,000 gross tons, and a curtailment in pig iron of 2,500,000 tons or a trifle more.

The Year's Production

The year's production of finished rolled steel was about 25,000,000 tons, while capacity is about 37,000,000 tons. Thus about one-fourth of the lack of production can be ascribed to the steel strike and about three-fourths to lack of orders. It was certainly ironical that orders should be scarce up to the time of the strike and be all too plentiful, for the market's stability, when the strike was about over.

The "Transitionary" Period

During the war and for some months afterwards there was a great deal of talk about "the transitionary period" during which industry, finance and everything would adjust itself and change for war-time to regular peace-time conditions. The idea is now seen to have been the biggest blunder that could possibly be made. In one way there is no transitionary period and in another way the world will not be done with its transition in five years or ten years, perhaps not in 15 years. There have been remarkable changes in 1919, falling prices and wages, and then advancing prices and wages, and there will be such changes in 1920 and succeeding years.

POINTS IN WEEK'S MARKETING NOTES

Scrap markets are dull, especially in copper. There seems to be too much copper on the market at present. It is being produced at a high rate, while little of it is being shipped out of the United States.

—

It may be that higher prices will shortly be paid for steel scrap, which constitutes a large part of the scrap business.

—

Everything in sheets is very hard to secure. In galvanized it is almost impossible to get a shipment, and premiums are readily paid for any material that can be secured.

—

Montreal, it is reported, has increased seamless and lapwelded tubes 10 per cent., but no advance has been made in Toronto warehouses yet. An increase seems likely, though.

—

A large amount of machinery and equipment is being put on the market by the U. S. Ordnance Department in Canada. This was taken from the shops where U. S. contracts were held.

—

Makers of small tools are being asked for a special price on a fairly large order. Dealers are anxious to see what happens as price shading has been absent from the selling in this district for some weeks past.

—

A large purchase by France of war tools on the U.S. market has cleared the situation there. This order was for $25,000,000, and paid for by ten-year bonds.

—

New York machine tool market says that 1920 is going to be the greatest year yet.

CONDITIONS MUCH LIKE THE WAR YEARS

Deliveries Distant, Prices High, and a Lot of Business are the Features Just Now

TORONTO.—The close of 1919 witnesses a market much the same as the market from 1915 to 1918—the busiest years of the war.

At that time dealers were swamped with business they could not handle. They could only guess at delivery schedules. Now the situation is not much different. Deliveries are not improving. The costs are mounting, and in some lines it begins to look as though the end were not yet in the matter of mounting costs.

Millers, for instance, are due for an increase, according to some of the dealers. They were brought down about 20 per cent. some months ago, and have since been selling on that basis. The reduction was made on the assumption that there would be decreased prices in all machinery lines following the war, but these have not come. No intimation has been given yet on the price of millers, but dealers are expecting something to happen in that direction.

A large quantity of used machinery is being placed on the Canadian market at present by the United States Ordnance Department. One hardly has a conception of the amount of machinery that was put into the munition shops until the lists are looked over showing the amount of machinery that had to be disposed of. Machines that were entirely of the single-purpose variety were scrapped some time ago, and a good many of them went out of the way in this fashion. The steel billets have been cleared out, but there remains about a half-million pounds of copper ingots in the Montreal district, for which sealed tenders are being asked.

The Small Tool Market

Business continues brisk, with bookings satisfactory, and, what seems to please the dealers most of all, there appears to be an absence of price shading in this field. One instance is being noted with some interest. A firm that has a good order to place is trying out the various makers to see if a special price can be secured. As far as CANADIAN MACHINERY can learn, there has been no move made yet to meet this request. The special representatives cannot afford to go below their regular selling schedule, or they would have nothing to come and go on.

Some very nice orders are coming in from a wide range of industries, and, for the holiday season, the dealers are satisfied with the amount of business they are doing.

Steel Markets

Although Toronto dealers have not done so yet, information points to the fact that they have announced a new rate for boiler tubes, which is practically a ten per cent. increase over the last issued schedule. So far, the price has not moved here, and the chances are that, for the present at least, the price will not move, although, when selling has to be done on the basis of replacement of stock, a new schedule will probably be necessary.

A change was made some weeks ago in the manner of pricing cold rolled shafting. The old way was a list price, with a plus or discount. Now there is a base price for mills and jobbers for sizes and quantities. The base at the mills has been $4.95, and from the jobbers $5.50; but the price of $5.75 will probably be nearer what the jobbers are asking.

There is nothing in the way of improvement in the matter of galvanized sheets. They are scarce—very scarce comes nearer to the truth. As far as some cases are concerned, the real situation is that they are not to be had for any price. The 10¾ ounce are priced now at $9; but that price is more or less nominal, as a person who really has to have sheets is apt to pay a pretty stiff premium, and to do so willingly. Although that is the case, it cannot be said that any of the dealers or galvanizers are out to gouge the trade for this particular line, and, as a general rule, they seem to be content to make a fair profit on the deal, especially in view of the difficulty of replenishing the stock in their warehouses.

Sheets, as a general thing, are away back on deliveries. No. 10 are now quoted from the warehouse at $6.50. Blue annealed were fixed by the Government, when Government control was on, at $3.55 for No. 10 gauge. That price was on under war conditions. To-day the price is $4, and the mills are not a bit particular about taking on any more business, as they have more than they can handle, as things stand at the moment.

Scrap Market Dull

There is nothing much moving in the scrap market, and dealers are not looking for any improvement until business gets under way following the holiday season. The steel items are the best in the whole assortment, and the chances are that some higher figures may be necessary in order to induce some of the holders to let go of their material. Steel, of course, is the big end of the scrap market, so far as the ferrous lines are concerned.

Copper, and the rest of the yellows, are weak, and the best guess is that they are going to stay that way for a while yet. The big companies are going ahead and producing copper just as though the export trade were active—while, as a matter of fact, the export business, owing to the exchange rate, is almost a dead letter. There are still some nice lumps of copper in the country from the war contracts. For the time being, there is too much copper in the market to suit the man who wants to make money out of a rise. Of course, this is a condition that would soon right itself were conditions to become normal and the export business to resume.

AMERICAN MACHINE TOOL TRADE LOOKS FORWARD TO GREAT BUSINESS

Special to CANADIAN MACHINERY.

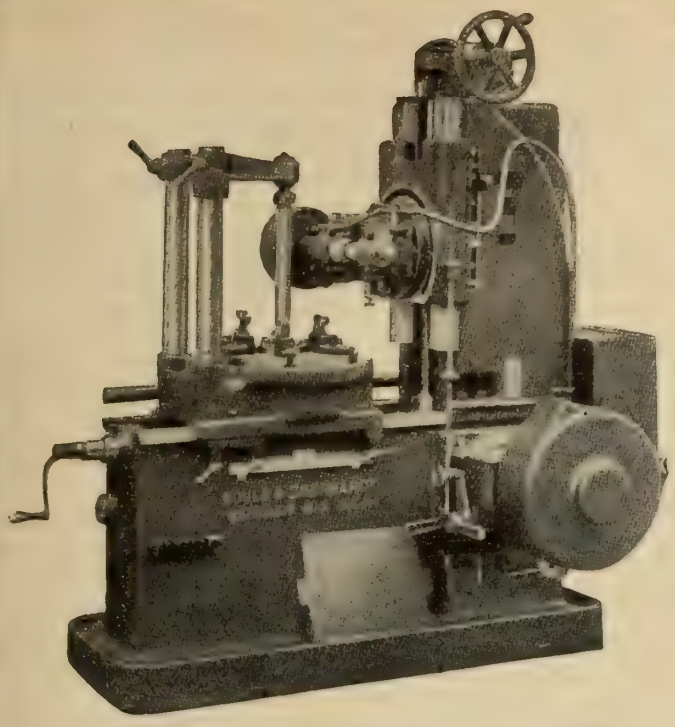
NEW YORK, Dec. 31.—With many machine tool manufacturing plants sold up for three to six months, or longer, and orders still coming in at a very good rate, the American machine tool trade has brighter prospects at the beginning of 1920 than it ever had in its history, with the exception of the war years. The year closes with good business in all lines, many buyers hurrying to get their orders on the books before Jan. 1, when some advances in prices will undoubtedly go into effect.

Throughout the year, the automotive industries have stood out prominently in the buying of machine tools. In fact, without the automotive industries, the machine tool trade might have had a very dull year. At the close of the year, however, manufacturers in many other metal-working lines have begun to place their orders, and the requirements of a goodly number are still to be met in the new year.

Practically all of the automobile companies have bought new equipment in 1919. The total purchases of the General Motors Corporation run into many millions, while orders from $100,000 to $1,000,000 have been placed by other companies in the same field. Outside of the automotive industry, the largest buyers have been the E. W. Bliss Co., Brooklyn, N.Y.; the American Locomotive Co., New York; the American Car and Foundry Co., New York; the General Electric Co., Schenectady, N.Y., which has also bought for new plants at Rochester, N.Y., and Decatur, Ind.; and the Columbia Graphophone Co., Bridgeport, Conn.

Export trade has not maintained the promising start it made early in the year, but the falling off has been due largely to the unfavorable rates of exchange with European countries. Japan, China, and some of the South American countries, have bought fairly well.

While the trade during the early part of the year viewed with grave apprehension the possibility of a flood of used war tools, this factor has now largely been removed from consideration. The French Government will buy $25,000,000 worth of the Government surplus, and a commission is now on its way to the United States to make selections. The tools are to be paid for by 10-year French bonds. Of the remaining tool surplus, there probably will not be



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Automatic** therefore **Economical

If you cut gears in quantities they can be cut with advantage on G. & E. Gear Cutting Machinery.

For gears up to 120" dia.

Catalog describing full line of Gear-cutting, Hobbing and Rack-cutting machines on request.

Write for prices and deliveries

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

64 Front Street West
TORONTO

Acid Electric
STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

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"CLASS"

There is "Class" to each "MORROW" product; that indefinable something which lifts them out of the ruck.

"Good enough" won't do in "MORROW" manufacture. Everything must be "better than" the average. Each article is built on honor and sold on merit.

As quality is the sole argument to the discerning buyer, we can appeal to him with "MORROW" manufactures.

Remember these "MORROW" products in your next requisition.

"MORROW" Set Screws.
"MORROW" Cap Screws.
"MORROW" Nuts.
"MORROW" Twist Drills.

They have the "CLASS."

John Morrow Screw & Nut Company, Limited

Ingersoll - Ontario

Ingersoll Files Are Good Files

DRILLS FILES

MORROW NUTS MORROW

If interested tear out this page and place with letters to be answered.

enough high-grade machines to affect the situation seriously. It is significant that the demand for second-hand tools keeps up at a good rate, in spite of the large buying of new tools. The demand for second-hand tools is, in fact, stimulated by the shortage of new tools for prompt delivery.

During the past week, the American Car & Foundry Co. has placed some fairly large orders. The General Electric Co. continues to buy, and orders have been placed for numerous tools by the Neptune Meter Co., New York, C. H. Johannson, Inc., Poughkeepsie, N.Y., and the Poole Engineering & Machine Co., Baltimore, Md. The latter is buying a list of equipment for the manufacture of electric washing machines.

AS HIGH AS 3.25 IS OFFERED FOR PLATES TO SOME INDEPENDENTS

Special to CANADIAN MACHINERY.

MONTREAL, Dec. 31.—There is every prospect of a busy period developing early in the new year, although there is a temporary lull at present, due very largely to the holiday period and the general stock-taking of many firms at this time of the year. Business is taking on an undertone of activity and deferred action in many cases is the inability to get definite assurance of delivery of material. This is particularly true in respect to finished steel lines, and very little betterment is looked for until well into the spring. Business in machine tools has not been very active, but the volume of inquiry is sufficient to maintain the interest of the trade. Delivery of tools from the States is still of uncertain character, and sales of used equipment are frequently made when immediate needs are considered. The old material market is quiet, but the outlook is for a better and firmer market.

Scarcity in Finished Steel

"Shortage of steel lines in every direction," was the remark of a dealer here this week. "Most of the large mills are booked ahead for nearly six months, so there is little hope of relief in the way of steel for some months to come." The larger producers are holding firmly to the price of $2.65 on plates, at mill convenience, but as high as $3.25 has been offered to some of the smaller independents for immediate delivery.

In the case of some of these smaller mills, the bookings are seldom more than two or three weeks ahead, and they are frequently in a position to take advantage of premium offers. Officially, the strike of steel workers is still effective, but the return of many workers has enabled a resumption of operations that is slowly, but gradually, returning the mills to normal activity. Reorganization of employers and departments has resulted in restricted production, and it is roughly estimated that upwards of four million tons of finished steel has been lost in consequence of the strike, and in the face of the present demand it will take some time to overtake this handicap.

The insistent demand for sheets and plates prevents the mill from overtaking it and a marked scarcity of these products is still pronounced. The shortage of black sheets is reflected in galvanized, as the galvanizers are unable to procure sufficient base material to satisfy the trade requirements. Boiler tubes are still hard to get and the market is very firm. Price changes this week are confined to sheets; black 28 being quoted at $7.00, an advance of 45 cents per hundred. Canada dull plates are quoted at $7.65. Premier 28 is quoted at $8.85, a rise of 65 cents per hundred, and 10¾ oz. at $9.25, shows an advance of 75 cents per hundred lbs.

Metals Move Upwards

The non-ferrous situation is affected more by the changes in the States and abroad than by any material altering of local conditions. The market here, as regards sales, shows little change, and demand is quite steady. Exchange rates and the English market are responsible for daily fluctuations in the States, but this is not always reflected here, although it keeps the dealers very active following the movements of the larger interests. Lake copper has advanced to 25 cents, with castings quoted at 24 cents, an advance of ½ cent per lb. The nervous condition of tin is shown in the sharp advance of the week, which is now 65 cents per lb.; this, however, is a nominal figure, and is subject to change from day to day.

There is a fairly good demand for spelter and the quotation of 11½ cents represents an advance of 1½ cents per lb. Lead is also up 1¼ cents and is selling at 9½ cents per lb. Antimony is up a cent at 11½ cents per lb.

Steel Scraps Advancing

There is little to report in the old material situation, as the market is affected by the holiday season and some plants have been operating at low capacity during the past week, so that the requirements for scrap have been lighter than usual, with the feeling that this will continue throughout the present week. Dealers, however, are looking forward to increased demand early in the coming year, and anticipate a stronger market than that now prevailing. With the steel trade gradually getting back to normal in the States, it is expected that better buying will develop before the close of January. All metals are moving slowly with quotations on non-ferrous quite firm. Iron and steel scraps are taking on strength and prices are advancing. Advances range from $1 to $7 per ton, malleable scrap taking on this last advance. Wrought iron axles are quoted at $25, an advance of $5 per ton. Revised prices will be found in the selected market quotations.

U.S. SCRAP METAL

The demand for scrap is showing improvement which is a reflex of the improved coal situation. There have been some price advances. Following are reports from various sources:

ST. LOUIS.—There has been a general advance in prices from $1 to $3.50 for all grades. Old car wheels have gone to $28.50 and $29. There is a very confident feeling in the market due to a good general demand and a marked scarcity of material.

NEW YORK.—Foundries are buying scrap freely without question of price. No. 1 heavy machinery is quoted $27 to $28 f.o.b. New York. City wrought pipe, long stock, is $21.50 to $22.50 f.o.b. New York. Machinery cast is $29 to $30. Heavy melting is unchanged but firm.

PHILADELPHIA.—There have been good purchases of heavy steel scrap, blast furnace borings and turnings and machine shop turnings. Heavy steel scrap brought $22 delivered, which is not considered high. No. 1 cupola has sold to $35 delivered.

PITTSBURGH. — The steel making grades are very firm, heavy melting being quoted at $25 delivered. Machine shop turnings are quoted at $16, a rise of $1. Low phosphorus steel is $30 delivered.

BUFFALO.—There is little trading, everybody evidently waiting for the New Year. Prices, while quoted higher, are really nominal.

BIRMINGHAM.—There has been no change in prices, although the tendency is for them to go up. Contracts are being made, and some grades are getting scarce. Heavy melting steel is still held too high by the dealers to interest consumers.

CHICAGO.—There is a generally firm feeling in the market. Mills producing bar iron are getting into operation again, and this has helped the demand for wrought scrap and bushellings. There is a better demand for steel-making grades.

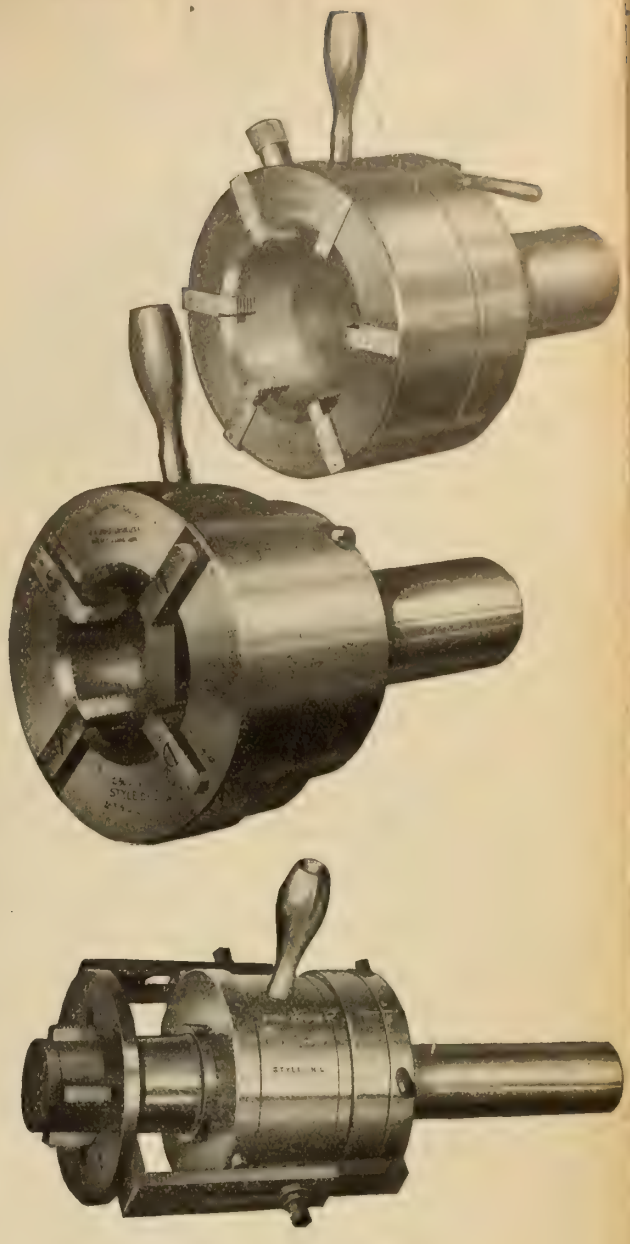
BOSTON.—The market is quiet, the only grade shewing activity being cast scrap. As high as $36.50 has been obtained for mixed railroad and machinery scrap. Heavy melting steel and turnings are quiet.

CLEVELAND.—There is little doing here as far as consumers are concerned. Dealers are doing some speculative buying, offering in some cases considerably higher than the market. Other dealers are sitting tight, neither buying nor selling. Prices remain the same generally.

A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.



Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the majority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta

For any thread, any size, any pitch — there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need — whatever it may be. Ask us.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon..2.25% to 2.75%	$37.00 to $40.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Steel bars, 2 in. to 4 in. base	5 50
Steel bars, 4 in. and larger base	6 00
Iron bars, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	4 50
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge, base	4 40
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$25 00	$24 00
Electro copper	24 00	24 00
Castings, copper	24 00	24 00
Tin	65 00	60 00
Spelter	11 50	10 75
Lead	9 50	8 75
Antimony	11 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

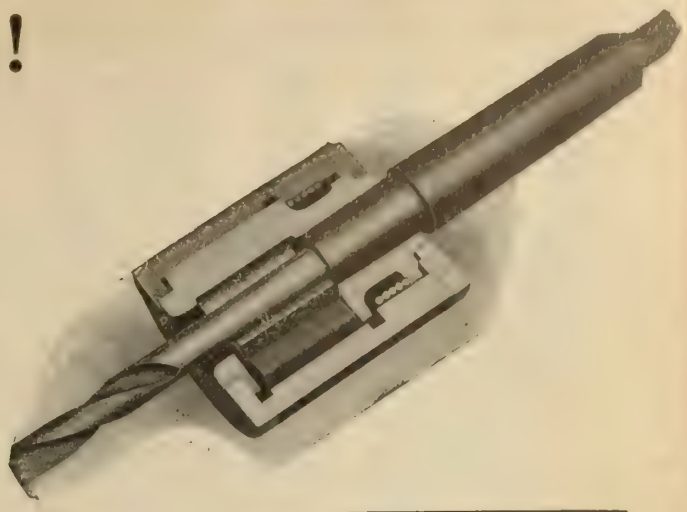
Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net

Save Time!

Aikenhead's



WAHLSTROM
Automatic Drill Chucks

will save a great deal of time on your drilling jobs. This chuck takes any size drill within its capacity and grips it centrally and by the entire shank—so firmly that slippage and chewed-up shanks are impossible. You can remove the tool and replace it with another in a second without stopping the spindle. You can drill any number of holes of various diameters regardless of the number of spindles in your drilling press, at a minimum cost.

We carry a full line of Wahlstrom chucks in stock. Also the Wahlstrom tapping attachment.

Write for circulars.

AIKENHEAD HARDWARE LIMITED

17, 19, 21 Temperance Street - - Toronto, Canada

Valuable Information
for the Pattern and Woodworking Shop

Long experience and careful experiment have shown that glue has its greatest adhesive strength—its greatest sticking power—when it is maintained and used at a temperature of 145 to 150° Fahr. A higher temperature than this will injure the glue, so that live steam at 212° Fahr. or more should never be used as a source of heat.

Aikenhead's Electric Glue Heaters

have been designed for these conditions. The heating element is carefully designed to supply just the right amount of heat. There are no steam pipes, no water, no evaporation and thickening of the glue, no wasteful scum, skin or dirt of any kind on the surface of the glue. This new heater eliminates all the filthy, wasteful features of the old style pot.

We shall be glad to send you a descriptive circular.



AIKENHEAD HARDWARE LIMITED

17, 19, 21 Temperance Street - - Toronto, Canada

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MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill ..... list plus 5%
At warehouse ..... list plus 25%
Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	8 60
Premier, 10¾ oz.	....	9 00
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 00	.....
1½ in.	30 00	26 50
1¾ in.	32 00	26 50
2 in.	31 00	26 00
2¼ in.	35 00	28 00
2½ in.	43 00	32 00
3 in.	48 00	40 00
3½ in.	.....	41 00
3½ in.	60 00	42 00
4 in.	75 00	56 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	24½
Machine oil, per gal.	36
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	4 00
Polishing wheels, bull-neck	2 25
Emery in kegs, American	06
Pumice, ground	06
Emery glue	35
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	50
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White.11 Dark colored.09
Mixed colored.10

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, yhdrochloric	.04
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulpuret	.50
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulpate	.16
Nickel carbonate	.32
Nickel sulpate	.18½
Potassium carbonate	.50
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.18
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

ILLINOIS

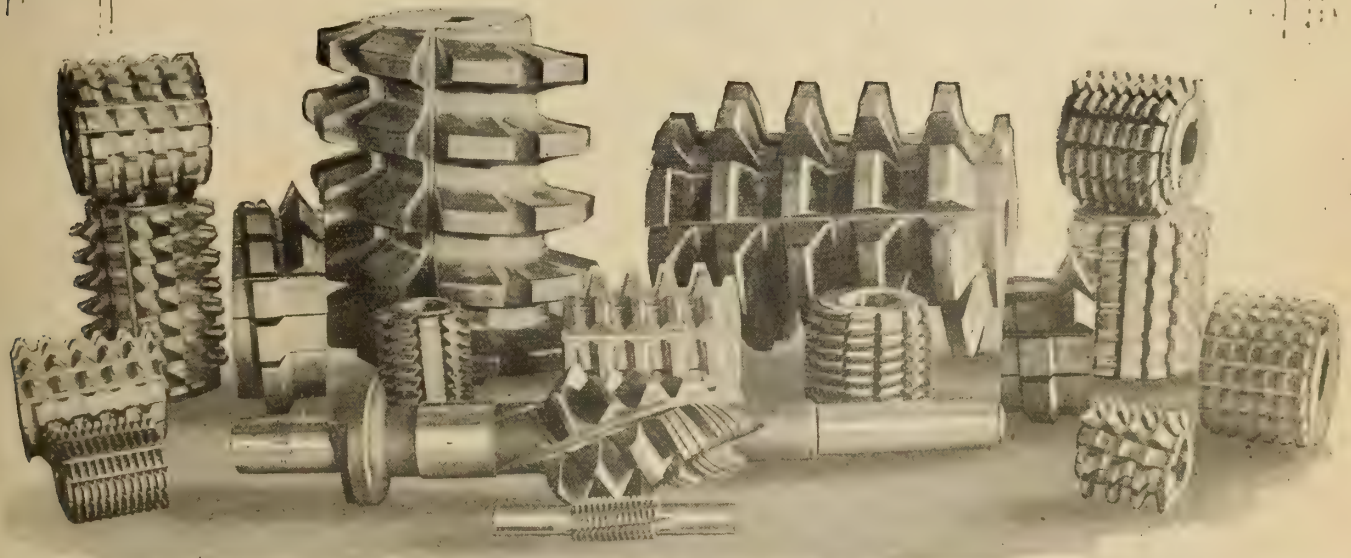
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The Iron and Steel of British Columbia

Efforts Are Being Made to Have a Basic Industry Established on the Pacific Coast Coast—Many Considerations Have to be Weighed Before Making a Start

THE possibilities of developing a steel industry in British Columbia are dealt with at considerable length in the annual report of the Research Council. Many things have to be considered, and the report leaves the impression that further research work will be necessary before definite findings would be possible.

On March 22, says the report, there was submitted to the Minister of Mines at Ottawa a memo from a delegation from British Columbia in which is set forth an argument for the establishment of an iron and steel industry in British Columbia. Copy of this is attached. While this memo sets forth clearly the benefits which would ensue if an iron and steel industry could be established in British Columbia, it brings forward no evidence to show that there has been any sufficient development of the ore bodies in British Columbia on which can be based data for the establishment of an iron and steel industry, or that there is any sufficient data of any kind upon which to base the formation of such an industry.

It is clear that a very great deal of expensive investigation will have to be undertaken before any practical consideration can be given to the establishment of the iron and steel industry on a large scale.

The first thing to be done is to determine the extent and nature of the available ore bodies, and any aid that can be given either by the Provincial or the Dominion Government to this work will doubtless produce valuable results.

Such work, however, would take a long time even if a very large sum of money were immediately available, and in the meantime the iron and steel industry in British Columbia can only be expected to start from small beginnings and gradually to grow to larger things.

The most likely direction in which immediate progress can be made is in electric smelting.

The Present Capacity

There is at the present time only one electric furnace in British Columbia. This is a 5-ton, 3-phase, furnace established at the Port Moody Steel Works by the Aetna Iron and Steel Co., and now being operated by the Columbia Iron and Steel Co. This furnace has been in operation since the end of May. It is producing pig iron from ordinary scrap and the product is being exported to Japan at a price of about $70 per ton. So far the maximum production in any month has been 380 tons, but it is hoped that a steady production of 500 tons per month can be obtained.

The use of an electric steel furnace for such a purpose is clearly only justified by war prices, and high grade steel instead of cast iron will have to be produced after the war.

There is at present no electric steel casting furnace in British Columbia, and in this respect Vancouver is badly behind the times. There is only one steel foundry in Vancouver, and while this is doing good work its product cannot approach the product of the electric steel furnace for castings.

Negotiations are under way, if not concluded for the establishment of a second electric furnace for the production of pig iron, using part scrap and part ore.

The existing power companies can sell power for melting steel in electric furnaces at a remunerative price which costs the producer about $6 per ton of product for the power used. The amount of power, however, which is required for smelting iron ore is three times as great as is required for melting, and the product for the "after the war" market could not possibly stand a price for power of $6 per ton. On the other hand the existing power supply companies, having been built for general light, power, and street railway purposes, cannot sell power remuneratively at the low price required for smelting iron ore under the conditions of electric smelting which have prevailed up to the present time.

If a high grade steel can be produced in one process directly from the ore, as is being done in the experimental furnace of Dr. Robert in Seattle, it is possible that the electric furnace could pay a price for power which would be remunerative to the existing power companies.

If a process can be made commercially successful whereby the preliminary reduction of the ores can be carried out by reducing gases at low temperature, and reduction can be furnished in the electric furnace, the amount of power required per ton of product will be so greatly reduced that the existing power companies will be able to sell power for electric smelting, on a small scale, at prices which would make smelting profitable. Furnaces of small capacity could then be established at various convenient points in British Columbia.

If, however, electric power amounting to around 2,000 kw.h. per ton of product is required for smelting purposes, then it would appear that some one of the numerous power sites on the British Columbia coast will eventually have to be developed for this special purpose.

There are a number of sites on Vancouver Island, and along the coast between Vancouver and Prince Rupert, where power can be developed as economically (considering differences in cost of material and labor), as any power development that has been made in Norway or Sweden. These power sites are situated at tide water where ore, limestone, coke and other raw materials can be delivered at low cost, and the product can be shipped from the works in ocean-going vessels at any time of the year.

Such power, however, cannot generally be economically developed unless the plant is built to the fullest capacity at the start. This usually involves an investment that is too large for any small commercial undertaking. If, however, there could be established a group of industries for the electric smelting of iron, ferro-manganese and other metal products, for the production of nitrates, calcium carbide and other electro-chemical products a sufficient demand for power would be created to make it possible to take full advantage of the economical value of the power sites along this coast.

It appears to be quite possible that such an undertaking might be commercially successful either under war, or after the war, conditions, and it is suggested that further investigations along these lines would be of value.

That normal transatlantic shipping is not yet an accomplished fact is shown by the recent announcement of the British Ministry of Shipping regarding the early 1920 sailings to the West Indies, that had been arranged by the White Star-Dominion Line. The SS. Megantic was to have been placed on this route for a number of pleasure cruises, but the powers-that-be have seen fit to decide otherwise, and this vessel will remain on her regular route throughout the winter to assist in relieving the heavy service that is expected during the next six months.

T. W. Rogers has joined the staff of the St. Lawrence Welding Company, of Montreal, and will have the position of general sales manager for the company. Prior to his recent appointment, Mr. Rogers was eight years with Darling Bros., four years as a travelling salesman and the last four as purchasing agent. He was formerly with the heating division of Taylor, Forbes Co. The tank development of the St. Lawrence Welding Company will necessitate additional selling organization, and Mr. Rogers will have full charge of this department.

A St. Paul man has invented a fan for barber shops to carry advertisements and be hung where a patron can read them while he is in a chair, at the same time being within easy reach of a barber.

WANTED

Young man who can write advertisements for mechanical lines.

We have an opening for a man who understands machinery and who can write intelligently and convincingly. One who has had advertising experience preferred.

Give, in the first instance, full particulars as to age, education, experience, etc. Applications will be treated in confidence.

Canadian Machinery

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TORONTO, ONT.

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



TRADE GOSSIP

Car Company's Transfer.—Sir John Gibson has been making arrangements in New York for the transfer of the National Steel Car Company to the American Car Company. The Board of Control of Toronto have decided to buy a truck from the new company, and the city will be the owner of the first truck sold by it.

Embargo on New Steel Removed.—The British Government has notified Professor Arnold, of Sheffield, that the restriction placed on his patent rights in connection with the new steel alloy invented by him have been removed. The restrictions were in connection with the Defense of the Realm Act, and prevented the patents being utilized industrially.

Canadian Trucks for England.—Great Britain is in need of 5,000 new railway trucks, according to Sir Eric Geddes. The Canadian Trade Mission in London have endeavored to secure the orders for some of these for Canadian firms, through Sir Eric, but the latter informed the Commissioners that the matter would have to be discussed with each individual railway.

Outlook Good for Steel Trades.—There is a very good prospect of export trade in view for the Nova Scotia Steel & Coal Company, according to D. H. McDougal, president of the company. Mr. McDougal, accompanied by Mr. W. D. Ross and Mr. Thomas Cantley, arrived from England recently, where they have been forming connections which will be very valuable for the company. There will be a good opening for the Wabana ore when shipping facilities are easier, and finished goods such as heavy forgings and axles.

MARINE

Glasgow.—The new torpedo-boat destroyer "Tyrian," on her four-hours' full-speed trial, made a world's record, attaining the speed of 45 miles an hour.

Cleveland.—The season just ended has been a bad one for the freighters. Owing to high operating costs, which were the highest on record, carrying rates which had been reduced, delay due to labor troubles at steel plants and coal mines, many of the boats lost money, while a good many more just cleaned up even on the season's work.

BAINES & DAVID LIMITED WILL CARRY ON BUSINESS AT SAME SITE

FOLLOWING the dissolution of the partnership existing between Messrs. Baines & Peckover, steel merchants, business will be carried on at the old Baines & Peckover premises by the new firm, Baines & David Limited. Mr. W. M. David, the new partner, has been sales manager for Baines & Peckover for a number of years, going with the firm in the first place some fourteen years ago. He has been associated with the steel trade, in one way or another, practically his whole life.

Mr. R. A. Baines began business first in Toronto as a manufacturers' agent in 1894, his particular line, at that time, being the London Bolt & Hinge Works. The first office was on Scott Street, from which place a move was made to Bay Street, where the Trust & Guarantee Co. building now stands. The business of Baines & Peckover moved to the present site, 98 Esplanade East, some ten years ago.

The new firm, Baines & David Limited, will carry on business at the same address, and will also take over the warehousing proposition at the Eastern Harbor Terminals. This site will be considerably enlarged, and increased facilities will be added for the handling of the business there. The new partnership becomes operative at once.

Dunnville.—The car ferry Maitland No. 1 ran ashore in Patton's Bay, with a cargo of thirty cars of coal. She lost her bearings in a fog, and grounded about six miles west of Port Maitland, going hard and fast on the beach. Wrecking tugs were sent for immediately, and her early release is expected. She was not in any great danger, and damage, so far as could be seen, was slight.

Goderich.—The close of the shipping season was celebrated at Goderich by a complimentary dinner, held in the assembly room of the Masonic Temple, at which the captains and officers of nine steamers were entertained. Many influential citizens of Goderich were present, including G. L. Parsons, the president of the Board of Trade; R. J. Megaw, manager of the Western Canada Flour Mills, the editors of the local papers, and many others.

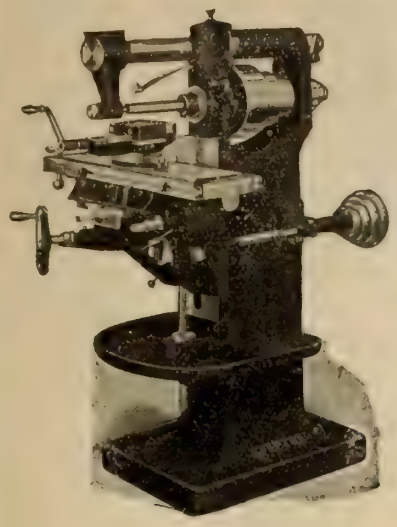
Oppose Wooden Ship Contracts.—The request that the Government should give contracts for wooden ships to be built in British Columbia is meeting with considerable opposition. The request was made in order to overcome the unemployment situation. The opposers of the idea point out that wooden ships, which were perhaps justified during the emergency in the shipping world, have no chance of competing with steel ships in an open market.

Directory of Electric Stations.—The Dominion Cabinet committee on power has released to the public what should be a very valuable book. It contains a directory of every electric central station in Canada, and is more complete than anything that has yet been published on the subject. Information as to power available for sale, the prices it can be obtained for, industrial sites in proximity thereto, and transportation facilities in the district are tabulated.

Washington.—The German vessels that were seized in United States harbors when war was declared are to be sold by the U. S. Shipping Board. The number of vessels is over 100, having a deadweight tonnage of 250,000 tons, and a price of $250 a ton has been suggested but not finally decided on. The vessels, if sold, will be sold under the stipulation that they be retained under the American flag.

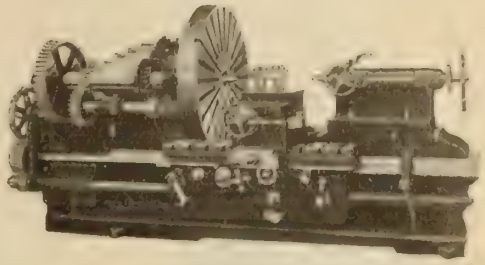
Drop in Freight Carried.—The tonnage which passed through the United States and Dominion locks of the Sault Ste. Marie canals during the past season was the lightest for five years. Although the cargo volume decreased, the number of passengers carried was greater than ever before. The net register tonnage of vessels passing through the canals was 50,089,090, the smallest since 1914. Lumber, flour, wheat, iron ore and coal, all showed a falling off, while salt and oil make some gains, and the volume of general merchandise was greater than last year.

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PIG IRON TRADE

The demand still exceeds the supply in the pig iron market. Prices are going higher, and the shortage of cars is adding to the difficulties. Following are reports from U.S. points:

PITTSBURGH.—No. 2 foundry has sold in small lots for $40 valley furnace, and some fair tonnages of standard basic at $35 valley furnace. A good tonnage of bessemer in small lots has sold at $37 valley furnace. Production still remains behind demand, and furnaces which might light up are held back for want of coke.

NEW YORK.—Foundry iron at 2.25 to 2.75 silicon has now gone to $40 Eastern Pennsylvania furnace. Some small lots of this grade have sold spot for $43 and $44. The general market price for first half delivery is from $40 to $42.

BUFFALO.—Demand is away ahead of supply in this district, and furnaces are compelled to keep out of blast owing to a shortage of coke. The only furnace in the district that can take first half iron is quoting for No. 2 plain, $40; No. 2X, $41.25; No. 1X, $43. No third quarter iron is for sale.

CLEVELAND.—1.75 to 2.25 silicon is worth $38 furnace in this district, and 500 tons of malleable for first quarter has been sold at $38 valley furnace. There has been a very active inquiry, amounting, it is estimated, to about 50,000 tons. Northern and Southern Ohio steelmakers are looking for basic, over 20,000 tons of this grade being inquired for.

CHICAGO.—Iron is very scarce, and the difficulty of obtaining cars is resulting in furnaces piling iron in their yards. Foundry iron is quoted at $40 furnace, but very little is obtainable. An inquiry is out for 30,000 tons of basic.

CINCINNATI.—There is plenty of inquiry, some of which is very urgent. There is very little iron to satisfy it, and prices are getting stronger all the time. Iron for first quarter 1920 has been bid up to $41. Coal and coke supplies are also short.

ST. LOUIS.—Producers are getting a line on future production costs, and are not offering much iron for sale. There is great activity among the foundries, and foundry iron is in greater demand than steel-making grades. With the easing up of the coal situation, several more Southern furnaces are expected to blow in.

PHILADELPHIA.—There has been an advance in basic, a fairly large lot having sold at $39 Eastern Pennsylvania furnace for first quarter delivery. Malleable has been sold at $39, and is now quoted at $40 Eastern Pennsylvania furnace. There has been a good volume of business in foundry iron during the week.

BOSTON.—The market has been quiet during the week, feeling the holiday spirit. Consumers are taking inventory, and are deferring their purchases till that is completed. New England makers are pretty well sold up, but Southern furnaces have iron to offer. The car shortage is making deliveries slow.

A game of checkers by wireless has been played by two Delaware men, who flash their moves back and forth through the air between Wilmington and Greenville, Del. They are Fred R. Fooding of Wilmington, an official of the Delaware Bank and a licensed radio operator, and William Anderson of Greenville, a student at Delaware College.

The first game of the series lasted an hour and a half. At the end of the period each player had six men on the board. As each player flashed his move on the checkerboard to his opponent he made the move on the board in front of him, which was duplicated by his opponent.

This item is contained in current news, without any explanation, however, of how the ban on transmitting was overcome.

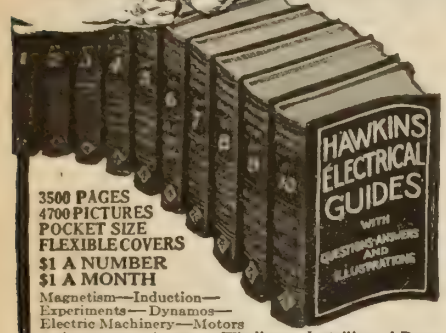
A new speed record for an airplane is claimed for an Italian aviator, who attained a speed of 170 miles an hour.

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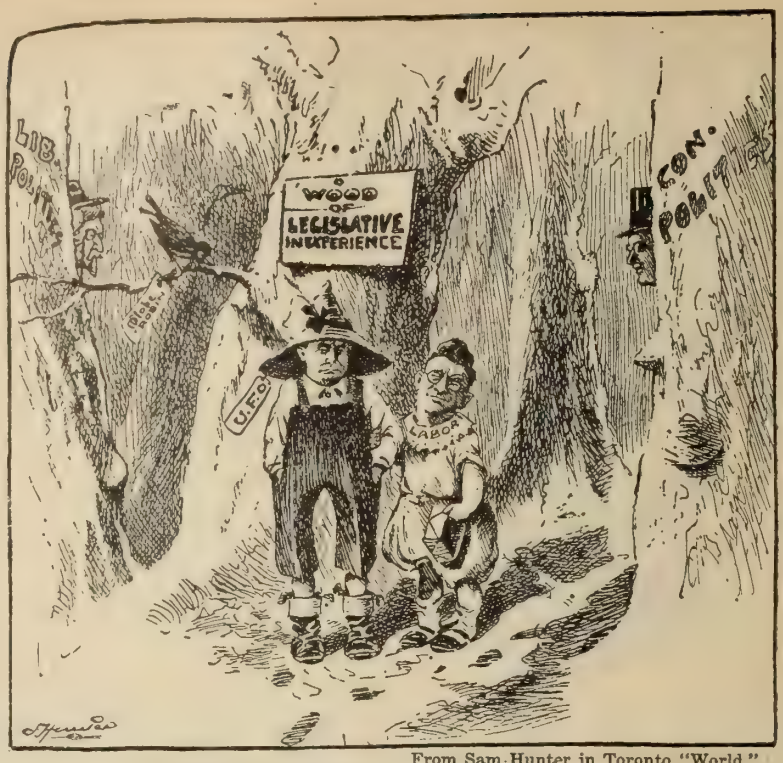
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WHEN ANSWERING ADVERTISEMENTS KINDLY MENTION NAME OF THIS PAPER



From Sam Hunter in Toronto "World."

Let the Babes Beware of the Wicked Uncles.

As an expression of goodwill, the employes of the W. H. Sumbling Machinery Co., 7 St. Mary St., Toronto, surprised Mr. Sumbling on the day before Christmas, by presenting him with a handsomely engraved signet ring. Mr. Frank Allen, the foreman of the shop, made the presentation, voicing the feelings of the staff in wishing Mr. Sumbling the compliments of the season, to which the recipient replied suitably.

Extension at Preston.—The Preston Woodworking Machinery Co., Ltd., propose completing an extension of 100 x 100 to their plant early in the year. This firm is also anxious to secure a used 36 in. Bulland boring mill or equal.

Not Raising Wages.—The report that wages in the Ford plant would be raised to a minimum of $8 a day has been denied by E. G. Leibold, Mr. Ford's personal secretary. Mr. Leibold states that the Ford Company have no immediate increase of wages in view at their plant.

Subsidy for Shipbuilders.—The Montreal Board of Trade at their weekly meeting considered a draft of an application to be made to the Minister of Marine. The petition will be for a bounty or subsidy to be paid by the Government on steel ships built in Canada, sufficient to enable the yards to develop and expand, so as to be able to compete successfully with other countries. The matter was referred to the Harbor and Navigation Committee.

Strips of whalebone instead of bristles are used in a new hair brush that is intended to stimulate the scalp of users and to last for years.

TENDER

The city of Winnipeg requires tenders, which will be received up to Jan. 12, for the supply and delivery at the power house, Point du Bois, of electrically-operated oil switches and switching apparatus. Specification may be obtained at the office of the City Light and Power Dept., 54 King street, Winnipeg.

At the forthcoming municipal elections in Galt a by-law will be submitted, authorizing the raising of $30,000 for the installation of a central heating plant for the Galt General Hospital, the Isolation Hospital, the Maternity Hospital and the new Nurses' Home. An addition to the laundry and present heating plant of the Galt Hospital will be included.

The Department of Public Works requires tenders for a public building at Calgary, Alta., situated at the corner of First Street E. and Eighth Avenue. Tenders will be received up to February 5th, 1920, and plans and specifications can be obtained at the office of the Chief Architect, Department of Public Works, Ottawa; the Resident Architect, Calgary; District Engineer, Edmonton; the Resident Architect, Winnipeg; and the Builders' Exchange, Winnipeg, Montreal and Toronto.

Tenders are required by the city of Winnipeg for the supply, delivery and erection in the power house, Point du Bois, of two three-phase generators for direct connection to double reaction turbines and for spare parts for same. Tenders will be received up to January 20. Specifications can be obtained at the office of the City Light and Power Dept., 54 King street, Winnipeg.

IDLE PITY GIVING WAY TO PRACTICAL EFFORT ON BEHALF OF CANADA'S SIX THOUSAND BLIND

You have doubtless been interested in what you have read or heard regarding the progress of a national effort on behalf of the blind of Canada.

Do you realize just what this effort means?

Here are some of the things that are being done:

Industrial training and employment is being provided for the blind in centres established in Halifax, Toronto, Winnipeg and Vancouver.

Useful handicrafts, and the reading and writing of embossed characters, are taught in the homes of those blind people who, for various reasons, are unable to take training at one of the regular centres.

The product of the home-workers is bought and sold.

Personal contact is established with recently-blinded persons, and with cases which are sometimes so old that they become new in a very real sense. This work is done by an experienced Field Agent.

Books, magazines, and music in embossed types, are circulated free to the blind of Canada. The monthly average circulation of books, etc., is close to eight hundred. The Institute also arranges for the transcription of music for any of its members at cost price.

An active publicity propaganda dealing with various dangers to which the eye is subject is carried on, and this is followed up with personal work, looking to the larger co-operation of medical men and nurses, employers of labor, Boards of Education, etc., in the vital matter of preventing blindness.

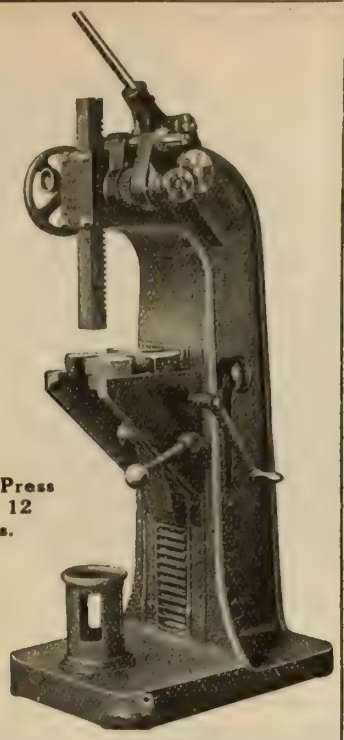
A residence and training centre, "Pearson Hall," has been provided, where blind soldiers may find congenial conditions while taking vocational instruction. In this connection, it may be interesting to know that the Institute has entered into an agreement with the Department of Soldiers' Civil Re-Establishment, under which the Institute has established an after-care department for Canadian Soldiers blinded in the war.

There are other things, but they may all be summed up by saying that the Institute endeavors, in every practical way, to advance the interests of the blind, and to ameliorate the conditions under which they live.

Will you aid in supplying the most vital need of this work?

Then mail your cheque to the CANADIAN NATIONAL INSTITUTE FOR THE BLIND, 36 King Street East, Toronto, Ont.

The French Government is planning to build a canal parallel to the Rhine River about 80 miles long on which eventually there will be ten hydro-electric stations producing 7,000,000 horsepower.



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ATLAS PRESS CO.
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Kalamazoo, Mich., U.S.A.

The town of Lakefield, Ont., will present a by-law to the electors, seeking the authorization of an expenditure of $33,500 to install a Hydro-Electric system. The amount covers the reconstruction of the present system and the purchase price of the present company.

In connection with the extension of the Winnipeg power plant at Point du Bois, four tenders for the installation of water turbines have been received. The firms tendering are the Boving Hydraulic and Engineering Co., Ltd.; Canadian Allis Chalmers Co., Ltd.; S. Morgan Smith Co., and Vickers, Ltd. The figures quoted are said to be in the neighborhood of $200,000.

A novelty for cigar stores ejects a match when a button is depressed, lights it and holds it for a man to light his cigar and then drops it into a tray.

For garages or service stations a gasoline pump entirely operated and controlled by electricity has been invented.

An Iowa man is the inventor of a work bench clamp to hold automobile radiators of any size or shape.

Paints that are said to be both fire and water proof are made from the oil of a Manchurian bean.

The Italian Government has decided to electrify 6,000 kilometers of railroads with power obtained from waterfalls.

B.G.I.T. BERING
136 York St. Toronto

PATENT ATTORNEYS

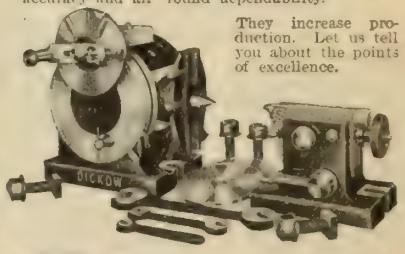
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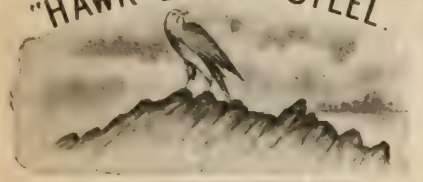
Pulverized street rubbish and coal tar have been found to make good fuel briquettes in Amsterdam.

A new electric dental engine runs on either direct or alternating current or can be supplied by dry batteries where no other supply of electricity is available

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The body of an ambulance invented by an Englishman for horses is mounted on a pivot so it can be turned around to enable an animal patient to walk out head first.

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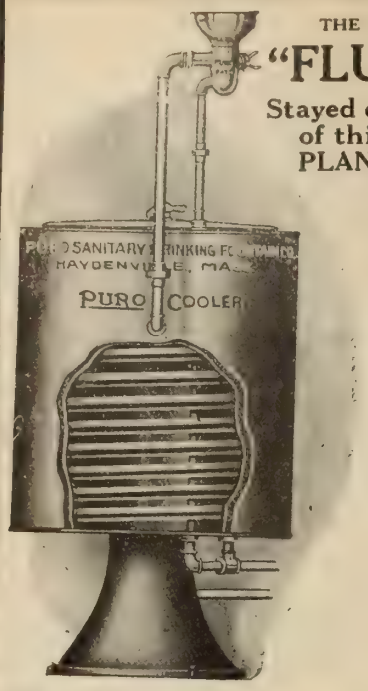
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THE GREB CO., 318 State St., BOSTON



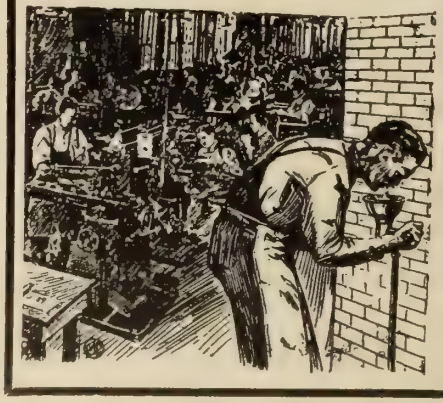
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ALUMINIUM SOLDER

A new aluminium solder has been discovered by K. Binggeli, of Berne, that enables very strong joints to be made, and renders construction of aluminium tins for foodstuffs possible. The electric resistance of joints made by the process is exceedingly low.

Tensile tests made by the Swiss National Testing Bureau show that rods joined with the solder break outside the joints and that the strength of the joints exceeds 1,500 kg. per sq. cm. (Elektroindustrie, Sept. 15, 1919.) No. 6458.

A new industry, which may soon find other fields of operation, is being established near Denver, Colorado, namely, the production of potash in commercial quantities by the electrolytic decomposition of feldspar and leucite. The process is worked under a patent recently granted to Edmund Fuller and Thomas McCulloch. An abundant supply of the raw material exists within twenty miles of Denver capable of being mined by benching in the open. Hence the cost is low.

The rock is crushed to about 60 mesh, decomposed in digesting pans, and electrolyzed in special earthenware cells to potassium aluminate, with accompanying complete segregation of the silicon. The special diaphragm cell is the crux of the process. The porous pot contains the cathode, immersed in water contained within the diaphragm. Surrounding this, and enclosed in the cell-body itself, is the sulphuric acid solution of decomposed feldspar, in which the anode is immersed. Impressed current ionizes the solution, and the alkali and the aluminium travel through the diaphragm, forming $KAlO_2$ at the cathode, amorphous silicon remaining as a sludge about the anode. This $KAlO_2$ is broken down by the action of CO_2, resulting in aluminium hydrate and K_2CO_3, the latter remaining in solution, while the $Al(OH_3)$ is precipitated. These are the essential features of the process. The K_2CO_3 is decanted, and the remaining aluminium hydrate is washed and dried by an atomizing process. The potash solution is now in a state for the production of any desired commercial salt. The Fuller-McCulloch Co. is at present chiefly concerned with the production of 100 per cent. soluble K_2SO_4, which is accomplished by digestion with gypsum, whereby a pure carbonate is precipitated.

A promising feature of this process is the large quantities of amorphous silica containing some aluminium compounds, which are separated from the circulating electrolyte—a material which will probably be welcomed by the ceramic industry. The company proposes to erect numerous plants near agricultural centres, where sufficient supplies of potash-feldspars, gypsum, and phosphate can be obtained, and to market a 100 per cent. soluble material comprising a balanced proportion of potash, phosphate, and nitrate. It is stated that a plant capable of roducing 300 tons of K_2SO_4 will give, as by-products, 165 tons of Al_2O_3 and 700 tons of silica. (Chemical and Metallurgical Engineering.)

Some European railroads are experimenting with electric locomotive headlights so mounted that engineers can direct their rays in any desired direction.

ELECTRICAL WELDING

An interesting paper on Electrical Welding was read before the Toronto section of the American Institute of Electrical Engineers at a recent meeting of the Engineers' Club. Tracing the development of various forms of welding and welding apparatus from the blacksmith's forge, the speaker dwelt on the industrial importance of welding in present day industry. As an instance of this the repairing of the German vandalism on ships interned in American ports. Instead of the original estimate of one and one-half years, the work was done in five and one-half months and at a saving in cost of several million dollars.

Electric welding may be divided into at least two main divisions: Spot welding is typical of the one and arc welding and cutting of the other. The rivet can be almost entirely eliminated from thin sheet work and other work of a similar character. One of the electric stoves on the market to-day is built up by spot welding, only a few rivets and bolts being used for erection purposes.

The construction of the spot welder was gone into and a recent development was dealt with. This machine, the duplex welder, obviates the inductive effect in the secondary circuit of the transformer by the use of two transformer loops, one above and the other below the plate to be welded. The circuit is broken in two points and the two welds are made at one time.

For arc welding the direct current type has been found superior in its usefulness to the alternating current type since it may also be used for cutting and welding very large jobs. The various methods of control adopted by the several firms manufacturing welding equipment were described in detail and the alternating current type of equipment was also discussed.

In the discussion which followed it was brought out that the coated electrode was used to a large extent in Great Britain and in fact, was the only one sanctioned by Lloyd's.

A swarm of bees chased Willie
Till the boy was almost wild,
His anxious parents wondered
Why the bees pursued the child.

To diagnose they summoned
Their physician, Dr. Ives.
"I see," he said, "the reason's clear,
Your Willie has the hives!"
--Walter Pulitzer in N.Y. Globe.

A power-operated machine has been invented which can be adjusted to wrap packages of various sizes rapidly and uniformly and apply paste to the wrappers if desired.

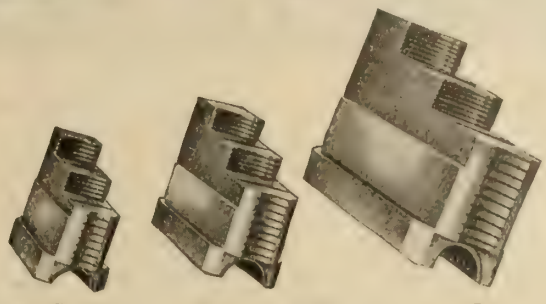
The British Government has established a research station to determine the fuel value of coal and its products, and especially to ascertain the extent to which low-grade coal and colliery waste can be utilized.

That normal Trans-Atlantic shipping is not yet an accomplished fact is shown by the recent announcement of the British Ministry of Shipping regarding the early 1920 sailings to the West Indies, that had been arranged by the White Star-Dominion Line. The S. S. Megantic was to have been placed on this route for a number of pleasure cruisers, but the powers-that-be have seen fit to decide otherwise, and this vessel will remain on her regular route throughout the winter, to assist in relieving the heavy service that is expected during the next six months.



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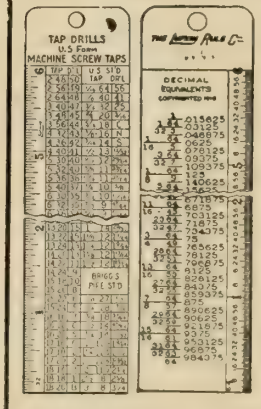
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FIRST-CLASS MACHINIST WANTED

EXCEPTIONAL OPPORTUNITY FOR MAN OF ability and education to become demonstrating rate setter. Requirements are thorough knowledge of machine tools and skill in their operation, initiative, perseverance and tact. In reply, please state age, experience, salary expected and when available. Box 646, Canadian Machinery. (c4m)

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MECHANICAL SUPERINTENDENT OR GENeral foreman seeks position. Extensive experience in layout work, designing, developing, manufacturing and maintenance work in light, medium and heavy work. First class executive with initiative ability. Apply Box 647, Canadian Machinery. (c3m)

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IF YOU ARE INTERESTED IN BUYING A patent for the latest labor-saving device in mitre boxes, address Box 636, Canadian Machinery.

FOR SALE—BRAND NEW INGERSOLL-RAND After-cooler, never used, for compressor up to 14 x 14". London Mfg. & Machine Co., Ltd., London, Ont. (ctfm)

FOR SALE — WATSON-STILLMAN HYDRAUlic Press, complete with four-plunger automatic variable belt pump. A. G. Crawford, 14 Mail Bldg., Toronto, Ont.

FOR SALE

DOUBLE AND PUNCHING MACHINE, 31" gaps, capacity 1" through 1"; planing and moulding machine 12" x 4", makers, Robinson; 7½ B.H.P. variable speed motor, 220 volts D.C.; vertical drilling machine, 2½" dia. spindle, circular swing table; 6" S.S. & S.C. lathe, straight bed, makers, Lang & Son; planing machine, capacity 30 ft. x 20 ft. x 10 ft., motor driven; planing machine, capacity 20 ft. x 10 ft. x 10 ft., belt driven, makers, Shanks & Co.; planing machine, capacity 20 ft. x 9 ft. x 9 ft., motor driven, Vickers drive; planing machine, capacity 12 ft. x 4 ft. x 4 ft., belt driven, makers, Noble & Lund; 20 ft. plate edge planer, open ends, belt driven; plate edge planer, 21 ft., belt driven; 30 ft. set plate bending rolls, forged steel rolls, will bend plates up to 1¼" thick; 14 ft. set plate bending rolls, bending plates up to ⅝" thick, belt driven; 10 ft. set mast rolls, top rolls withdrawn, belt driven; 20-ton loco. steam crane, gauge 10' 9", motors Jessop, Leicester; surface condensing plate, 2,750 square feet cooling surface, motor driven; air and circulating pumps. Apply.

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The "want ad." gets work for workers and workers for work.

It gets clerks for employers and finds employers for clerks. It brings together buyer and seller, and enables them to do business though they may be thousands of miles apart.

The "want ad." is the great force in the small affairs and incidents of daily life.

Manufacturers desirous of selling in Great Britain are asked to give particulars to

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CANADIAN MACHINERY

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Honestly Rebuilt Machine Tools at bargain prices.

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GENERATOR K.W.	Volts	2/3 Phase, 25 Cycles. R.P.M.	ENGINE Cylinder Dimensions	Pressure
450	550	125	24 x 40 x 36	
1000	240	107	24 x 48 x 42	150 lb.
		2/1 Phase, 60 Cycles		
75	2200	720	18 x 18	
165 K.V.A.	2200	225	20 x 18	80 lb.
300	2300	150	18 x 30 x 22	120 lb
1000	2400	100	28 x 52 x 46	150 lb.
		3 Phase—60 Cycles,		
18½	2400	360	7 x 8	100 lb.
30	2300	250	30 H.P.	
50	2300	300	12 x 13	
75	600	1200	14 x 20	
75	2300	276	13 x 15	
100	2300	180	10 x 18 x 24	150 lb. steam
100	2300	257	14 x 14	
100½	240	277	14 x 14	125 lb.
170 K.V.A.	2300		4 cylinder	
200	2300	200	Cross compound	
250	2300	200	15 x 29 x 22	
300	440/480	150	14 x 28 x 30	
325	2300	150	18 x 36 x 24	
325	2300	120	24 x 36	
400	240		22 x 42	
400	600	150	24 in.	
450	2300	100	22 x 42 x 48	150 lb.
500	480	120	20 x 40 x 36	
500	600	150	21 x 32 x 30	
550	480	171	26 x 32	
600	2300	150	20 x 38 x 24	
800	2300	150	23 x 40 x 30	200 lb
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Paxton & Mitchell Locomotive Rod Packing.
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International Machinery and Supply Company, Limited
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Baines & David, Limited

Iron and Steel Merchants

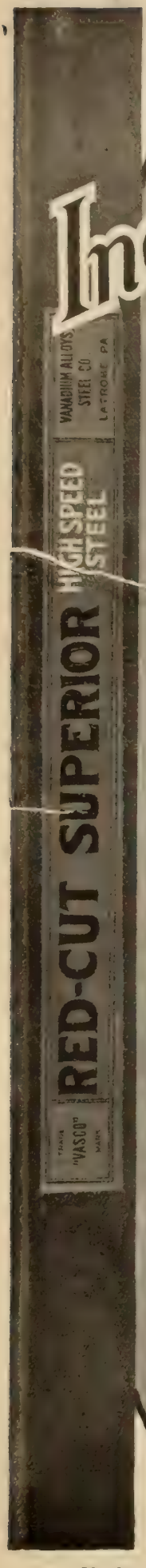
announce that they are carrying on, without interruption, in the same premises formerly occupied by Baines & Peckover, 98-116 Esplanade Street East, and warehouses at Eastern Harbor Terminals.

Note new telephone number, Adelaide 6540. Private exchange lines.

BAINES & DAVID
LIMITED

98-116 Esplanade E. Toronto, Ontario

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A GREAT MAN wrote this: "I'm called away by particular business, but I leave my character behind me." And nobody had to guess whose character it was. Even if the familiar Red Cut label should disappear there would be no doubt as to the character of the steel that remained. More than ever would the quality shine forth in the results when it was worked. Adherence to the highest standard with an unvarying uniformity has placed a well merited reputation all its own on

"Red Cut Superior"

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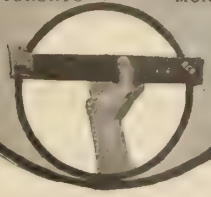
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PRESSES

	Stroke Inches	Width Bed	Approx. Cap. Tons
2—No. 666 Toledo Embossing Presses....	2	32	1,200
2—No. 27 Bliss Embossing Presses.....	2	32	1,000
2—No. 87 Bliss Crank Presses, double back geared	16	27	250
2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
9—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
1—Robertson Hydraulic Press with pump and extra set of columns.....	24	27	800
1—360 Brown & Boggs Press.			

LATHES

7—11" Blount Speed Lathes, 5' bed.
4—No. 2 Warner & Swasey Speed Lathes.
2—20" Stoll Wood Turning Lathes.
35—Bullard Cartridge Case Lathes.

GRINDERS

2—Wells Cutter Grinders.
1—12" x 72" No. 4 Cincinnati Universal Grinder.
1—No. 70 Heald Internal Grinder.
1—No. 75 Heald Internal Grinder.
1—10" x 24" Landis Grinder.
1—No. 1 American Surface Grinder.
1—No. 74 La Salle Surface Grinder.
1—Ford-Smith Double Head Grinder, 3" x 24" wheel.

FURNACES

1—Gas Muffle Furnace, 3¼ x 1½" x 7" long.
1—Gas Tempering Furnace with oil reservoir.
1—Gas Tempering Furnace with Tray in Reservoir.
1—H.S. Tool Hardening Furnace, 9" x 8" x 9" long.
1—Double Door Gas Furnace, Doors 20½" x 12" high. Fire Space 50" wide, 12" high, 54" long.
5—26 ft. Rockwell Single Chamber Annealing Furnaces, equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

BLOWERS AND FANS

	Size of Outlet	Displacement per rev.
1—Root Positive Blower	8" Vertical	3.3 cu. ft.
2— " " "	6" "	1.5 " "
1— " " "	6" Horizontal	1.5 " "
1—Boland Positive Blower	4" "	
3—Desk Fans.		

MOTORS

	Volt	Phase	R.P.M. buffiing	Cycle spindle.
1—Type Dumore	115 with			
1—Garage Pump and Motor	110	1	1400	25
1—10 H.P. Westinghouse	200	2	1245	60
1—20 H.P. Westinghouse	200	3	710	25
1—25 H.P. Westinghouse	200	3	710	25
5—50 H.P. Westinghouse	200	3	715	25
1—75 H.P. Westinghouse	200	3	720	25
1—1 K.W., 2 H.P., Can Gen. Generator Shunt Wound	125		1950	

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1—No. 1 Quickwork Rotary Shear.
11—No. 3 Brown-Boggs Trimming Machines.
1—No. 3 Tinius Olsen Testing Machine, 10,000 lbs., capacity hand-operated.
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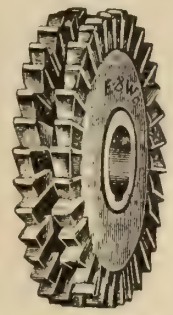
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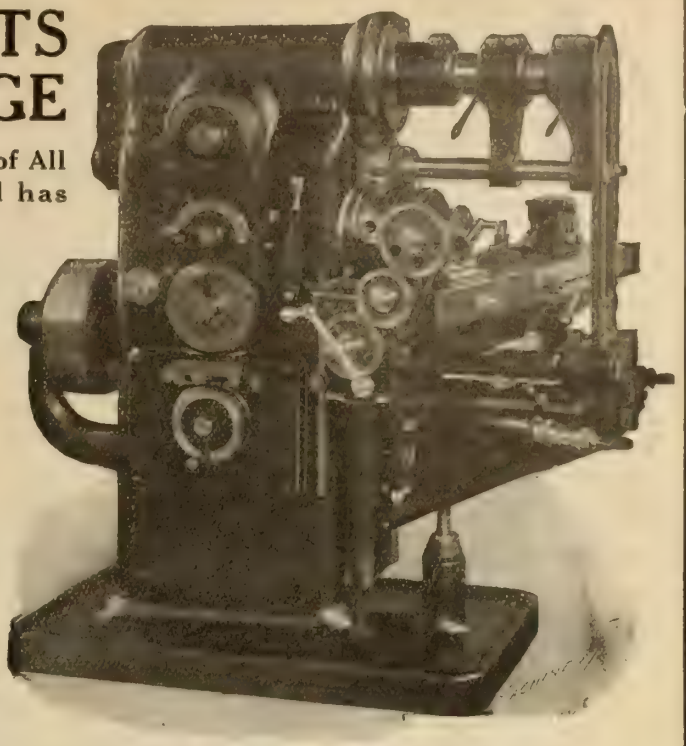
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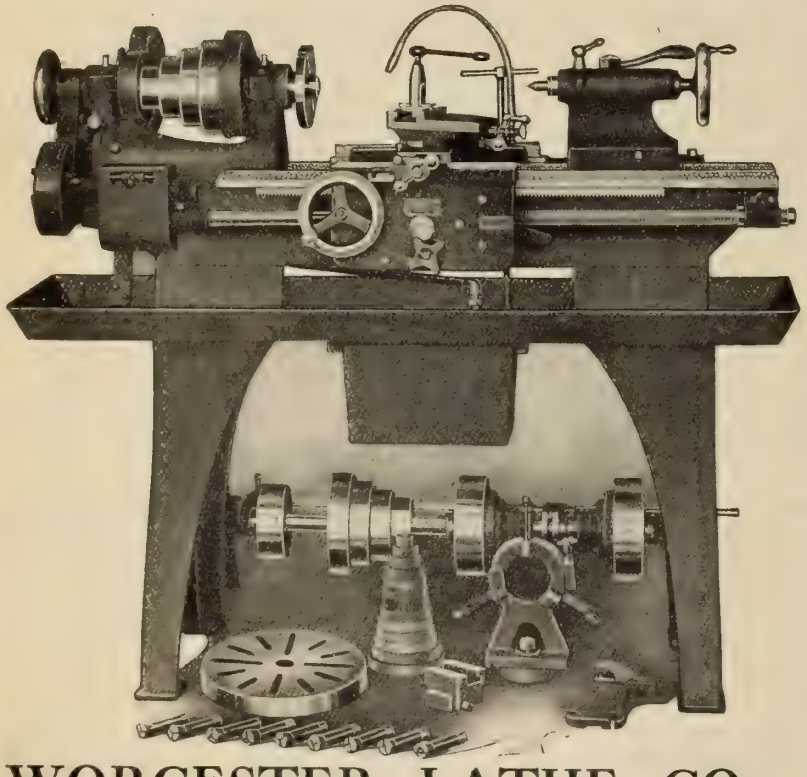
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Then one of the Commissioners criticized the farmers. It was a false step—a skid which he has probably lamented and has endeavored to repair, for it has lost him much popularity.

Now the Board of Commerce is setting prices for the retailer. It has dealt with some grocery lines—with clothing.

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"For instance, the percentage of profit on bacon and boned ham is set at 20 per cent. The merchant naturally asks on what basis he is to reckon his 20 per cent., and there is nothing in the published report of the ruling to assist him. Does it mean 20 per cent. on the price he actually pays for the goods? That is probably the viewpoint that any court would take of the matter, yet as every sound merchant knows, 20 per cent. on a buying price is just 16 2-3 per cent. of the selling price, and it is only the profit on the selling price that represents the actual profit to the merchant.

"The lowest cost of business for such retail stores is between 18 and 21 per cent., according to the class of business done. Take the cost of doing business at the modest average of 19 per cent. and on bacon selling for 60 cents a pound the retailer on the basis of profit outlined above loses 1 4-5 cents on every pound of bacon sold. If he slices the bacon he is permitted to take 2 cents a pound more; that would seem almost to let him out even.

"There is, however, the large element of waste to be considered here; the ends of the ham or bacon must, of necessity, be a complete loss, which the merchant who slices his bacon has himself to meet. That the two cents per pound margin is pitifuly small to cover these items of loss is illustrated by the fact that the New York City fair price list sets the margin for slicing bacon at 5 cents a pound, believing that it requires that amount to cover the element of loss in the process.

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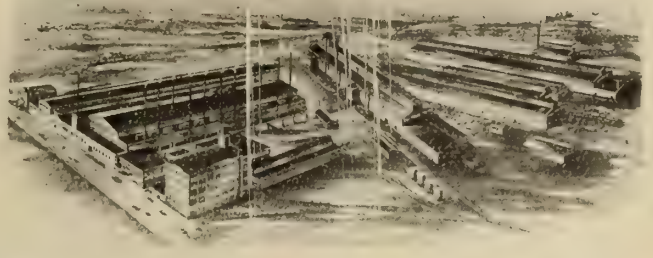
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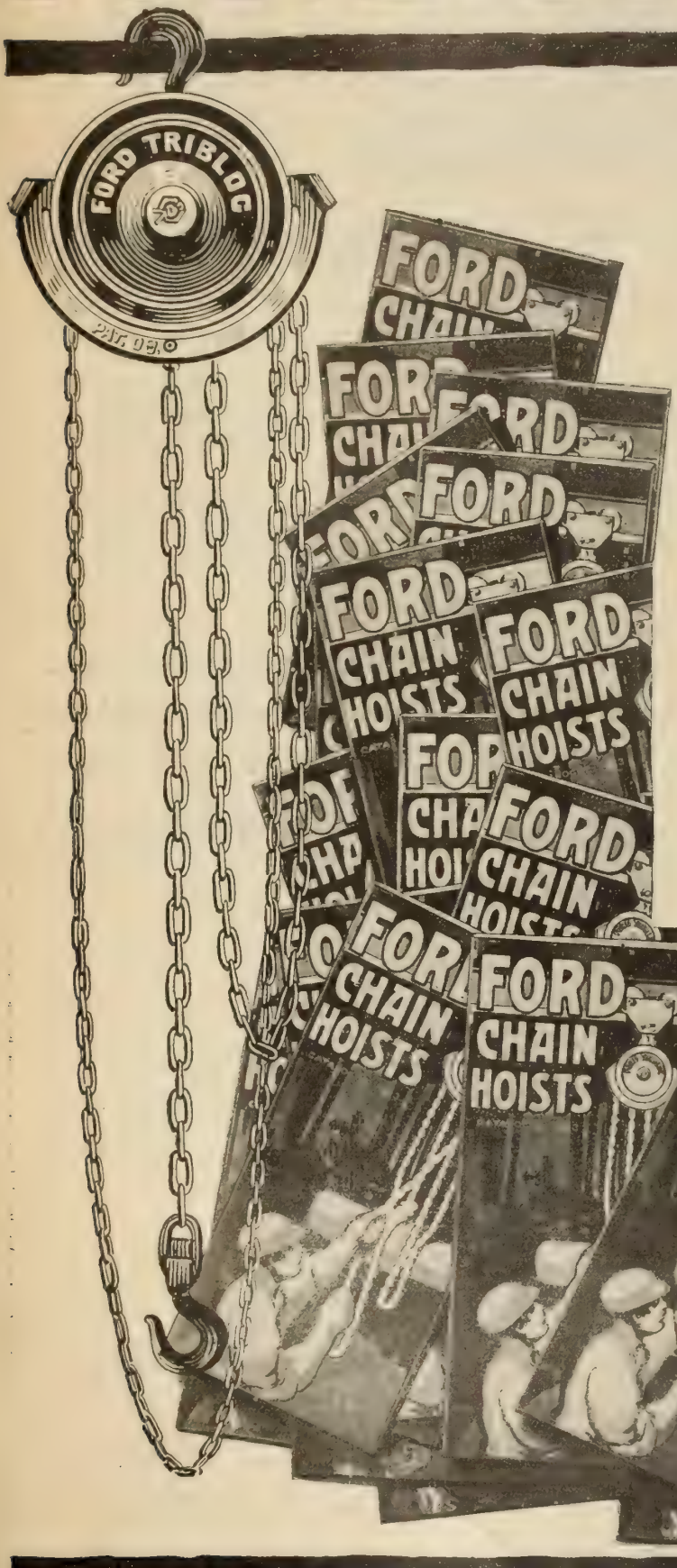
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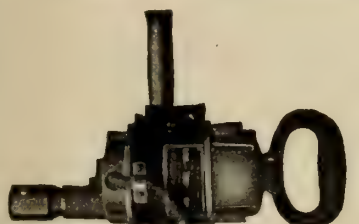
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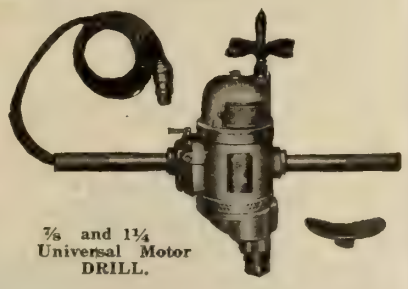
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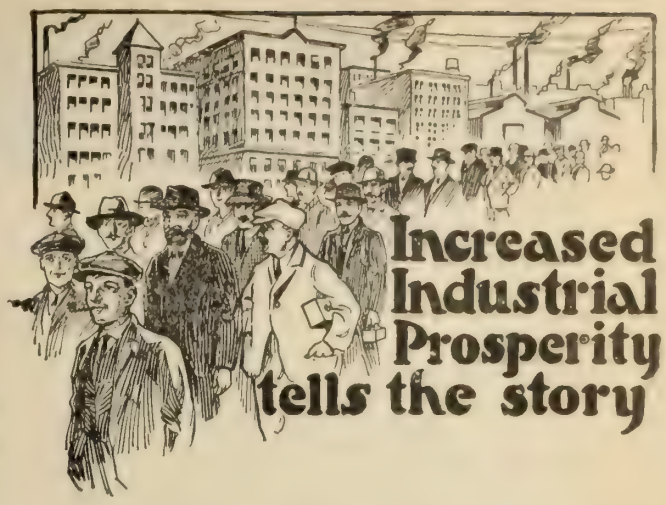
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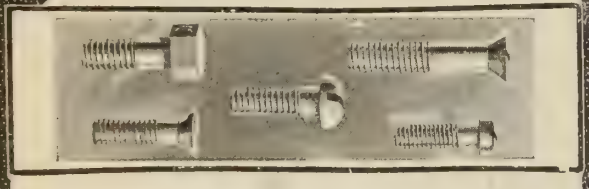
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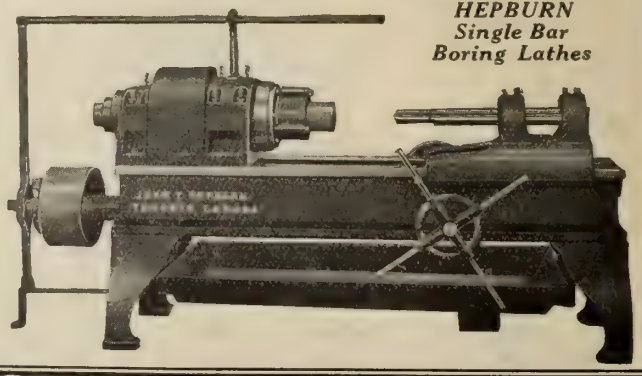
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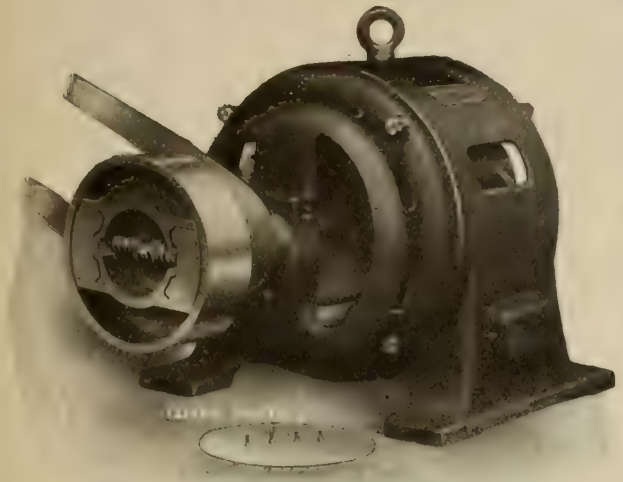


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Centrifugal Friction Clutches

To Ensure the Easy Starting of A.C. & Squirrel Cage Motors

½ H.P. to 1500 H.P.



No Motor Should be Without This Simple and Unique Device.

Entirely Dispenses With all Starting Difficulties

The Clutch also Effects a Great Saving in Current Consumption and Reduces the Initial Cost of Motor and Switchgear.

Please Mention Speed and H.P. of Motor When Sending Enquiries and State the Current Supply.

Write for Catalogues and Full Particulars

Thomas Broadbent & Sons, Limited

(Dept. 2)
Central Ironworks. HUDDERSFIELD, ENGLAND

Every Emery Wheel With Its Own Dresser



Desirable, isn't it, now that cost is no objection? For with an inexpensive Desmond-Stephan Dresser for every wheel, every wheel will be touched up frequently and so kept true and equal to its original cutting efficiency.

For all ordinary shop grinding wheels specify "Diamo-Carbo" —the perfect diamond substitute.

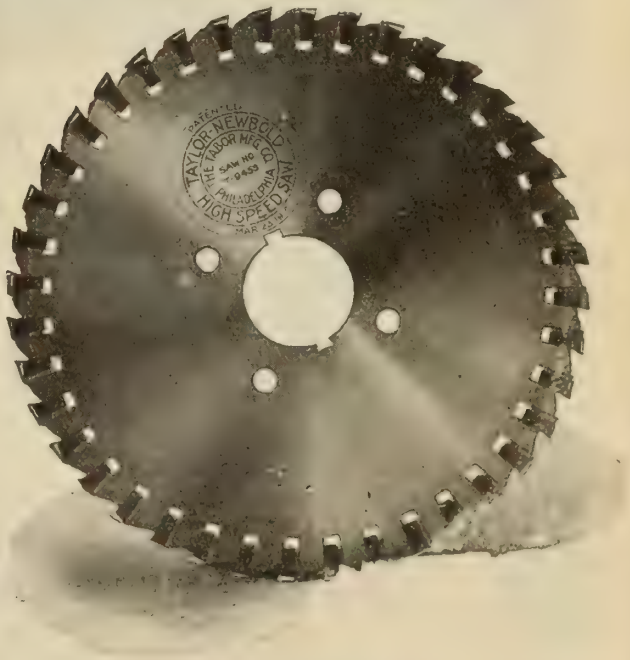
For large, coarse, hard wheels ask for the "Desmond-Huntingdon."

Sherman Corrugated, 2 sizes
Norton Zig-Zag, 2 sizes
Magazine
Diamonds

The Desmond-Stephan complete line of Economical Grinding Wheel Dressers is catalogued. Write for copy.

The Canadian Desmond-Stephan Mfg. Company
HAMILTON, ONTARIO
Alfred Herbert, Limited, Coventry, Agent for Great Britain

THE IMPROVED
TAYLOR-NEWBOLD

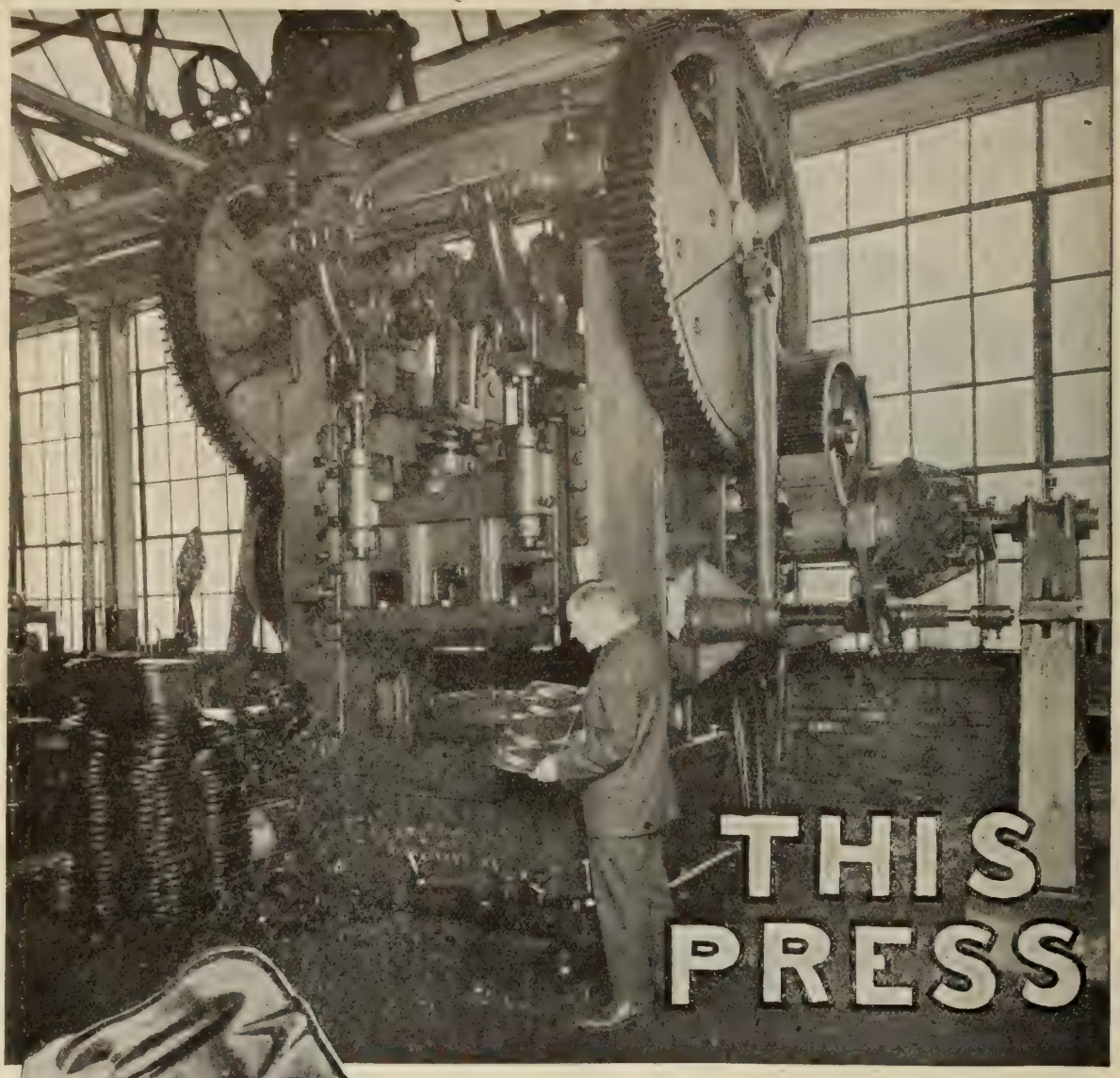


INSERTED TOOTH COLD SAW

WRITE FOR BULLETIN T-S

Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

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We build larger and smaller sizes of this type Press

(Photographs and Data by Courtesy of our customer)

Makes This— oil pan, 29⅛ x 12½ x 4½ deep for The Continental Motor Corporation. It is a "BLISS" Double Crank Toggle Press, No. 407, and will handle work up to 39½ x 27 and lift out up to ɔ½ deep.

The C.M.C. finds the "BLISS" Patented Toggle Motion and the design and construction of the Press a reliable insurance of uniformly good product.

BLISS 1857

E. W. BLISS COMPANY

BLISS 1920

Main Offices: BROOKLYN, N.Y., U.S.A.

American Factories: BROOKLYN, N. Y. *and* HASTINGS, MICH.

SALES OFFICES

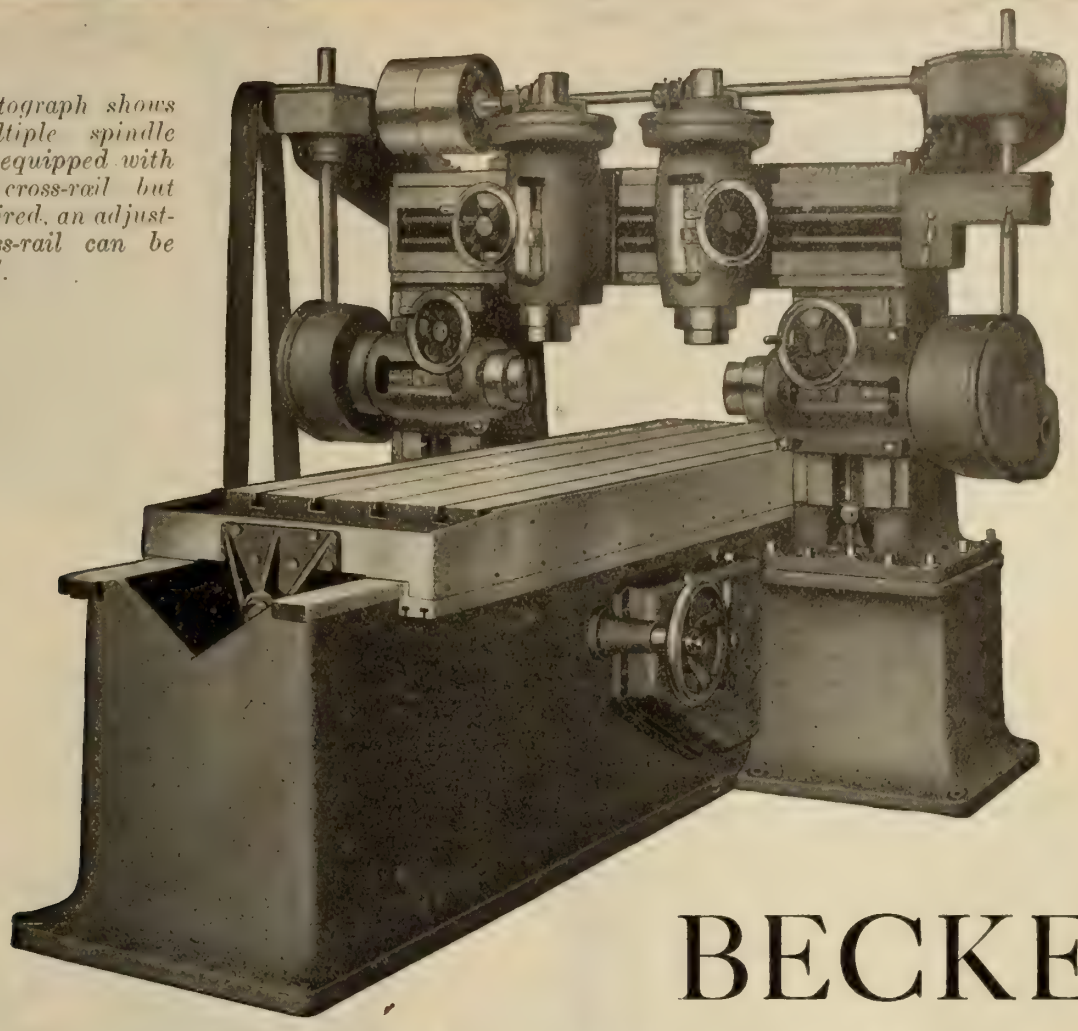
CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg.
CINCINNATI, Union Trust Bld. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg.

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50

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



The photograph shows the multiple spindle machine equipped with a fixed cross-rail but when desired, an adjustable cross-rail can be furnished.

BECKER

IMPROVED MULTIPLE SPINDLE PLANER TYPE MILLING MACHINES

An important addition to the Becker Line and a potent factor in machine shop production.

The Bed is very rigid and well braced with internal ribs, it is properly proportioned to accommodate the work to be done.

The Table, of length and width to suit requirements, is operated by a feed screw of large diameter and is provided with power rapid traverse in either direction and fast intermittent feed between cuts as well as hand feed for setting up work.

Spindles are of Machinery Steel, accurately ground and are carried in saddles of the Becker "Barrel" type construction. Each spindle is provided with in and out adjustment and a micrometer stop gauge.

Feeds and speeds are arranged to suit individual requirements and are operated through gear boxes which are centrally controlled.

As a whole, the machine is well built, rugged and very convenient to operate—a typical Becker Production Machine Tool.

Becker Planer Type Millers will increase your production.
Write for further information to-day—NOW.

BECKER MILLING MACHINE COMPANY

HYDE PARK, BOSTON, MASS.

DETROIT	CLEVELAND	NEW YORK (Export)	WORCESTER	INDIANAPOLIS
529 Majestic Bldg.	408 Frankfort Ave.	24 Stone St.	134 Gold St.	940 Lemcke Annex

BUFFALO, J. L. Osgood
CHICAGO, E. L. Essley, Mchy. Co.
DAYTON, M. D. Larkin Supply Co.
LOS ANGELES, Niles Bement Pond Co.
MILWAUKEE, E. L. Essley Mchy. Co.
MOLINE, E. L. Essley Mchy. Co.
MONTREAL, Rudel-Belnap Co.
NEW HAVEN, Manning, Maxwell & Moore.
NEW YORK, Manning, Maxwell and Moore.
PHILADELPHIA, Manning, Maxwell and Moore.
PITTSBURGH, Manning, Maxwell & Moore.
SAN FRANCISCO, Niles-Bement-Pond Co.
SEATTLE, Niles-Bement-Pond Co.
SYRACUSE, H. A. Smith Mchy. Co.
TORONTO, A. R. Williams Mchy. Co.

If interested tear out this page and place with letters to be answered.

McCrosky

McCrosky WIZARD Quick-Change Chucks and Collets

WIZARD production is continuous output on many jobs. On any job they will pay their own cost in a short time.

The tools are changed in rapid succession, without stopping the spindle for a moment and while running at any speed. Will more than double your drill-press in one continuous operation.

With the WIZARD you can drill, ream, counterbore, tap, set studs, etc.

Think what it means to turn out completed jobs with only one handling of the work. It means cutting out costly lost motion which eats up your profits. It means that a WIZARD outfit enables a girl to do more and better work than two men, the old way.

It means keeping your plant busy when the less efficient plant is having a hard time to make ends meet.

Read the full story of the WIZARD and other McCrosky Cost Cutting Tools in Efficiency Book No. 6. Yours on request.

McCrosky Tool Corporation
(Formerly McCrosky Reamer Co.)
Meadville, Pa.

Detroit : Kresge Bldg., Mr. C. M. Sutton, Mgr.
Export Manager :
B. Whittaker, 21 State St., New York



COST CUTTING TOOLS



The Largest Selling Quality Pencil in the World

VENUS PENCILS

17 Black Degrees and 3 Copying

AN error the breadth of a pencil line in the design of a gasoline engine might mean irretrievable loss. The grading of the famous VENUS Pencils is absolutely uniform. Engineers know that a VENUS Pencil, wherever found, **can be depended on.**

FREE Write on your letter-head for free samples, specifying the degrees you wish to try.

American Lead Pencil Co.
238 Fifth Ave., New York
and London, Eng.



At stationers and stores throughout the World

WHEN THINKING
OF BELTING
KEEP IN MIND THAT

The back of the Ox



is the part where the fibre of the hide is tightest and unaffected by the action of breathing, therefore the most suitable to produce a dead straight and practically stretchless belt.

Tullis
LEATHER BELTING
COLUMBIA BRAND

is made entirely from this portion of the hide.

SEND FOR OUR ILLUSTRATED CATALOGUE

JOHN TULLIS & SON, LTD.
BELTING SPECIALISTS
ST. ANN'S WORKS, GLASGOW, SCOTLAND
Established 1834

Canadian Agents:
UNIVERSAL SUPPLIES Limited
Room 25, 204 St. James Street
MONTREAL



MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES
for
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CASTINGS
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Write for Bulletins

MESTA MACHINE CO.
Pittsburgh, Pa. U. S. A.

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Your Money's Worth

Never again will the Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET YOUR MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools; in other words he must and will

USE ARMSTRONG TOOL HOLDERS

No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men—a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

Try It Yourself

The best argument in favor of throwing away files the moment they become dull is to try filing a job yourself with a dull file.

If it makes you irritable, think what effect it must have on a man who has to file all day long.

Don't let your men work with dull files. Tell them to turn them in when they become dull.

When buying, specify Famous Five Files. You get a good run of sharp service from them because each file is accurately cut, well balanced and properly hardened.



GARVIN MACHINE TOOLS

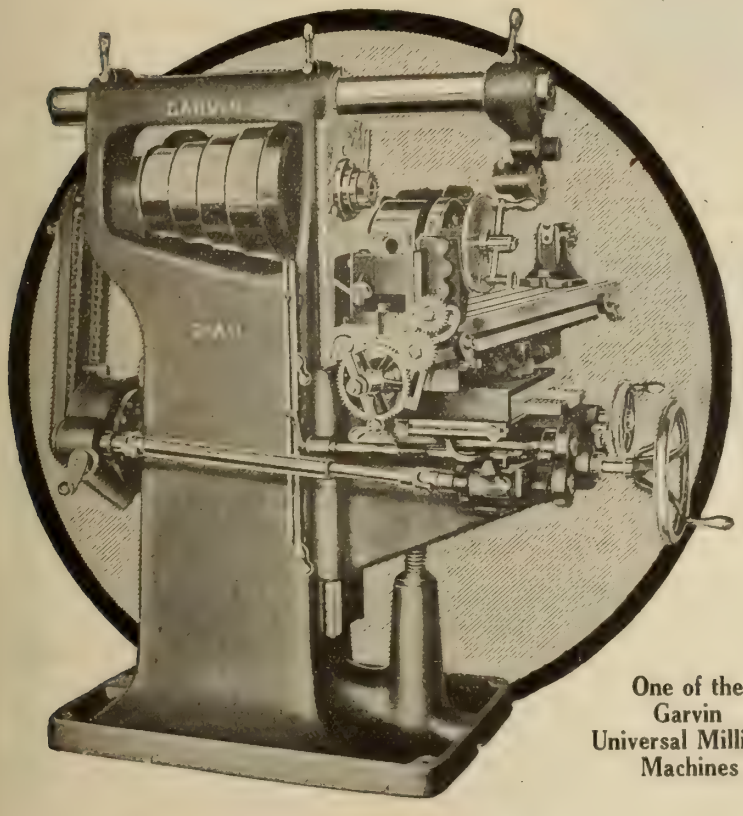
Buying Machine Tools As An Investment

GARVIN MACHINE TOOLS

- Milling Machines
- Profilers
- Cam Cutters
- Die Slotters
- Screw Slotters
- Automatic Tapping Machines
- Duplex Horizontal Drills
- Gang Drill Presses
- 4-head Right Angle Drills
- Screw Machines
- Cutter Grinders
- Wrenchless Chucks
- Surface Grinders
- Duplex Slot Millers
- Hand Lathes

The purchase and installation of a battery of machine tools may be either an expense or an investment. Most plant operators prefer to choose quality and make an investment rather than buy on a price basis alone. A high grade machine tool pays dividends in the greater amount of work it turns out, in reliable service and in a lengthy life of sustained efficiency.

The Garvin Company builds for precision, reliable service and economy of operation and upkeep. Its product is in use in thousands of industrial plants the country over and its reputation is of the highest. Many have taken great pride in passing on the word that their Garvin Machines have out-distanced their competitors in ability to continue effective service under the gruelling load of heavy duty. You, too, can make no mistake in pinning your faith to a Garvin Machine tool.



One of the Garvin Universal Milling Machines

Have you the 340 page Garvin Catalogue?

Shall we send a copy ?

The Garvin Machine Company
Spring and Varick Streets
New York, N.Y.

Agents in Principal Cities

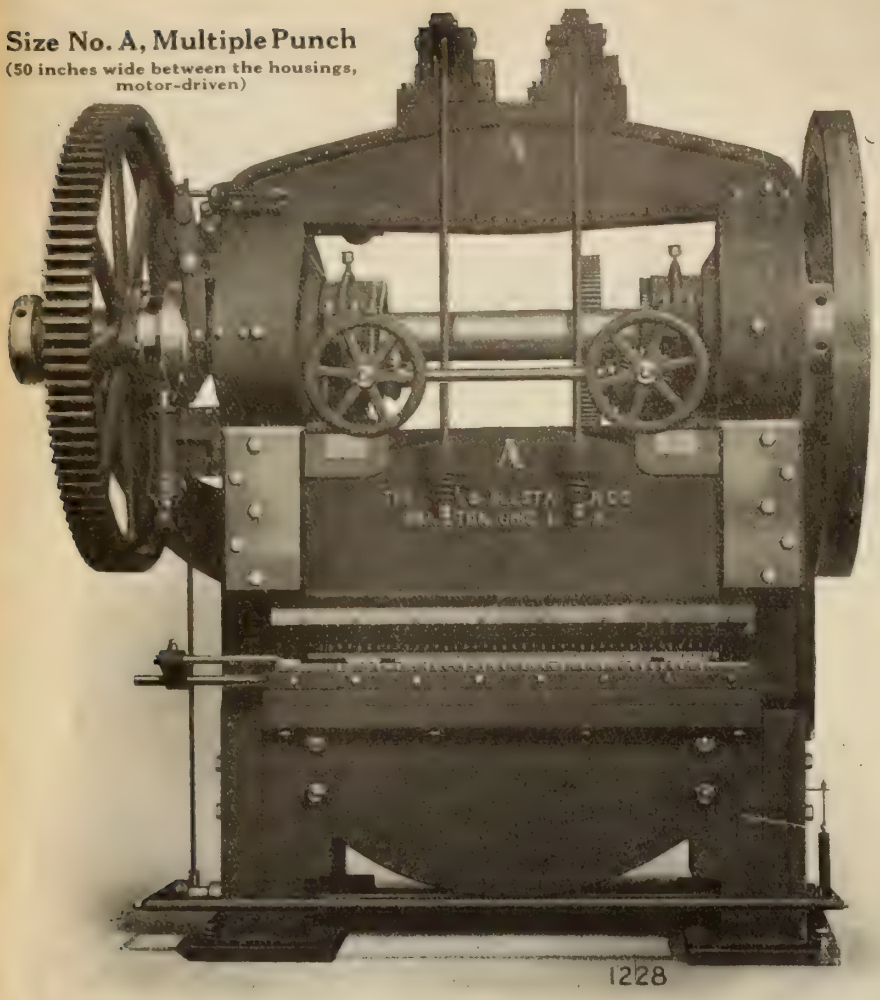
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GARVIN

BUILDER OF BETTER MACHINE TOOLS

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Size No. A, Multiple Punch
(50 inches wide between the housings, motor-driven)



"The Quality Line"

Punching and Shearing Machinery

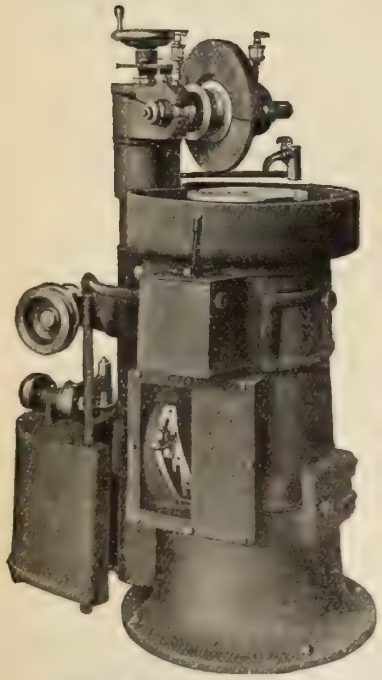
Includes

Alligator Shears
Angle Iron Shears
Bar Iron Shears
Billet Shears
Squaring Shears
Guillotine Shears
Plate Splitting Shears
Beam Punching Machinery
Boiler Punches
Disc Punches
Horizontal Punches
Multiple Punches
Structural Punches, etc.

Let us figure on your requirements.

The
Long & Allstatter Co.
American Punch & Shear Works
HAMILTON, OHIO, U.S.A.

Established 1856 Incorporated 1878



BRISTOOL

Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.
It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.
And it is built to last.
It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.
Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.
Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

Free Tool Grinding Chart

Grind your cutting tools in exactly the right way to get best results—and you save time. That's obvious. It is precisely that that this Tool Grinding Chart enables you to do.

It has been adopted as standard by many firms that found it a long way better than guess work.

CANADIAN MACHINERY would like to see this Chart in every shop in the Dominion. Mail the coupon below for your copy to-day.

Shows at a glance Correct Clearance and Rake Angles for Cutting Tools

---

CANADIAN MACHINERY,
153 University Avenue, Toronto.

Please send me / us free, one of your tool grinding charts.

Signed .....

Firm Name .....

St. Address .....

City .....

Prov. .....

Don't Keep It--Sell It

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue TORONTO, ONT.

Let them know it's there

In complimenting us upon the results secured from their advertisement in the classified section, one advertiser said:

> **"Of course we would not have sold it without letting people know it was here, that is obvious, and thanks are due you for letting the people know it was for sale."**

If you have any old or used equipment for sale, let people know it's there. Your message in Canadian Machinery will be placed before the probable buyers of such equipment.

Canadian Machinery
Classified Advertising Section
143 University Ave., TORONTO

If interested tear out this page and place with letters to be answered.

CANADIANS MUST BE SQUARE

IN the course of an article in January issue of MACLEAN'S MAGAZINE (now on sale), Mr. Lloyd Harris, who was head of the Trade Mission to Great Britain, makes the important statement that "Canada must develop a high standard of commercial morality—she hasn't that standard now." This is a vitally important article, pointing out the tremendous opportunity for profitable trade in Europe that is open to Canada, but at the same time issuing a grave warning as to what we must do, and must not do, if we are to grasp the golden chance.

Mr. Harris shows the opening for permanent trade connections that has come about as the result of war conditions and the "sentimental preference" that Canada now has in Europe—a preference created by the record of our soldiers. His message is one that every Canadian should read—business man or workingman, exporter or laborer.

Other features found in January MACLEAN'S are:

"Politics Under the Shadow"

Dominion politics are summed up by J. K. Munro in his usual pithy and unsparing style. He tells what is happening in Ottawa where the shadow of an impending farmer invasion hangs over everything.

"The Birth of a Labor Party"

Up to the recent election in Ontario, Canada hadn't a real Labor party. As a result of the return of a solid group of Labor candidates, a new party may be said to have been born. J. L. Rutledge gives interesting sketches of the first Labor members.

"The Woman's Court"

Mrs. Arthur Murphy (Janey Canuck), the first woman magistrate to sit on a bench in Canada, tells of the operation of the first Woman's Court.

"A Woman on the Warpath"

Mrs. Nellie McClung, who has figured on the public platform more prominently than any other Canadian woman, tells interestingly of her experiences, particularly with regard to the campaign in Manitoba against the Roblin Government.

Six Bright Stories by Well-Known Authors

The Thread of Flame—By Basil King.
His Majesty's Well-Beloved—By Baroness Orczy.
Spanish Doubloons—By Camilla Kenyon.
The Fall Triumphant—By C. L. M. Brown.
The Empty Chair—By Alice and Claude Askew.
Winning a Post in Fur Land—By Robert E. Pinkerton.

Keep in Touch with the World

The world is being remade in these trying times and the man or woman who would keep up with the march of events, can do no better than read the "Review of Reviews" department in January MACLEAN'S, in which the best articles and most interesting selected from the periodicals of the world are reprinted in condensed form. Look at the list of articles in this department in January MACLEAN'S:

Britain's Supremacy is Threatened
Japan is Fighting For Her Life
Admiral Reveals Vital Secrets
Germany is Still Dangerous
Can Life Be Lengthened?
How Ole Hanson Was Elected
The Diamond Market Cornered
Balking Life's Handicap
Britain Must Remain Strong Military Power
The Song of the Bolsheviks
Political Chaos in Britain
The New Roosevelt
Death Rate Exceeds Births
Secrets of "Make-Up"
Revolution Brewing in Egypt

Over 80,000 Canadian Families Buy

MACLEAN'S

"CANADA'S NATIONAL MAGAZINE"

January Issue *Now on Sale At All News Dealers* ***20c.***

THE

TRADE K-A-T-IE MARK

FOUNDRY

GALT, ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

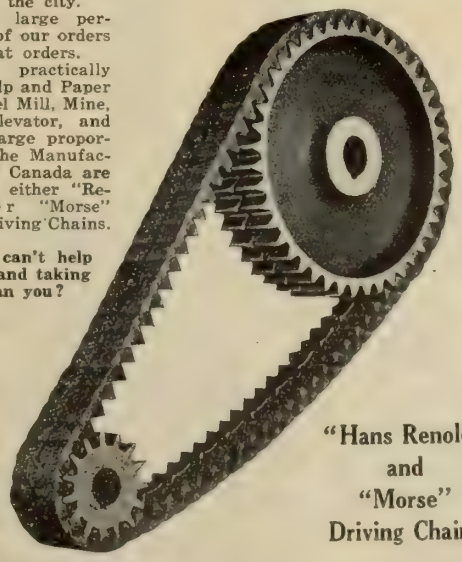
We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

It's Interesting

WHEN a large Hydro-Electric Plant installs a 5000 H.P. "Morse" Silent Chain Drive.
WHEN one of the largest Canadian Manufacturing Plants install over 27 "Renold" Silent Chain Drives totalling over 4000 H.P.
WHEN a large Canadian city installs a 500 H.P. "Renold" Silent Chain for driving Generators to provide light for the city.
WHEN a large percentage of our orders are repeat orders.
WHEN practically every Pulp and Paper Mill, Steel Mill, Mine, Grain Elevator, and a very large proportion of the Manufacturers in Canada are Users of either "Renold" or "Morse" Silent Driving Chains.

Well, you can't help sitting up and taking notice. Can you?



"Hans Renold" and "Morse" Driving Chains

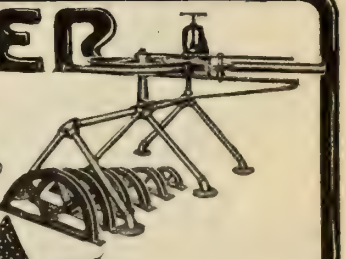
Sole Canadian Agents:

JONES & GLASSCO (Reg'd.)
Engineers.

MONTREAL
St. Nicholas Building.

TORONTO
Bank of Hamilton Building

WONDER "Bending Machines"



DON'T WASTE ELBOWS

BEND PIPE COLD

ELIMINATE FRICTION

2 New Models

"Wonder" Pipe and Tube Bending Machines (pat.) electrically operated to bend from 1" to 8".

We also manufacture 10 other sizes

Hand operated to bend from ⅛" to 6".

American Pipe Bending Machine Company

52 Pearl Street

BOSTON, MASS. U. S. A.

The Canadian Fairbanks-Morse Co., Ltd., Montreal, Que., Agents for Canada

GOODYEAR
MADE IN CANADA

EXTRA POWER BELTING

You can find no safer guide in selecting your belting equipment than the experience of others.

In over one thousand of Canada's plants Goodyear Extra Power Belting is being used with marked success. Scores of these have written us telling of their experience with Extra Power Belting.

Read this letter from The Dominion Steel Products Co., Limited, of Brantford, a concern noted for its progressive methods. It tells of a belting experience which must impress you.

Price was a minor factor with Dominion Steel Product·, but on this alone they made a saving of $4,000.

Length of service, general efficiency, continuous operation and power saving were the determining factors in their decision to use only Extra Power Belting in their plant.

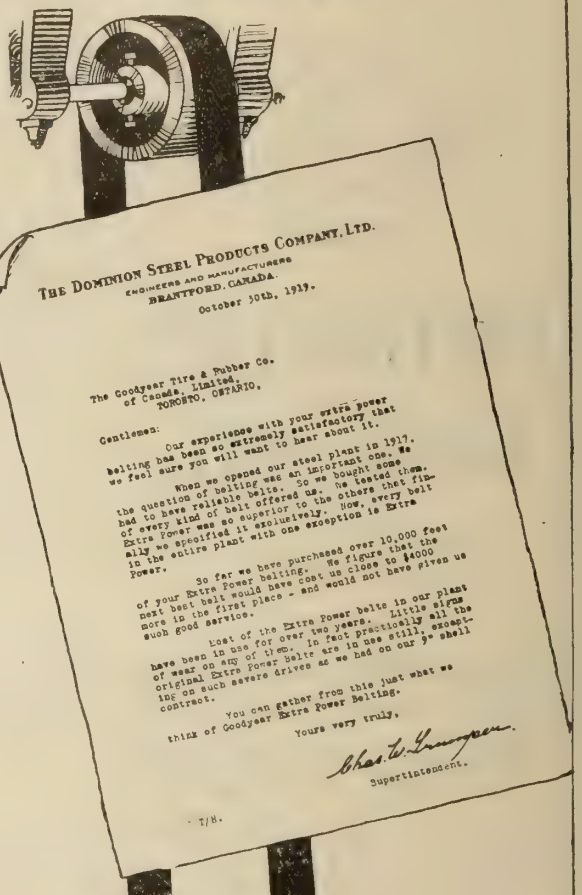
It may be that your plant is much smaller; that your saving would only be $400, but even this plus the greater efficiency of Extra Power Belting is too important for you to disregard.

You can easily prove to your own satisfaction that Extra Power would serve you as faithfully as it has the Dominion Steel Products Co.

Phone, wire or write our nearest branch, so that a man carefully trained in belting problems by Goodyear may call on you and present further evidence of the superiority of Extra Power Belting. No obligation other than fair investigation.

THE GOODYEAR TIRE & RUBBER CO. OF CANADA, LIMITED

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Edmonton, Calgary, Vancouver. Service Stocks in smaller cities.



THE DOMINION STEEL PRODUCTS COMPANY, LTD.
ENGINEERS AND MANUFACTURERS
BRANTFORD, CANADA.
October 30th, 1919.

The Goodyear Tire & Rubber Co.
of Canada, Limited,
TORONTO, ONTARIO.

Gentlemen:

Our experience with your extra power belting has been so extremely satisfactory that we feel sure you will want to hear about it.

When we opened our steel plant in 1917, the question of belting was an important some had to have reliable belts. So we bought them. of every kind of belt offered us. We tested them. Extra Power was so superior to the others that finally we specified it exclusively. Now, every belt in the entire plant with one exception is Extra Power.

So far we have purchased over 10,000 feet of your Extra Power belting. We figure to $4000 more best belt would have cost us close to in the first place - and would not have given us such good service.

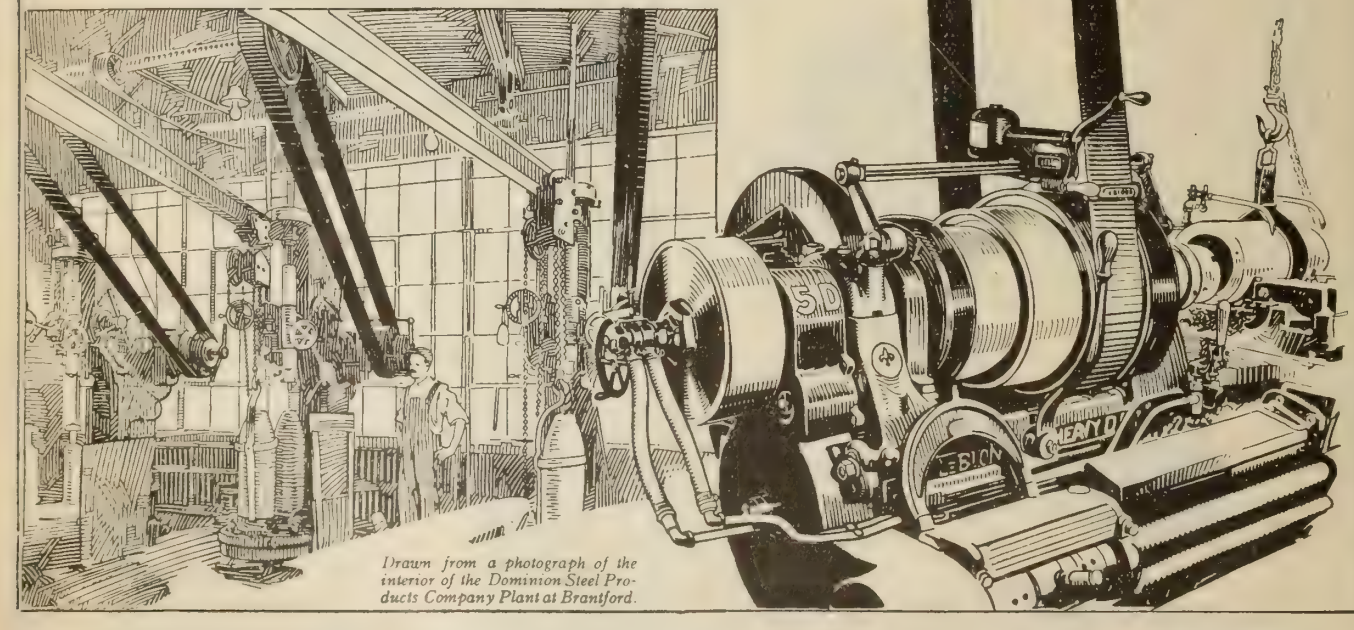
Most of the Extra Power belts in our plant have been in use for over two years. Little signs of wear on any of them. Practically all the original Extra Power belts are in use still, except on such severe drives as we had on our 9" shell contract.

You can gather from this just what we think of Goodyear Extra Power Belting.

Yours very truly,

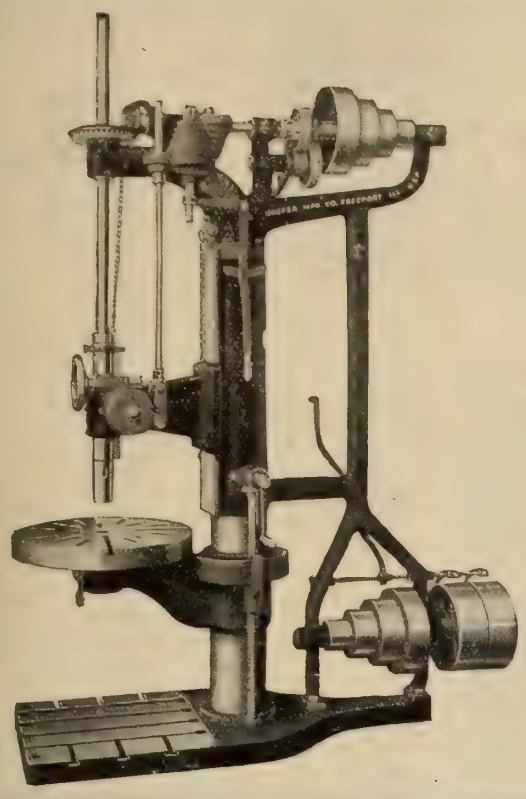
Chas. L. Thompson.
Superintendent.

T/H.



Drawn from a photograph of the interior of the Dominion Steel Products Company Plant at Brantford.

The Driller for Exact Work



HOEFER

Enable Your Workmen to Eliminate Spoilage

The Hoefer Driller is pre-eminently the one to be found in the best plants. "It's almost as good as a Hoefer," so often heard in the machine and tool trade, indicates the position held by Hoefer Drillers.

Exact drilling, to the last thousandth of an inch, pays by eliminating spoiled material. Hoefer Drillers pay for themselves and increase the workman's pride in his work.

Twenty-five Years on Market

Twenty-five years making drillers has given Hoefer the "Know-how." The Hoefer Drillers are used by many of America's leading manufacturers. Equip your factory the Hoefer way. Take any kind of a drilling problem you have to the Hoefer Manufacturing Company, and the Company's experts can tell you how it was solved by other men, some of whom you may know.

Investigate now. Write to-day for catalog. The Hoefer engineers are at your service.

HOEFER MFG. CO.
FREEPORT, ILL.

Manhattan

Universal Tool Grinder

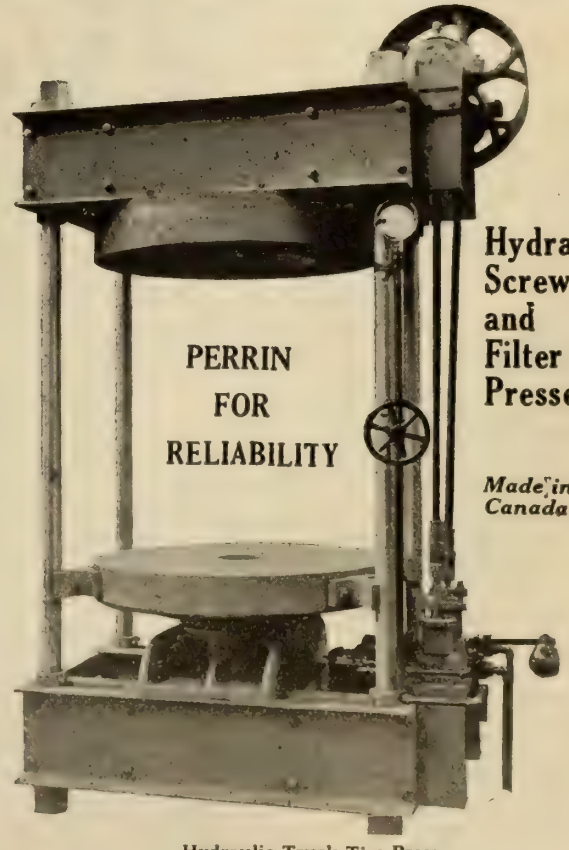
Capable of handling cylindrical or internal grinding with speed and accuracy.



An invaluable tool to the machine shop where there is a large variety of grinding to be done. Complete equipment.

Manhattan Machine & Tool Co.
Grand Rapids, Mich., U.S.A.

Foreign Representatives: "Aux Forges de Vulcain," Paris, France. Farmer & Co., Clerkenwell London, E.C.



PERRIN FOR RELIABILITY

Hydraulic Screw and Filter Presses

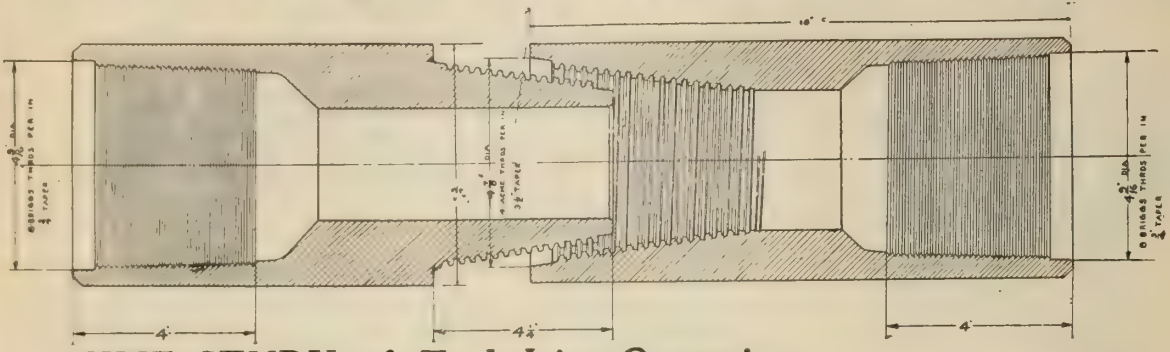
Made in Canada

Hydraulic Truck Tire Press

WILLIAM PERRIN LIMITED
TORONTO

If interested tear out this page and place with letters to be answered.

Smalley-General THREAD MILLING MACHINES



Lower Threading Cost

TIME STUDY of *Tool Joint Operation*—

MACHINE—Smalley-General Thread Miller No. 1.
PIECE MILLED—Tool Joint (Pin and Box).
THREAD—Large diameter, 4 13-16 in.; length, 4¼ in.; ¼ in. pitch, Acme Form; 3½ in. taper per foot.
MILLING FEED—3.8 in. per minute.
MATERIAL—.30-.40 Carbon Steel.

TIME STUDY

Chucking in and out	1 min.
Feeding Hob to position	40 sec.
Milling	4 min.
Total Time	5 min. 40 sec.

Above time is for either Internal or External Thread. It should be compared with former Lathe Time of approximately 41 minutes. Thread was completed in one revolution.

PIECE MILLED—Tool Joint (Pipe End).
THREAD—Diameter, 4½ in.; length, 3½ in.; ⅛ in. pitch, Briggs Standard, ¾ in. taper per foot.
MILLING FEED—4.7 in. per minute.
MATERIAL—.30-.40 Carbon Steel.

TIME STUDY

Chucking	1 min.
Feeding Hob to position	40 sec.
Milling	3 min.
Total Time	4 min. 40 sec.

Note—This work was done with motor driven No. 1 Smalley-General Thread Miller in the plant of a manufacturer of oil well supplies in Houston, Texas. Name on application.

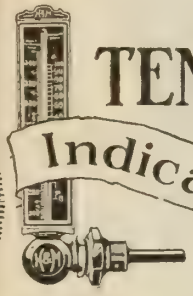
Consult us on every phase of Thread Milling. We will show you how to cut the costs

Smalley-General Co., Inc., Bay City, Michigan

Canadian Agents: Rudel-Belnap Co., Ltd., Montreal and Toronto

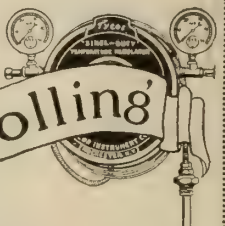
Tycos

TEMPERATURE INSTRUMENTS



Indicating Recording Controlling





Tycos Mercurial, Recording and Index Thermometers for all industrial and laboratory applications.
Electric Contact Thermometers.
Temperature, Pressure and Time Regulators.
Mercury Column Vacuum, Pressure and U Gauges.
Tycos Base Metal, Rare Metal and Radiation Pyrometers (Indicating and Recording) Fery Radiation Pyrometers.
Hygrometers, Hydrometers.
Mineral Oil Testing Instruments.
Aneroid and Mercurial Barometers.
Recording Barometers.
Pocket Compasses.
Surveying Compasses, Rain Gauges.
Anemometers and Air Meters.
Thermographs, Hand Levels.
Aviation Barometers and Inclinometers.
Tycos Sphygmomanometers.
Tycos Fever Thermometers.
Thermometers of all kinds for home and general use.

Tycos Products embrace a very wide line of accurate instruments that completely cover every possible condition that can be imposed, where the indicating, recording and controlling of temperature is necessary.

They are not made to answer the purpose but to suit the requirements, the result is you obtain in a *Tycos* both an accurate instrument and one that will endure in service and that is exactly suited to your need.

Tell us what your temperature requirements are, and whether the instrument should be indicating only or indicating, recording or controlling and we will send specific information.

The general trade mark name *Tycos* covers all indicating, recording and controlling instruments and regulating devices made by this company and is a synonym for standard apparatus—precision, reliability and permanence. We invite correspondence relating to our instruments and their uses.

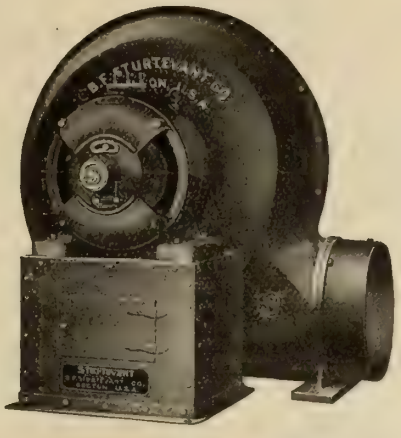
Taylor Instrument Companies
Rochester, N. Y.

There's a Tycos or Taylor Thermometer for Every Purpose

334

Sturtevant
(TRADE MARK)

MONOGRAM BLOWERS



Aid Manufacturing Processes

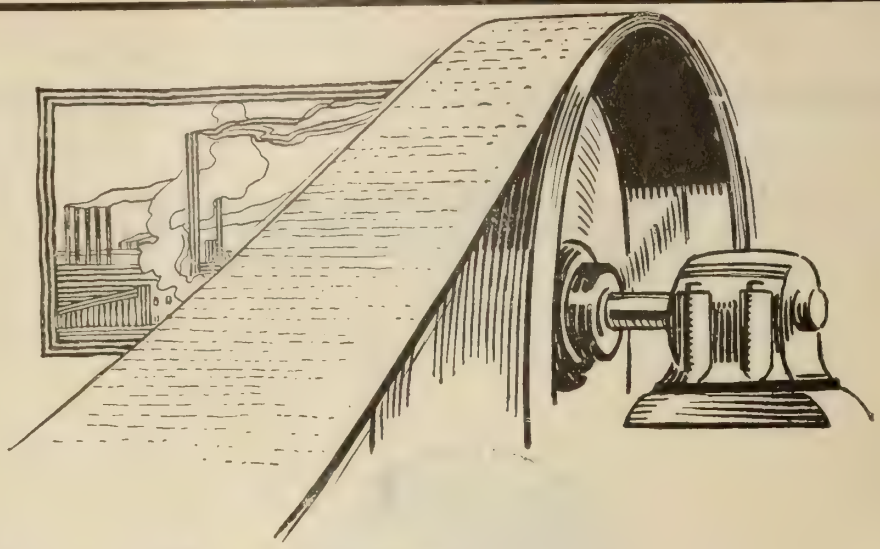
—in a thousand ways. They are adapted to ventilating rooms, exhausting chemical and acid fumes, drying, supplying air to forges and furnaces; in fact, any industrial problem where large volumes of air are required. Constructed like a battleship —they stand wear and tear, which many applications require. We carry a large stock and can ship without delay. Call upon any one of our twenty-three Branch Offices to help solve your problem. Bulletin 242-H gives a comprehensive idea of these blowers. Asking for a copy involves no obligation.

B. F. STURTEVANT COMPANY
OF CANADA, LIMITED

Head Office and Works: Galt, Ontario
Sales Offices: Toronto and Montreal

Sturtevant
PUTS AIR TO WORK

If interested tear out this page and place with letters to be answered.



A Short Route to Increased Production

Efficiency of equipment is the shortest route through which you can increase production, and offset the high cost of material and labor.

Your first consideration should be to get the most out of the power that you are paying for.

Dominion Friction Surface Belting

will transmit as near one hundred per cent. of each power unit as can be transmitted by a belt.

During more than fifty years of experience in belt building for power transmission, we have perfected a special friction compound that acts not only as a water-proofing, as a vulcanizer to the fabric plies of the belt, but enables Dominion Friction Surface Belting to take a grip on the pulleys that practically eliminates all power waste.

Our engineers will be glad to show you, without charge, how Dominion Friction Surface Belting shortens the route to increased production, thereby lowering *your* manufacturing cost. Their services are available through our nearest Service Branch.

CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION RUBBER SYSTEM
AND ASSOCIATED COMPANIES

Makers of Dominion Hose, Packing and Industrial Rubber Goods and Dominion Tires, the GOOD Tires for every purpose.

Service Branches:

Halifax,	Fort William,
St. John,	Winnipeg,
Quebec,	Brandon,
Montreal,	Regina,
Ottawa,	Saskatoon,
Toronto,	Edmonton,
Hamilton,	Calgary,
London,	Lethbridge,
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North Bay,	Victoria

57

RICH DRILLS



You Can Rely Upon Them!

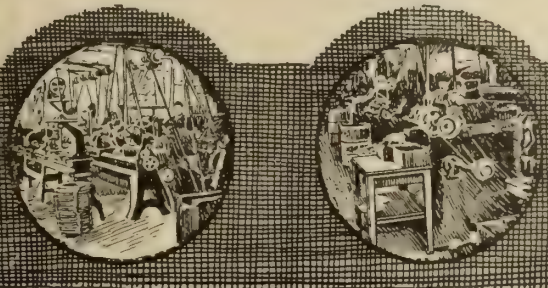
Machinery, Machine Tools, Factory and Mill Supplies

High speed steel of the highest quality goes into the Rich Tools.
Rich drills cut true—no variation. They retain their temper at high speed—no burning or binding.
Forged from the solid bar of the best grade of steel obtainable. Let us convince you of their durability. We will be pleased to mail our catalogue to you upon request.

Standard Machinery & Supplies Limited
261 Notre Dame St. West Montreal

SPECIAL TOOLS

Automatic Machinery
for all purposes
Punch Press Work
Screw Machine Products
Consult us on your machine problems
Toronto Tool Company
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"WHITNEY"

KEY-SEAT CUTTERS

For the Woodruff System of Keying

GET OUR PRICES

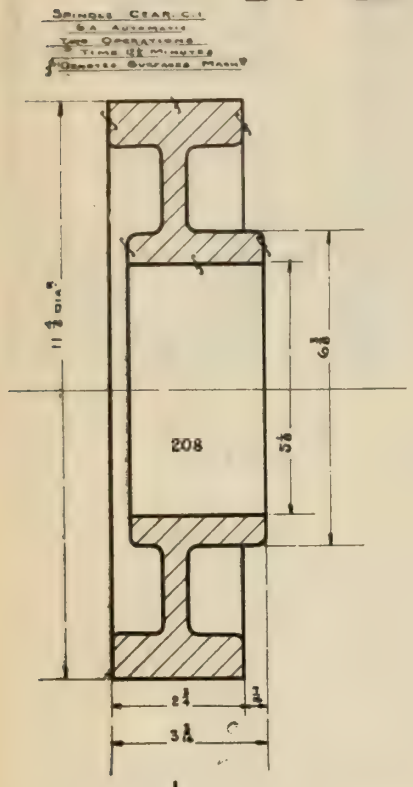


Either carbon or high-speed steel.
Material the best obtainable.
Unsurpassed in efficiency and durability.
Centred at both ends.
Unsurpassed in accuracy and finish.
Large quantities carried in stock.

The Whitney Mfg. Co., Hartford Conn.

Chains, Keys and Cutters, Hand Milling Machines

P. & J. Automatics At Your Service



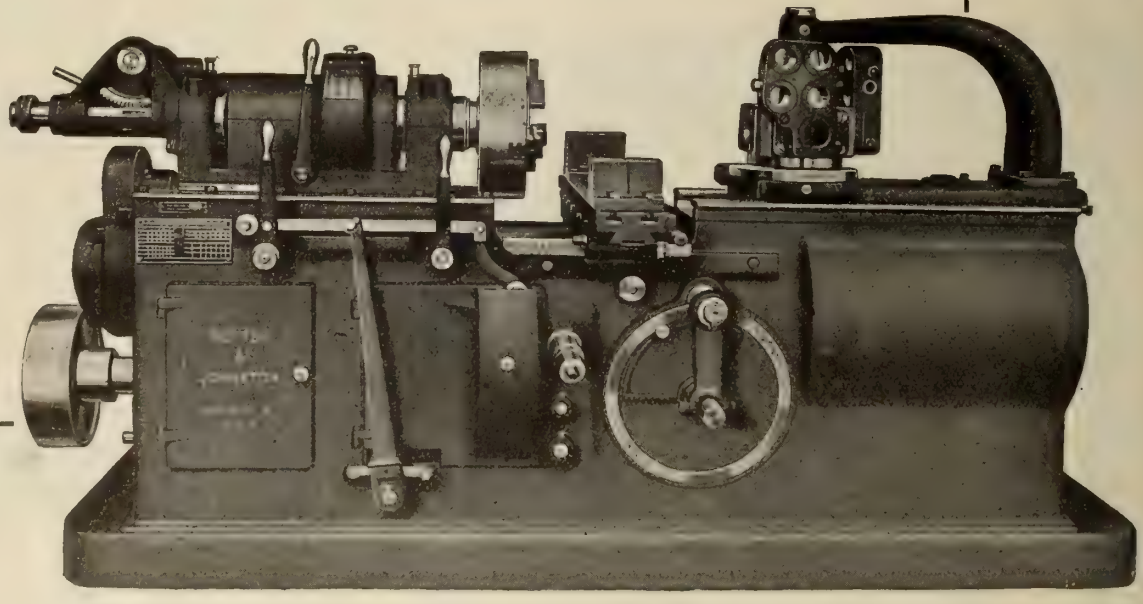
WHETHER you are making gears or flywheels or contemplating doing so, the proposition should look good to you.

The part illustrated is a gear blank and was finished on the Potter & Johnston Manufacturing Automatic Chucking and Turning Machines in two chucking operations.

We could give you the time on this job, but would rather give you figures on some of your own parts.

Send them along.

Bulletin 41



Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

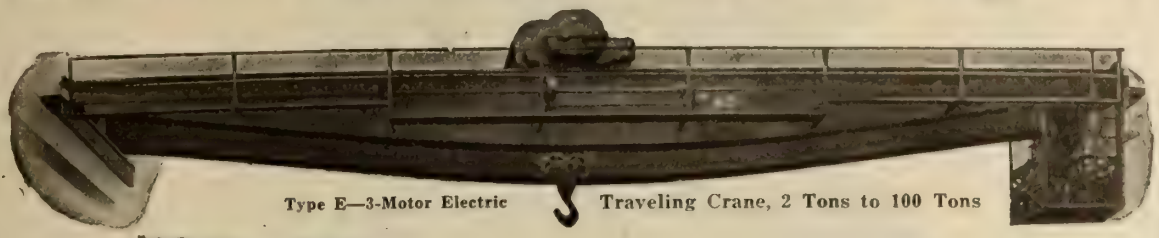
Head Office: 1501 Royal Bank Building, Toronto, Canada

Works and Warehouse: Galt, Ont., Canada

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes



Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons

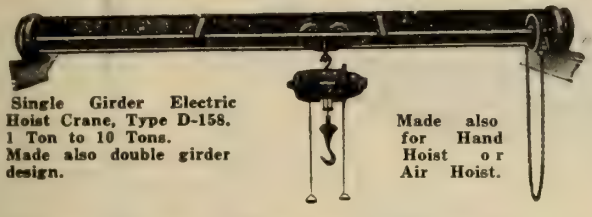


Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.







Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

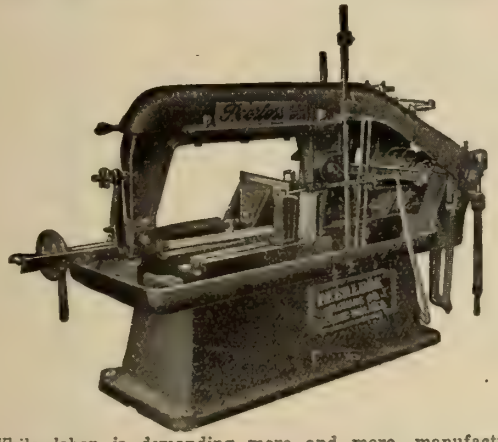
Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

Peerless HIGH SPEED

The Standard Metal Saw of TO-DAY



While labor is demanding more and more, manufacturers are demanding machines of greater output. The "Peerless" meets that demand. It is the standard metal saw of TO-DAY.

With its rapid cut and various time-saving features, it easily increases production from 50 to 100 per cent. With its automatic feed, straight line pull, positive blade clamp and general rigidity, it gets the maximum results of which a blade is capable and reduces breakage to a minimum.

OUR SIX-SPEED GEAR BOX

(not shown in cut) further increases output and saves blades wherever soft steel or metals of varying degrees of hardness have to be cut. The "Peerless" is furnished either with or without this feature, also with or without motor.

A trial order at our risk and expense is convincing

PEERLESS MACHINE COMPANY

1607 RACINE STREET RACINE, WISCONSIN

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

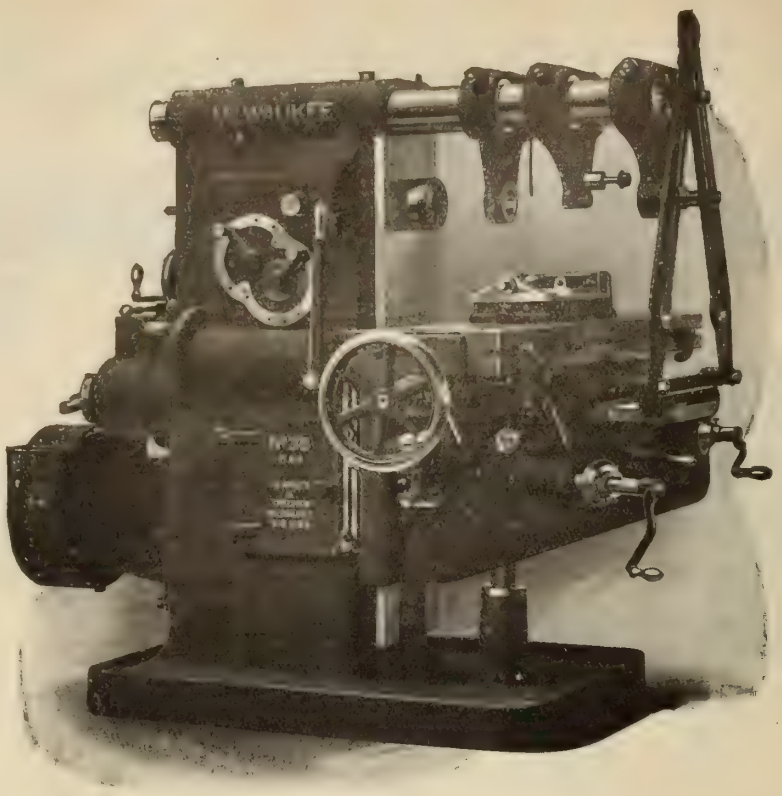
and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.

If interested tear out this page and place with letters to be answered.



MILWAUKEE MILLING MACHINES

Double Overarm maintains alignment.

It is impossible for the operator to place the arbor supports on the arbor and double overarm in any other way than in line. Arbor cannot be pounded out of line when using large, coarse pitch cutters on rough, heavy work.

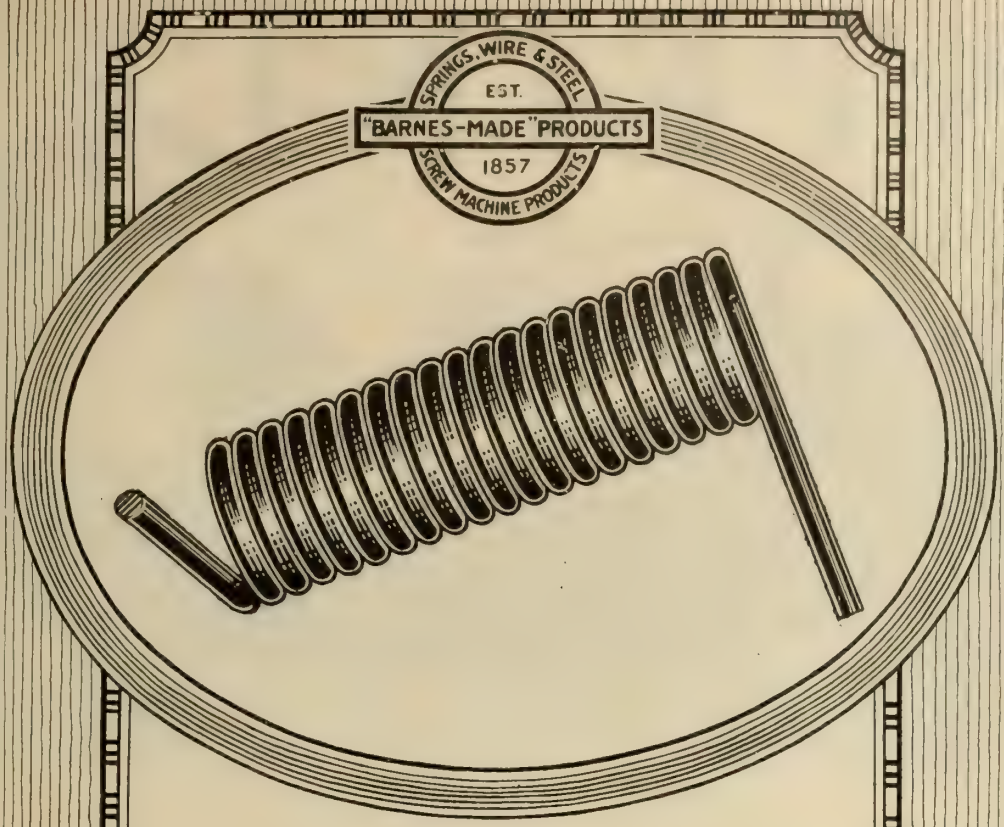
Other Distinctive Milwaukee Features:

Solid top knee—hardened steel gearing and shafts in the column and feed box—automatic flooded lubrication — one and one-half gallons of oil per minute pouring over all gears and bearings in the column and feed box, insuring lubrication at all times—flanged spindle with hardened steel collar for driving arbors—constant speed drive, reverse being self-contained.

Send for our No. 21 Catalogue. Illustrating and describing Milwaukee Milling Machines and accessories in detail

KEARNEY & TRECKER CO.

MILWAUKEE, WIS. U.S.A.



Springs-"Barnes-Made"

If your product depends on one or more springs for its performance, you should use springs that are "Barnes-Made."

Science and skill and special machinery together insure the quality of these springs. Sixty-two years' experience is built into them.

All "Barnes-Made" springs are specially made. State your particular need. Ask us to estimate.

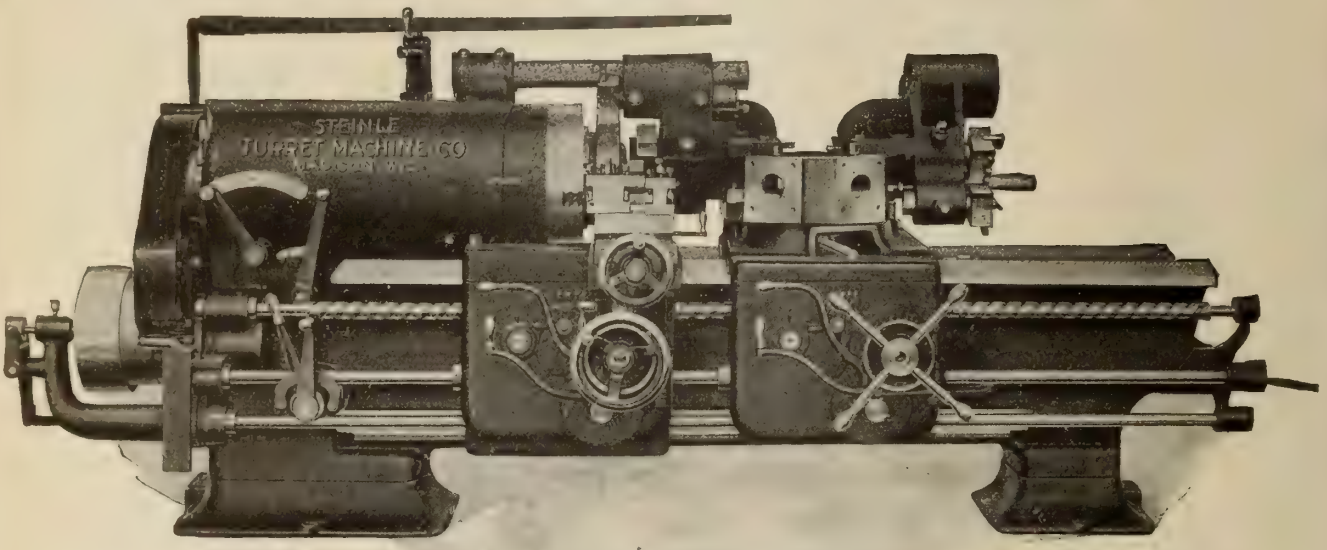
The
Wallace Barnes Company
Established 1857

Flat and Wire Springs of every type.
Screw Machine Products High Carbon Cold Rolled Stee

Main Office and Works: Bristol, Conn.
50 East 42nd St., N.Y. City Book Bldg., Detroit

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STEINLE



Another Steinle Reason

Above cut illustrates machine equipped with special combination turning and facing heads with overhead support and clearly shows harmony in the design and functioning of the various members and the exceptional provision for rigid support of tools.

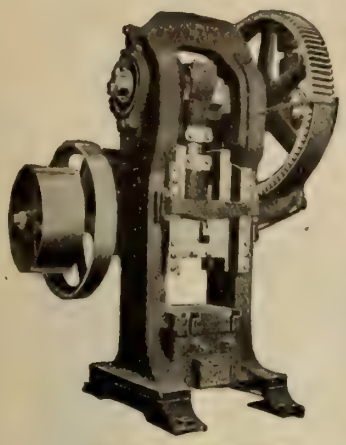
Write for Information

STEINLE TURRET MACHINE COMPANY

MADISON, WISCONSIN, U.S.A.

The "TOLEDO"

Straight Column Presses



The "Toledo" Straight Column Presses.

Designed for successfully withstanding the most severe working conditions.

Connections are massive and of improved design.

Slides are extra long moving in equally long and heavy gibs. Every detail is given the most expert thought and supervision so that these presses may prove pre-eminently dependable for working the heavier gauges of metal. Sixty-five sizes weighing from 3,000 to over 400,000 lbs.

The Toledo Machine & Tool Co.

Toledo, Ohio

Representatives: Allied Machinery Co. of America, 19 Rue de Rocroy, Paris, France: Via XX Settembre 12, Turin, Italy; 16 Seidengasse, Zurich, Switzerland.

TRAHERN

Lubricating Pumps

are rotary geared because experience has proven this construction to be the most practical for machine tool use.

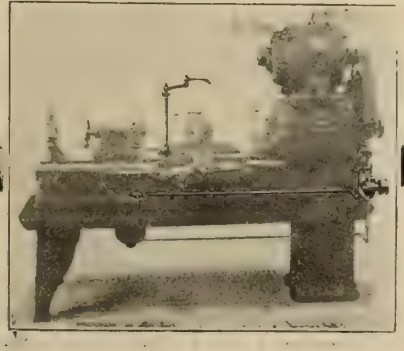
Hundreds of machine tool manufacturers throughout the United States and Canada furnish Trahern pumps as regular equipment on their product.

A good oil pump will help sell your product and will intrench its reputation.

TRAHERN PUMP DIV.

Geo. D. Roper Corporation

ROCKFORD, ILL. - - U.S.A.



A Suggestion

Williams' Superior Drop-Forged Wrenches

WHERE does your responsibility end? Do your wrench requisitions simply call for certain sizes of an unspecified design and make, or do you also demand *quality*—the quality that guarantees service?

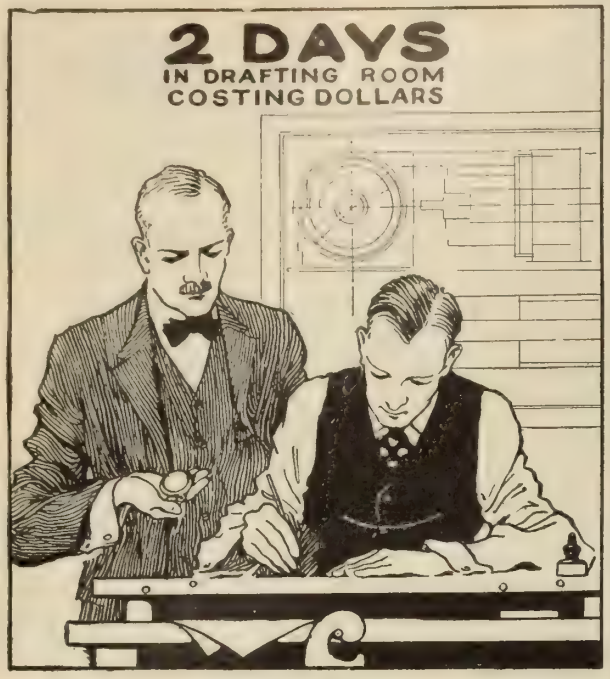
For nearly half a century we have been manufacturing wrenches, creating designs, standardizing lines to meet various trade needs, testing our materials and processes in the effort to develop quality; in short, striving by every means in our power to maintain and improve that *Superior* something in our product which makes it individual and Williams'.

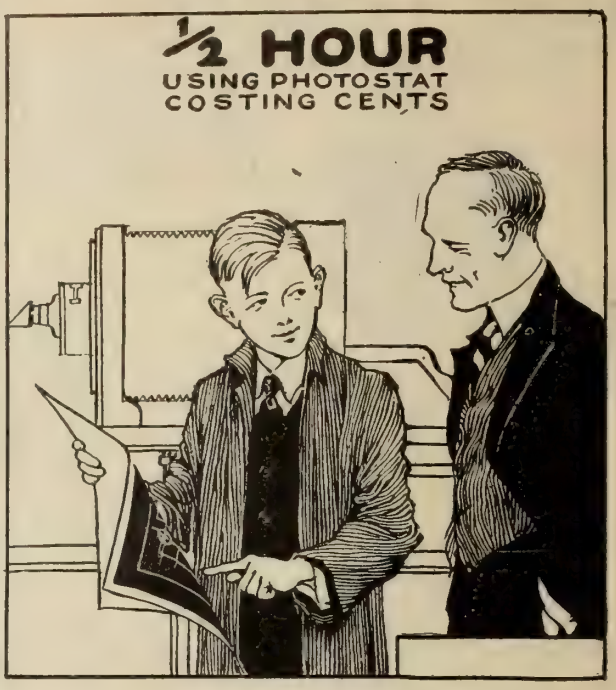
That this constant endeavor has been successful and is appreciated is evidenced by the many shops which *always* specify "Williams' Wrenches"—they want and insist upon obtaining *Superior* quality. Try this plan the next time you order.

Booklet describing 40 Standard Lines in nearly 1,000 sizes, with openings from 3-16" to 7⅝", sent on request.



The A. G. Low Co., Ltd., 45 Pacific Ave., Saskatoon, Sask. Agents for Manitoba, Saskatchewan, Alberta and British Columbia





Which? In Your Business?

Your customer sends you a blueprint for that new contract that you have just closed. You must have several copies for the shop. You can't make blueprints from a blueprint and to have a tracing made you must wait anywhere from two hours to two days, or possibly longer if the drafting room isn't able to start work at once. Then there is always the possibility of an error in the tracing when it is finished. It is discouraging, isn't it, when you've quoted that customer an "inside" delivery to get started with him?

And the chief draftsman isn't any more pleased than you, because he probably has to take an expensive man from a creative job and put him on an unproductive copying job.

But wait—there is a way out of your difficulties. It's the

PHOTOSTAT

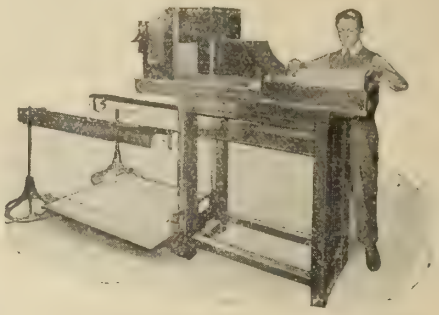
Trade Mark Registered

This machine will give a clear, clean, photographic copy of your blueprint, in a few minutes and without the use of expensive negatives or a dark room. Just think, in this short time it will deliver to you, ready for use, all the facsimile copies you need—and at a cost of only a few cents apiece. Also remember that the PHOTOSTAT

MAKES NO MISTAKES

Ask for our catalog giving complete details

The PHOTOSTAT quickly pays for itself not only because it copies blueprints, but because it copies pencil sketches and drawings, tracings, maps, plans, pages from books, advertising layouts, photographs, small tools and machine parts, production schedules, etc., at **original size, enlarged** or **reduced** within the limitations of the apparatus.



A PHOTOSTAT IN OPERATION

Manufactured by the Eastman Kodak Company Exclusively for

COMMERCIAL CAMERA COMPANY
ROCHESTER, N.Y.

CHICAGO, NEW YORK CITY, PHILADELPHIA, PROVIDENCE, SAN FRANCISCO, WASHINGTON

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Electric Furnaces and Equipment

THURY REGULATORS, NEW TYPE

ELECTRODE WINCHES

ELECTRODE HOLDERS

MAGNETIC BREAKS

ROOF COOLER RINGS

HAND CONTROLS

BUSS BARS SYSTEMS

ELECTRIC FURNACES

FOR SMELTING FERRO ALLOYS AND REFINING STEEL

PORTABLE ELECTRIC HOISTS,

MONO RAIL HOISTS,

GENERAL CONSULTING

VOLTA MANUFACTURING CO.

WELLAND, ONTARIO

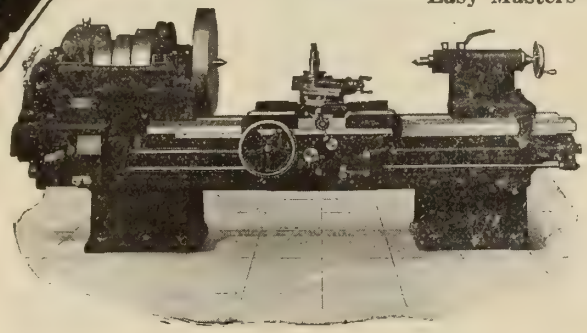
SIDNEY

For SERVICE

Heavy Duty Lathes

The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

Easy Masters of Big Jobs



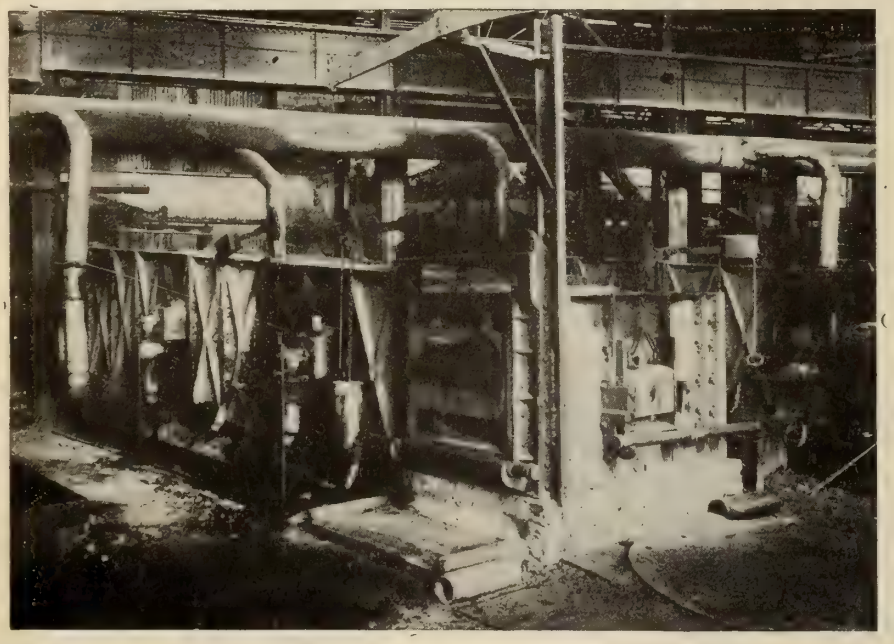
Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good—with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

The Sidney Tool Company
SIDNEY, OHIO

CANADIAN AGENTS:
Yeates Machinery & Supply Co., Montreal, Que.
H. W. Petrie, Limited, Toronto, Ontario.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.

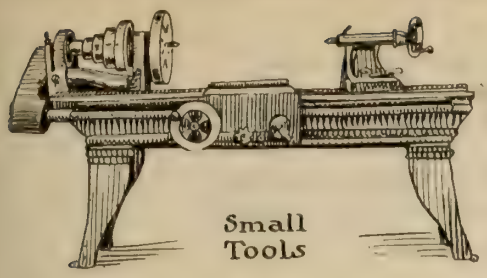


We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

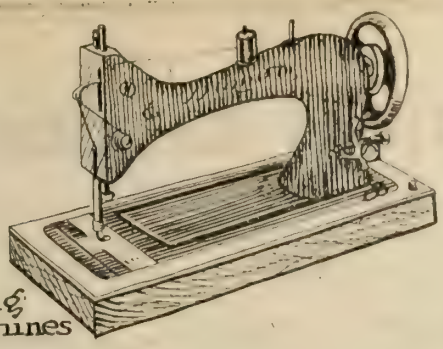
Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

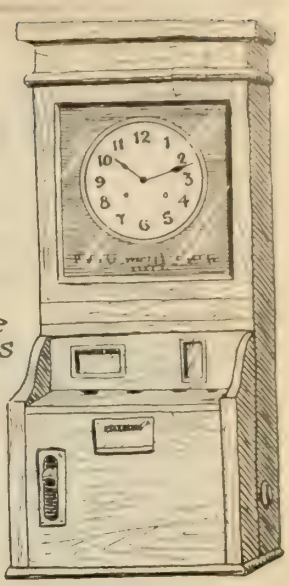
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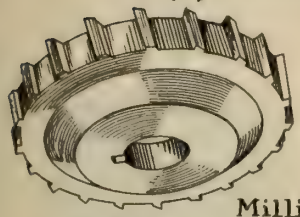
It is a valuable addition to your tool room for producing small milling cutters, reamers, etc.

If production increase interests you, our circulars will make pleasant reading; better put in that request to-day.

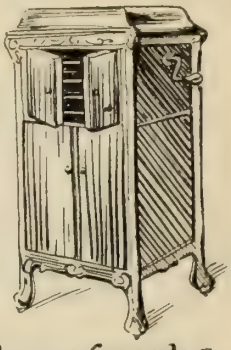
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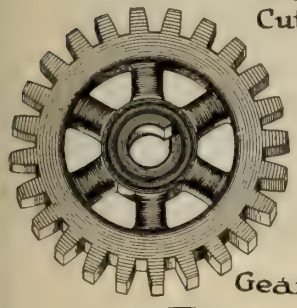
Locks



Milling Cutters

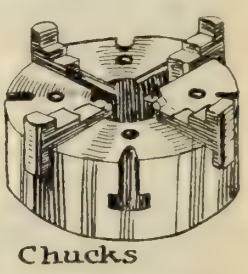


Phonographs



Gears





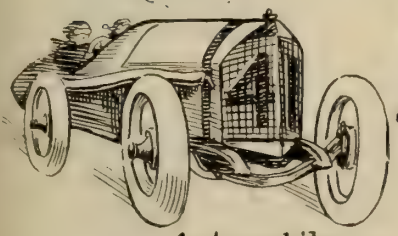
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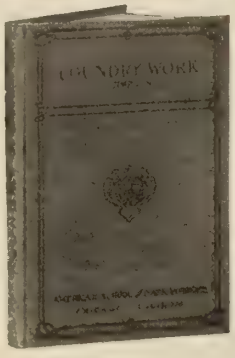
If you are desirous of improving yourself in your trade and so putting yourself in the position of making more money, these Mechanical Engineering Books will be found helpful.



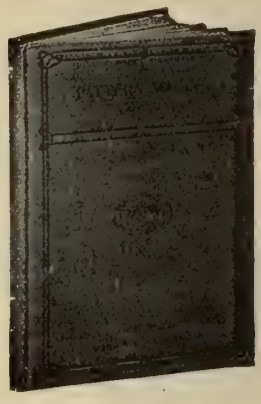
MACHINE-SHOP WORK. By Frederick W. Turner, Instructor in Machine-Shop Work, Mechanics Arts High School, Boston. 208 pp., 241 illus. Cloth binding. The use of various hand tools is explained, followed by a comprehensive discussion of the lathe and lathe tools, with the methods of screw cutting, taper and eccentric turning, etc. The way to figure compound gears for screw cutting; drilling; boring; planers; shapers; slotters; milling machines and cutters; how to cut spirals, gears, cams, etc.; grinding; the operation of automatic machines. Price $2.00



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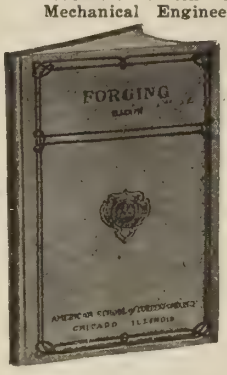


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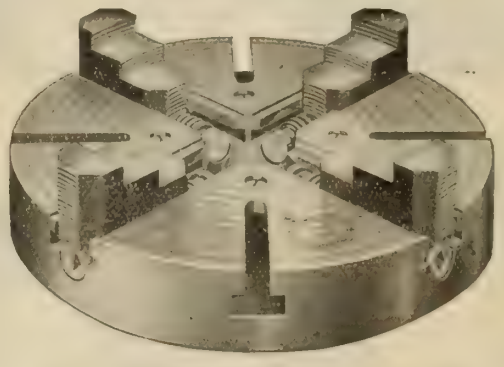
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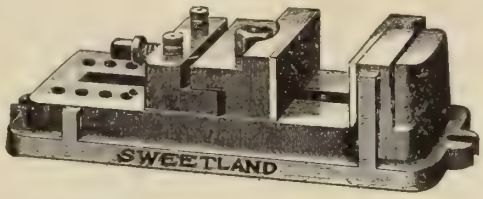
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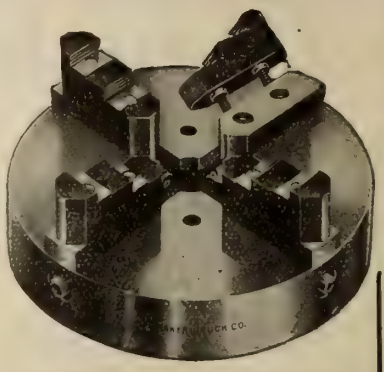


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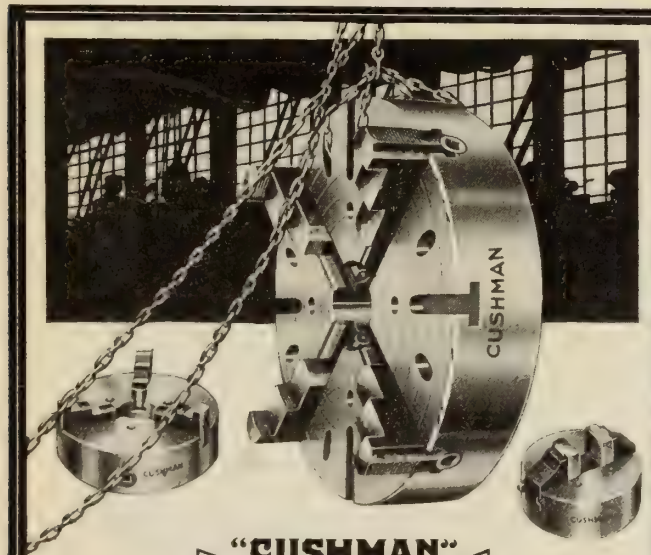
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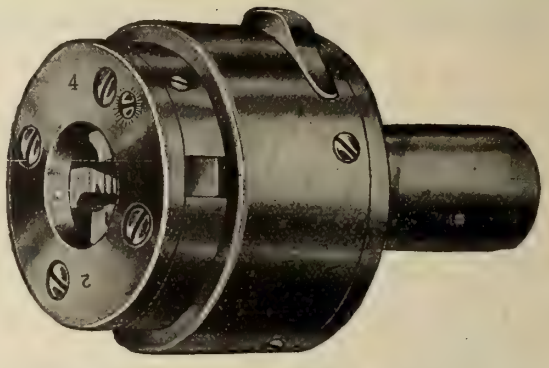


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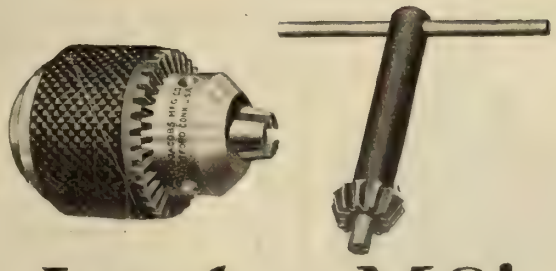
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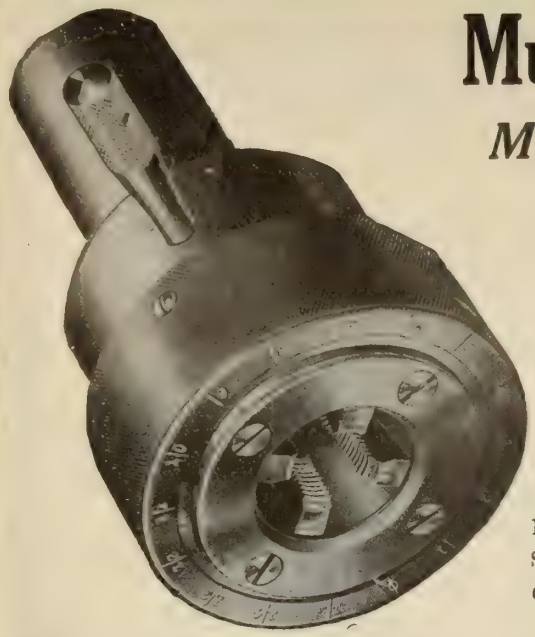
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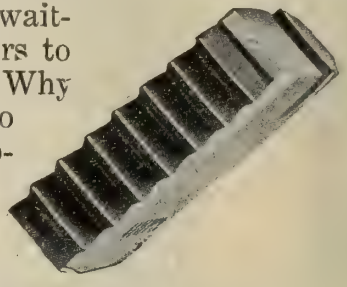
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Mean Quick Deliveries







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Fits Any Make Drill

A friction mechanism inside the body of the attachment is automatically adjusted by the driving pressure, creating a very sensitive drive and eliminating the sudden strain of the reverse—responsible for many broken taps. This attachment is fitted with a plain chuck with jaws that grip both the round and square end of the tap shank.

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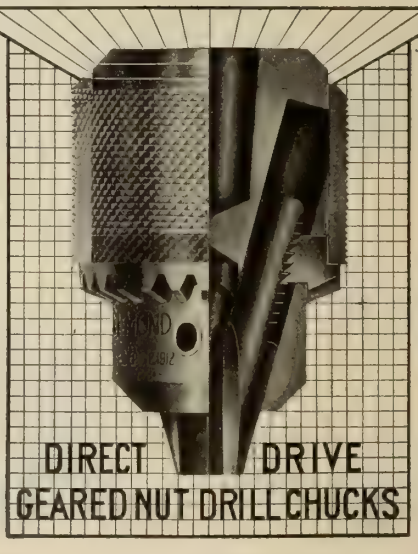


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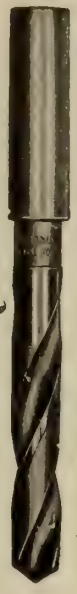
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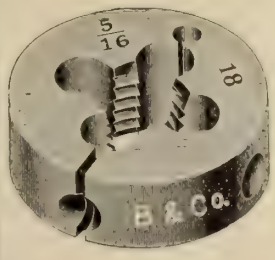
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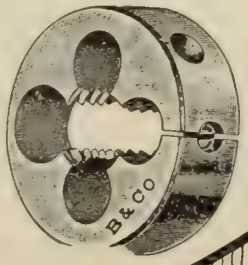
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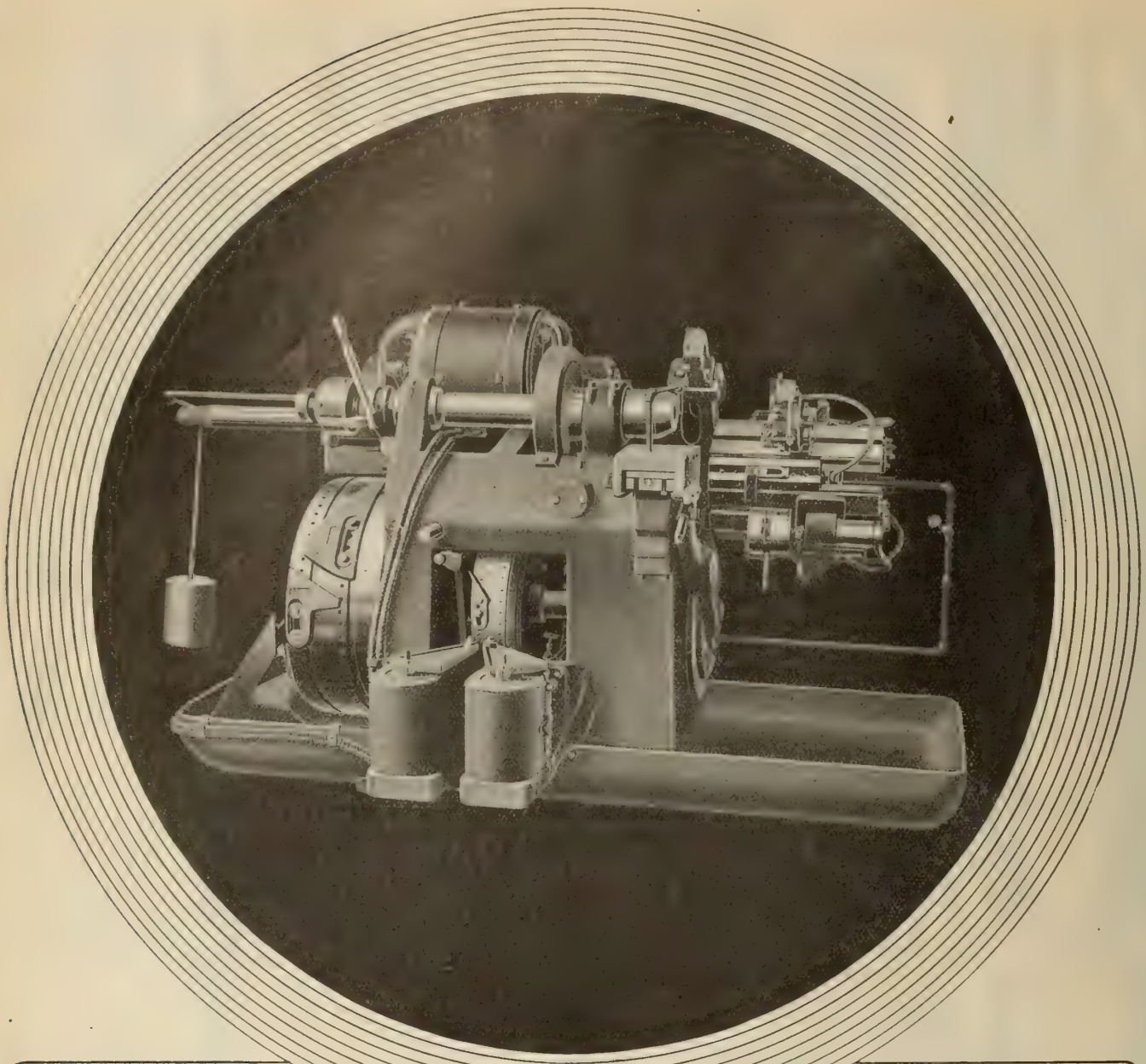
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are designed to meet every condition

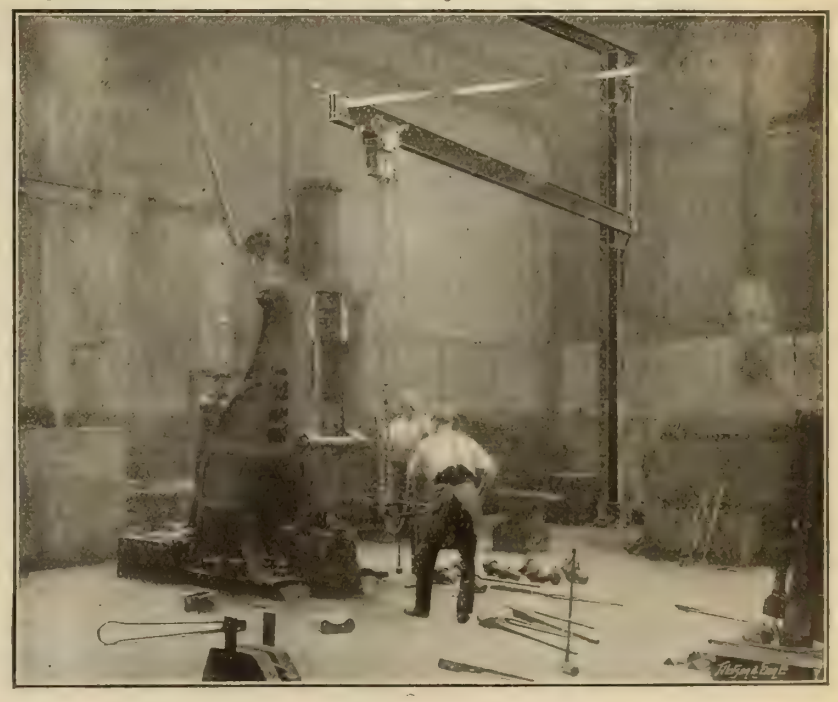
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Equipped for hand or electrical operation; adaptable to every branch of industry and built to withstand the hardest service, there is a Morris Jib Crane to meet your particular needs.

Book 766 gives further particulars. We shall be pleased to mail a copy upon request. It may lend a thought on your hoisting and conveying problems.



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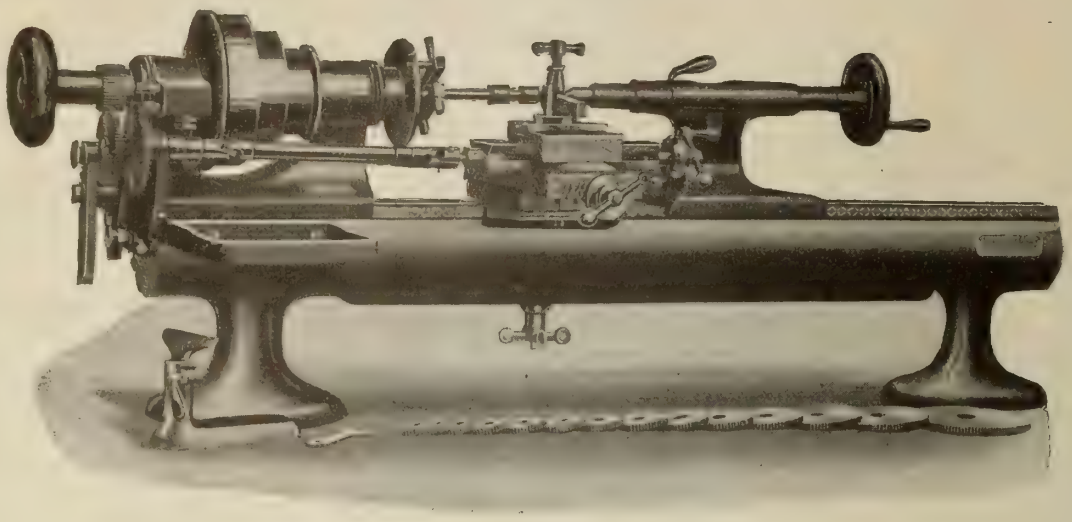
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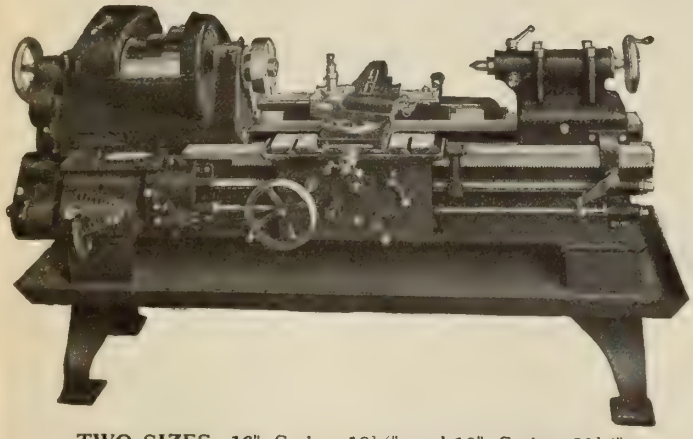


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TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

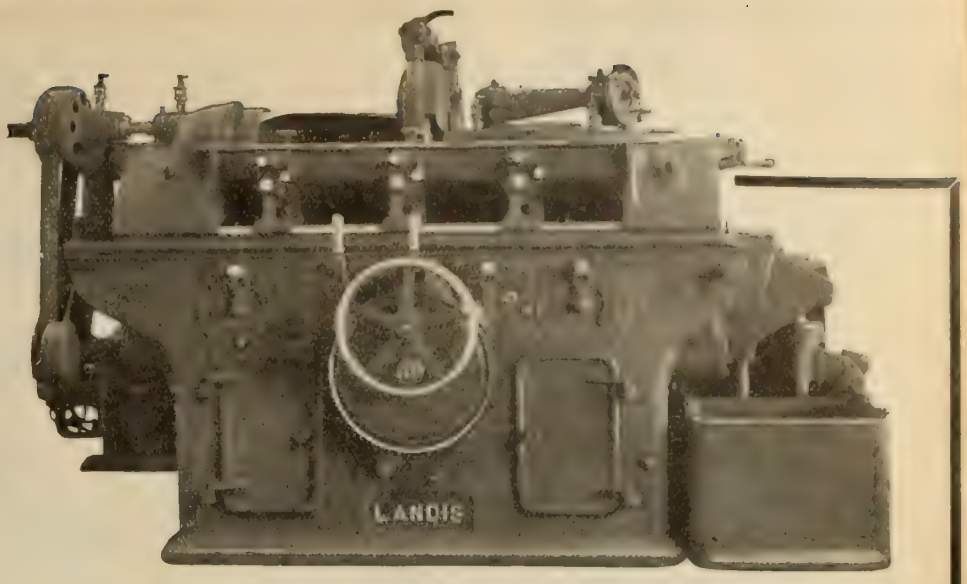
Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for heavy duty where power, strength and rigidity are required.

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CANADIAN AGENTS: A. R. Williams Machinery Co., Toronto, Winnipeg and Vancouver. Williams & Wilson, Montreal

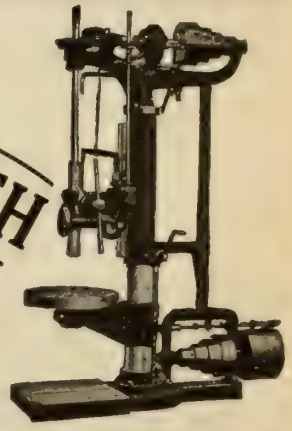


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25-inch

STRONG, speedy, accurate and dependable 20 and 25-inch drills, in which simplicity and convenience mark every feature.

They are in great demand for all modern machine shop practice.

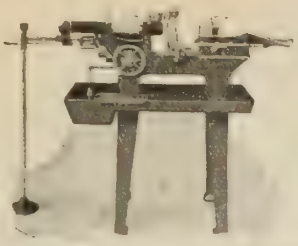
Compact, Efficient, Economical

The 20-inch drills are made in four distinct styles with plain lever feed, lever and wheel feed, power feed and automatic stop and back gearing.

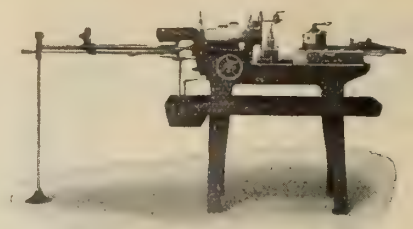
Drop a postal for attractive catalogue.

The Silver Manufacturing Company, Box 290, Salem, Ohio

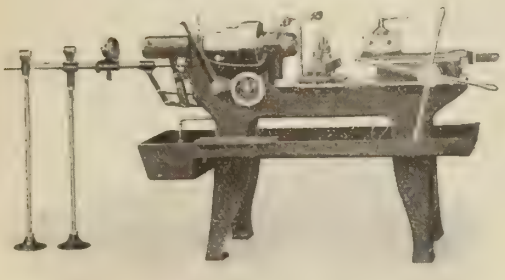
Manufacturers also of the Silver Radials



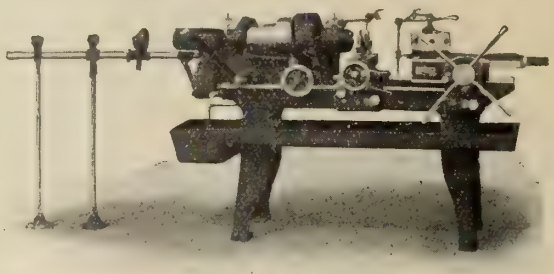
No. 0 P. H. SCREW MACHINE.



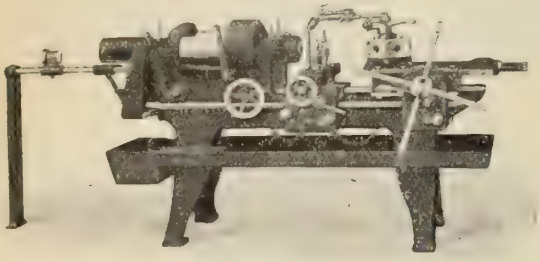
No. 1 P. H. SCREW MACHINE.



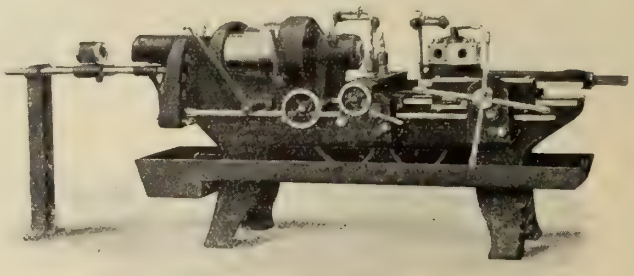
No. 3 P. H. SCREW MACHINE.



No. 3 F. H. SCREW MACHINE.



No. 5 F. H. SCREW MACHINE.



No. 7 F. H. SCREW MACHINE.

Another Proof That We Are Keeping the Lead

We herewith announce a complete new line of hand screw machines

Sizes ranging from 7/16" to 2-9/16".

THE DESIGNING AND PERFECTING OF A COMPLETE LINE OF SCREW MACHINES OF THIS CHARACTER IS AN ENGINEERING FEAT OF NO MEAN SCOPE.

Since we, about two years and a half ago, announced the 1-B Universal Turret Lathe, the new machines have followed each other at regular intervals. Each had incorporated several new ideas in turret lathe design.

The 1-B, 2-B and 3-B Universal Turret Lathes have already become recognized as the undisputed leaders in the turret lathe field. The main points of superiority found in these machines, the tremendous production which they have already demonstrated themselves capable of delivering coupled with an unexcelled ease of operation, have established the name of Foster Machine Company, as that of the leading turret lathe manufacturer.

This announcement is the climax.

To design this new line of hand screw machines the best talents in the country were secured. These men who are experts, not only in the field of screw machine and turret lathe work, but who also have a thorough knowledge of the nature of the materials that enter into machine construction and are well-grounded in the arts of manufacturing, have spared no effort to make these machines as near perfect as human skill and available metals make possible.

The six machines comprising this new line have been thoroughly and severely tested in our own factory for nine months. The result of these tests came fully up to our best expectations.

The features that establish these machines head and shoulder above all competition are too numerous to mention here. They will, however, be taken up and emphasized one by one on this page. Everybody interested will thus be put in a position to judge for himself as to their individual merits.

A complete set of circulars describing these machines are off the press. They ought to be in your file. Write for them to-day.

FOSTER MACHINE CO., Elkhart, Ind.

Canadian Machinery As An Advertising Medium

By J. H. M.

THERE is a saying that no matter where we go we will meet with a doubting Thomas, and, of course, the same holds good as far as advertising is concerned.

"You've got to show me," is a favorite expression of these Missouri inhabitants, so following is proof of the most convincing character. To commence with, the writer is not connected with the advertising staff, but merely one of the editorial department. He was not in search of a glowing tale regarding the possibilities of advertising, but he was out to find how business in general was going.

The gentleman whom he interviewed was S. L. Clark, Esq., of the Perfect Machine Tool Company, Galt, Ontario.

"How's business?" was my first question, and the reply was as follows: "Splendid. We are doubling our foundry capacity and intend doubling our machine shop space directly after."

Naturally, such a reply was encouraging.

"How do you account for this rush and where is the work coming from"? was my next query.

"To your first question I would say that this is the result of producing a first-class article and advertising the same judiciously and wisely; secondly, that our orders are coming in from all over the Dominion of Canada and Great Britain," was his reply.

"Evidently you are a firm believer in advertising," I said.

"I certainly am," was the reply. "Here are my views on the subject:

"In advertising, just the same as in anything else, good judgment must be used. You must study where to advertise, when to advertise and how to advertise. Each feature is equally important. You can spend more money foolishly through advertising than in any other way. In some cases I would not give five cents for space which they ask $10.00, $20.00 or $30.00 for, simply because I believe that no results would be obtained. In other words, I pick carefully where I advertise. I am a firm believer in the possibilities of export business and have secured inquiries from England, France, Spain and South America through judicious advertising in CANADIAN MACHINERY. We have made good connections already in England and hope soon to make connections of like nature in the other countries mentioned. The man who advertises is bound to go ahead, providing that the article he is advertising backs up every statement in his advertisement and he uses judgment in what he puts before the buying public.

"Personally, I cannot speak too strongly for the cause of advertising, and I firmly believe that CANADIAN MACHINERY, as an advertising medium, has helped us considerably in our present business expansion."

If interested tear out this page and place with letters to be answered.

HINTS TO BUYERS

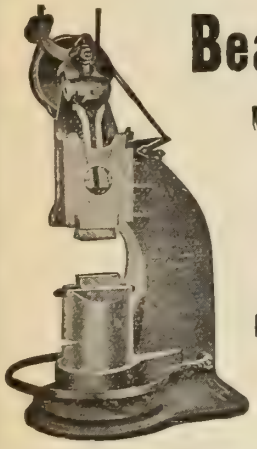
DARLING BROTHERS, LIMITED
Engineers, Manufacturers and Founders
120 Prince Street, MONTREAL, P. Q.

Pumps for any Service—Steam Appliances—Freight Elevators—Webster Vacuum Heating System.

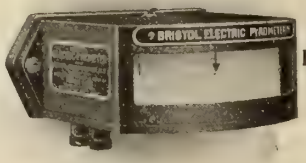
PRESSES and SHEARS
Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
26 Lansing St., BUFFALO, N.Y.

Bryant Chucking Grinder Company
Springfield, Vermont
Builders of
Hole, Hole and Face and Deep Hole Grinders

STEEL CASTINGS
ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.
PROMPT DELIVERY
Manitoba Steel Foundries, Ltd.
1204 McArthur Building
Winnipeg - - - Manitoba

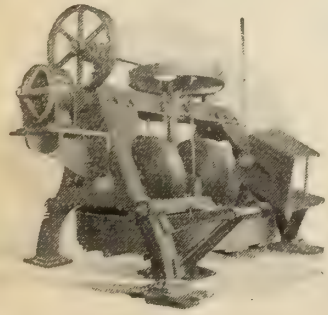


Beaudry Hammers
FOR GENERAL FORGING
Save Fuel, Time and Labor. Cut Forging Costs in two.
BELT OR MOTOR DRIVEN
BEAUDRY & COMPANY, Inc.
141 Milk Street, Boston, Mass.
Alfred Herbert, Ltd., Coventry, England, London, Paris, Calcutta, Yokohama.



TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE.
INDICATING AND RECORDING PYROMETERS
are compensated to eliminate errors due to cold and temperature changes of the thermo-couples.
There is no additional complication. You need these Pyrometers in your heat treatment room.
Laboratory Accuracy During Shop Use.
Write for Bulletin I-274
THE BRISTOL COMPANY
Waterbury, Conn., U.S.A.

Canadian Steel Foundries Need Frost Improved Sand Mills



WINNING FEATURES
Heavy Mullers
Unloading Device
Motor or Belt Drive
The Frost Mfg. Co.
112 W. Adams St., Chicago

STEAM TURBINE DRIVEN TURBO BLOWER SET
with Condensing Plant for quick delivery from stock at very favorable price.
Further particulars from
ESCHER, WYSS & CO.
112 Coristine Bldg. MONTREAL

IMPORTERS OF
WHEEL TRUEING TOOL CO.
DETROIT
MANUFACTURERS OF

INDUSTRIAL DIAMONDS



DIAMOND POINTED TOOLS

Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager
5 James Street, ST. CATHARINES, ONTARIO

All Mountings Fully Guaranteed
Office and Factory:
88 West Pitt Street, WINDSOR, ONTARIO

CLUTCHES

Combined Jaw and Friction. Friction only.
Gas Engine Clutches. Jaw Clutches.
Write for interesting printed matter.
The Positive Clutch & Pulley Works, Ltd., Canada
MONTREAL Factory: Aurora, Ont. TORONTO

FOR EVERY INDUSTRIAL REQUIREMENT
WILLSON GOGGLES
OR 20,000 PER DAY
REG. U.S. PAT. OFF.
WRITE FOR CATALOG
T. A. Willson & Co., Inc. *Canadian Office:* 23 Scott St., Toronto

"Cincinnati Electrics"
Cut Your Costs

Hand or Breast Drills, 12 sizes, ¼ to 2½ in. capacity. Ball bearing throughout. Larger sizes fitted with screw feed.



We make complete line of Portable Electric Drills and Grinders for all purposes. Especially built to withstand hard usage. For all currents and voltages. Catalog?

Cincinnati Electric Tool Co., Cincinnati, Ohio

STEEL CASTINGS

DELIVERY QUALITY

JOLIETTE STEEL CO.
LIMITED

Sales Office: MONTREAL, Que.
Works: JOLIETTE, Que.

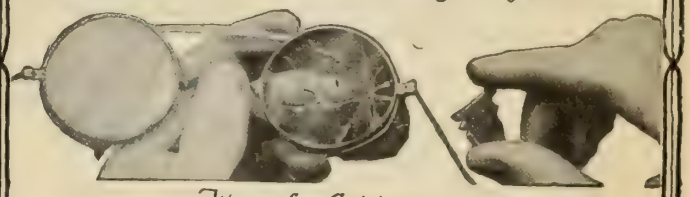
WILKINSON & KOMPASS
TORONTO HAMILTON WINNIPEG

IRON AND STEEL
HEAVY HARDWARE

Mill Supplies Automobile Accessories

WE SHIP PROMPTLY

SMELTERS & WELDERS GOGGLES
We have a style to meet every requirement



Write for Catalogue
Consolidated Optical Company
Montreal Toronto Winnipeg Vancouver

Riddel & Co., 40 St. Enoch Square
Estab GLASGOW, SCOTLAND 1876

Specialists in
HEAVY MACHINE TOOLS
for
Shipyards, Boilermakers, Engineers and Structural Iron Works

(New and Second-Hand)

Lists on Application. Enquiries and Correspondence Solicited.

SEND US YOUR INQUIRIES AND PRINTS FOR QUOTATIONS
ON **SPRING SHACKLE BOLTS** OR
PRESSED STEEL AND BRASS GREASE CUPS—OILERS—OIL CUPS



"PLAIN" "SECTIONAL"

Samples and Catalogues Sent on Request
Canadian Winkley Co Limited
Windsor, Ont.



Hamilton Gear Co. Ltd.

Van Horne St.
TORONTO

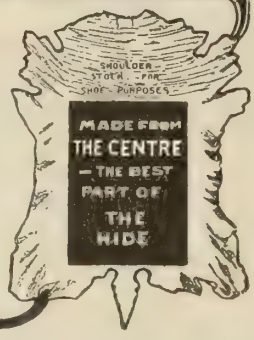
Forrest, Jackson & Forrest
Engineers, Contractors and Manufacturers' Agents
Portable Cranes, Turntables, Transveyors, Plastic Metallic Packing
HEAD OFFICE : 222 Craig St. W., Montreal, Can.

J.C.McLAREN BELTING

THE J.C. McLAREN BELTING CO. OAK EXTRA TANNED EST 1856

Will Save You Money In Every Day of Service

Modern plant and thorough knowledge of requirements of belting guarantees perfect satisfaction to all buyers. Our belts are the result of using best leather, and our 57 year's experience.
Ask for Quotations.
J. C. McLAREN BELTING CO.
Limited
Montreal Toronto Winnipeg





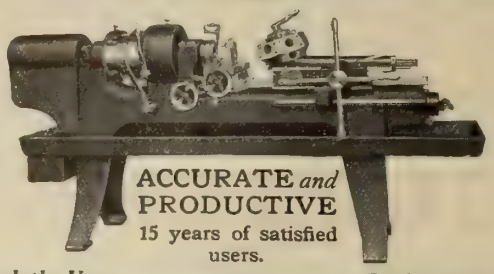
NORTON JACKS
FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
Made only by **A. O. NORTON, Limited**
Coaticook, Prov. Quebec, Canada

PRESSES ALL—TYPES

AUTOMATIC BAIRD MACHINE CO. BRIDGEPORT, CONN. MACHINERY

Press Attachments, Automatic.
Metal and Wire Forming Machines.
Tumblers—Large Line.
Burnishing Machines. Grinders.
Special Machines.
Baird Machine Co., Bridgeport, Conn., U. S. A

THE TILTED TURRET
A CLEAR TRACK TO THE STOCK



ACCURATE *and* PRODUCTIVE
15 years of satisfied users.
Ask the User *Send for Catalog*
WOOD TURRET MACHINE CO.
BRAZIL, INDIANA U.S.A.

IRON and STEEL PRODUCTS
New and Second-hand Machinery
Builders' and Contractors' Machinery
Engineering and Mill Supplies, Tools, etc.
Let us list your second-hand machinery or quote you on same.
We are also open for proposition to carry some good lines.
JAMES WHEATLEY
505 Eastern Township Bldg., MONTREAL, P.Q.

DIAMOND TOOLS
FOR TRUEING GRINDING WHEELS



TOOLS FOR ALL MECHANICAL PURPOSES
FURNISS, CLARKE & COMPANY
364 University St., Montreal
THE JOYCE-KOEBEL COMPANY, INC.
NEW YORK Formerly Geo. A. Joyce Co., Ltd. LONDON

Toronto Testing Laboratory LIMITED
METALLURGISTS CHEMISTS FUEL ENGINEERS
160 Bay St., Toronto.
Tests of Metals, Fuels, Oils, Water, Etc.
INDUSTRIAL RESEARCH

GEAR

GEARS AND GEAR CUTTING SPROCKETS AND CHAINS
In stock and to order, any size from one-quarter inch to six-foot in diameter, any material. Estimates and gear advice cheerfully furnished.
Grant Gear Works, Inc., 151 Pearl St. Boston, Mass.
G. B. GRANT U.S.A.



WE MANUFACTURE RIVETS of every description, 5/8 inch, dia. and smaller

PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONT.

NEW AIR-TIGHT BLAST GATE

For Low and Moderate Pressures



"These have given entire satisfaction."

CANADIAN PACIFIC RAILWAY COMPANY

Montreal, Canada

For low and moderate pressures our New Air-Tight Blast Gate easily supersedes the heavy, cumbersome, expensive and slow-acting gate valves and stop cocks.

Costs only a fraction of what you pay for gate valves and stop cocks and saves time and labor.

Write for Circular 123-T. It tells how our blast gate is made, how it works and what users think about it.

W. S. ROCKWELL COMPANY

Furnace Engineers and Contractors

50 Church St., New York

Canadian Distributors: Drummond, McCall & Co., Ltd., Montreal.

ARMCO IRON

WELDING RODS

ARMCO IRON [illegible] both electric arc and [illegible] welding. It has unequalled welding qualities [illegible] and physical and [illegible] content guaranteed [illegible] industrial centres.

PAGE STEEL & WIRE CO.

SALES OFFICES: 30 Church St., New York
Chicago, 29 South LaSalle Street; Detroit, Book Building; San Francisco, American Rolling Mill Company of California; Canada: Taylor & Arnold, Ltd., Montreal, Toronto, Winnipeg

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE CO. "MADE IN CANADA"

Davis-Bournonville Oxy-Acetylene Welding and Cutting Apparatus

"Made in Canada"

AT NIAGARA FALLS, ONT.

DAVIS-BOURNONVILLE COMPANY

Sales Offices: 168 King St. W., Toronto: 44 Craig St. W., Montreal. Factories in Jersey City, Elkhart, Ind.; Niagara Falls, Ont. Sales Offices in all principal United States cities.

For Hardness Testing

in shop and laboratory use the



Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.



THE SCLEROSCOPE (Set)

Heat Indication

THE PYROSCOPE

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem. Perfect constancy, inexpensive, no electricity used. Built to stand rough usage and upon common-sense lines. Used by the Government and best firms.

Shore Instrument & Mfg. Co. 555-7 W. 22n t. **New York**

Agents for Canada: A. R. Williams Machy. Co., Ltd., Toronto, Can.

WELDING APPARATUS AND . . . SUPPLIES

The REGO 100% Efficient Welding Torch

Saves Oxygen Eliminates Flash-Back Better Welding

Write to us for anything and everything you need.

WELDING & SUPPLIES COMPANY

C. ROYER, Manager 1142 Ontario Street East, Montreal

FITCHBURG

Plain Cylindrical Grinders

Built by

Fitchburg Grinding Machine Co.

FITCHBURG, MASS., U.S.A.

BATH Universal Manufacturing Grinders

built by

Universal Grinding Machine Company

Fitchburg, Mass. *U. S. A.*

IT IS IMPORTANT

when advertising that as many prospective buyers as possible read what you are selling. We advise you to use **Canadian Machinery.**

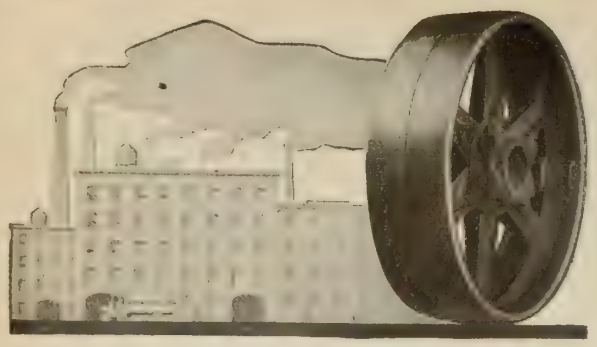
STEEL CASTINGS

1 to 5,000 pounds

Highest Quality

PROMPT AND RELIABLE SERVICE

SWEDISH CRUCIBLE STEEL CO. OF CANADA, Ltd., Windsor, Ont.



AMERICAN STEEL SPLIT PULLEYS

ARMS CUT THE AIR
MINIMUM BELT SLIP
EASILY APPLIED
RELIABLE
INTERCHANGEABLE BUSHINGS
CARRIED BY DEALERS
AVOIDS KEYWAYS AND SET SCREWS
NATIONAL DISTRIBUTION

Valuable Book, "Getting Maximum Pulley Efficiency," sent free on request.

The American Pulley Company
Philadelphia, Pa.

The Hughes Owens Co. Ltd.

MONTREAL TORONTO OTTAWA WINNIPEG

Manufacturers

Blue and Black Print Papers
Drawing Office Supplies for Students, Architects and Engineers.

CRANE VALVES

CRANE
LIMITED

HEAD OFFICE & WORKS
1280 ST. PATRICK ST
MONTREAL

BRANCHES: Vancouver, Calgary, Winnipeg, Toronto.

A Little Act of Courtesy That is Good Business

BY simply mentioning CANADIAN MACHINERY when writing to our advertisers you will be doing something which will prove of three-fold benefit.

First—It will benefit you because it enables the advertiser to immediately associate your enquiry with the product advertised, resulting frequently in quicker service.

Second—It will benefit the advertiser because it enables him to identify and classify enquiries and to give credit where credit is due.

Third—It will benefit **your** paper because in the records of the advertiser it will receive the credit for your enquiry, instead, perhaps, of some less deserving medium.

We are always grateful for favors of this kind. It costs the reader nothing, and yet as we said before, it is of three-fold benefit.

Jigs, Fixtures, Dies, Tools, Gauges

SPECIAL MACHINE TOOLS

GET OUR ESTIMATE
Before ordering

The Crescent Machine Co.
LIMITED
20 Longueuil Lane Montreal, Que.

If that old machine is not earning you money, then it's losing money, see!

Sell it to the firm who can use it, and both of you will make money.

ADVERTISE IT IN THE CLASSIFIED SECTION OF
CANADIAN MACHINERY

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Aikenhead Hardware Co., Toronto, Ont.
Brantford Emery Wheel Co., Brantford.
Canadian Fairbanks-Morse Co., Montreal
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co., Worcester, Mass.
Plewes, Ltd., Winnipeg, Man.
Pittsburgh Crushed Steel Co. Pittsburgh.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Ltd., Montreal.

ACETYLENE
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Union Carbide Co., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACETYLENE GENERATORS
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACORN DIE AND HOLDERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

ACCUMULATORS, HYDRAULIC
Canadian Fairbanks-Morse Co., Montreal
Garlock-Walker Mach'y. Co., Toronto.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Ltd., Montreal.

AIR COMPRESSORS
See Compressors.

AIR CONDITIONS, DEHUMIDIFYING—HUMIDIFYING
A. F. Sturtevant Co, Galt, Ont.

AIR CYLINDERS
Smalley-General Co., Bay City, Mich.

AIR RECEIVERS
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Williams & Wilson, Ltd., Montreal.
Welding & Supplies Co., Montreal, Que.

AIR WASHERS
Can. Blower & Forge Co., Kitchener.

ALUMINUM
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Toronto.
Tallman Brass & Metal Co., Hamilton.
Williams & Wilson, Ltd., Montreal.

ALUMINUM SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.

ALLOY, STEEL
Armstrong, Whitworth of Can., Montreal.
Biancke Co., L. C., New York City.
Boker & Co., Inc., H., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
General Steel Co., Milwaukee, Wis.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Norton, Ralph B., Agent, Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ANCHORS
Fellows Bros., Ltd., Chadley Heath, Eng.

ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Williams & Wilson, Limited, Montreal

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
Knight Metal Products, Toronto.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que

AUTOMATIC METAL CUTTING-OFF MACHINES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Furniss, Clarke & Co., Montreal, Que.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Limited, Montreal.

BAND SAWS
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Rochester Ball Bearing Co., Rochester.
Williams & Wilson, Ltd., Montreal, Que

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Biancke Co., L. C., New York City.
Chapman Double Ball Bearing Co., Toronto
Boker & Co., Inc., Montreal, Que.
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Rochester Ball Bearing Co., Rochester.
Marshall, Son & Bunney, Toronto.
Williams & Wilson, Limited, Montreal

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Wilson & Co., J. C., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Williams & Wilson, Limited, Montreal

BEARINGS, BRONZE
Lyman Tube & Supply Co., Montreal, Que.
Wilson & Co., J. C., Belleville, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Whitney Mfg. Co., Hartford, Conn.
Williams & Wilson, Ltd., Montreal, Que.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Baxter & Co., Ltd., J. R., Montreal.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Graton & Knight Mfg., Worcester, Mass.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams & Wilson, Ltd., Montreal, Que.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
John Tullis & Son, Glasgow, Scotland.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING ROLLS, PLUTE & AUGH
Wickes Bros., Saginaw, Mich.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Williams & Wilson, Ltd., Montreal.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Williams & Wilson, Limited, Montreal.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

BILLETS, FORGING
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLASTING MACHINES, SHOT AND STEEL GRIT
Pittsburgh Crushed Steel Co., Pittsburgh

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Williams & Wilson, Limited, Montreal.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.
Wickes Bros., Saginaw, Mich.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Wilson, Limited, Montreal.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKEBAND LINING CUTTERS
Peck, Stow & Wilcox Co., Southington, Conn.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER BARS, RODS
BRAKES, CORNICES
Peck, Stow & Wilcox Co., Southington, Conn

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
Greenleafs, Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.
Wilson & Co., J. C., Belleville, Ont.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

BRICKS, FIRE
Harbison-Walker Refractories, Montreal.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRONZE RODS AND SHEETS, PLATES
Brown's Copper & Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Williams & Wilson, Limited, Montreal.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd. Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Williams & Wilson, Limited, Montreal.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.
Peck, Stow & Wilcox Co., Southington, Conn.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANADA SILVER SHEETS, ROLLS
Brown's Copper & Brass Rolling Mills, New Toronto.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Wilson & Co., J. C., Belleville, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASTINGS, MACHINERY
Wilson & Co., J. C., Belleville, Ont.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Brockville Foundry Co., Brockville, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Greenleafs, Ltd., Belleville, Ont.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
Wilson & Co., J. C., Belleville, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, IRON
Warmington & Co., J. N., Montreal, P.Q.

CEMENT, ELASTIC JOINTING
mington & Co., J. N., Montreal, P.Q.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Williams & Wilson, Ltd., Montreal, Que

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Williams & Wilson, Ltd., Montreal, Que

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York, Glasgow N.S.

CHAINS, SPROCKET WHEEL
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHISELS
Whitman & Barnes Co., St. Catharines.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Williams & Wilson, Ltd., Montreal, Que.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bicknell-Thomas Co., Greenfield, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.
Williams & Wilson, Ltd., Montreal, Que

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Bicknell-Thomas Co., Greenfield, Mass.
Can. Blower & Forge Co., Kitchener.
Whitney Mfg. Co., Hartford, Conn.

CHUCKS, FRICTION AND TAP
Bicknell-Thomas Co., Greenfield, Mass.
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal, Que.

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams & Wilson, Ltd., Montreal, Que.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL
COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
J. C. Wilson & Co., Belleville, Ont.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.
Wilson & Co., J. C. Belleville, Ont.

COMPOSITION INGOT
Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMBINED OPEN SIDE PLANER-SHAPER
Lynd-Farquhar Co., Boston, Mass.

COMPRESSORS, AIR
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
Hinckley Machine Co., Hinckley, Ill.
MacGovern & Co., Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONNECTING RODS
Canada Found'a & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Marten Machine Co., Hamilton, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.
Wilson & Co., J. C., Belleville, Ont.
Windsor Mach. Tool Co., Windsor, Ont.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.

CONVEYORS, BELT AND CHAIN
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

CONVEYORS, OVERHEAD
Beatty Bros., Fergus, Ont.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
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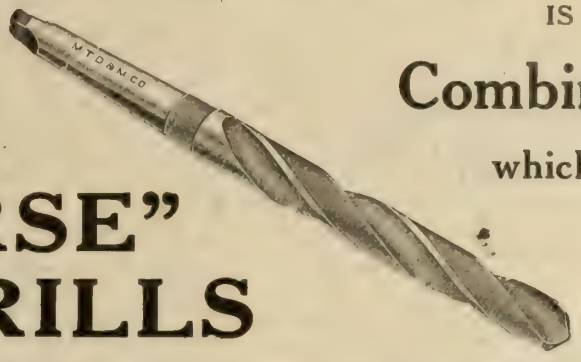
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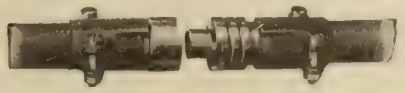
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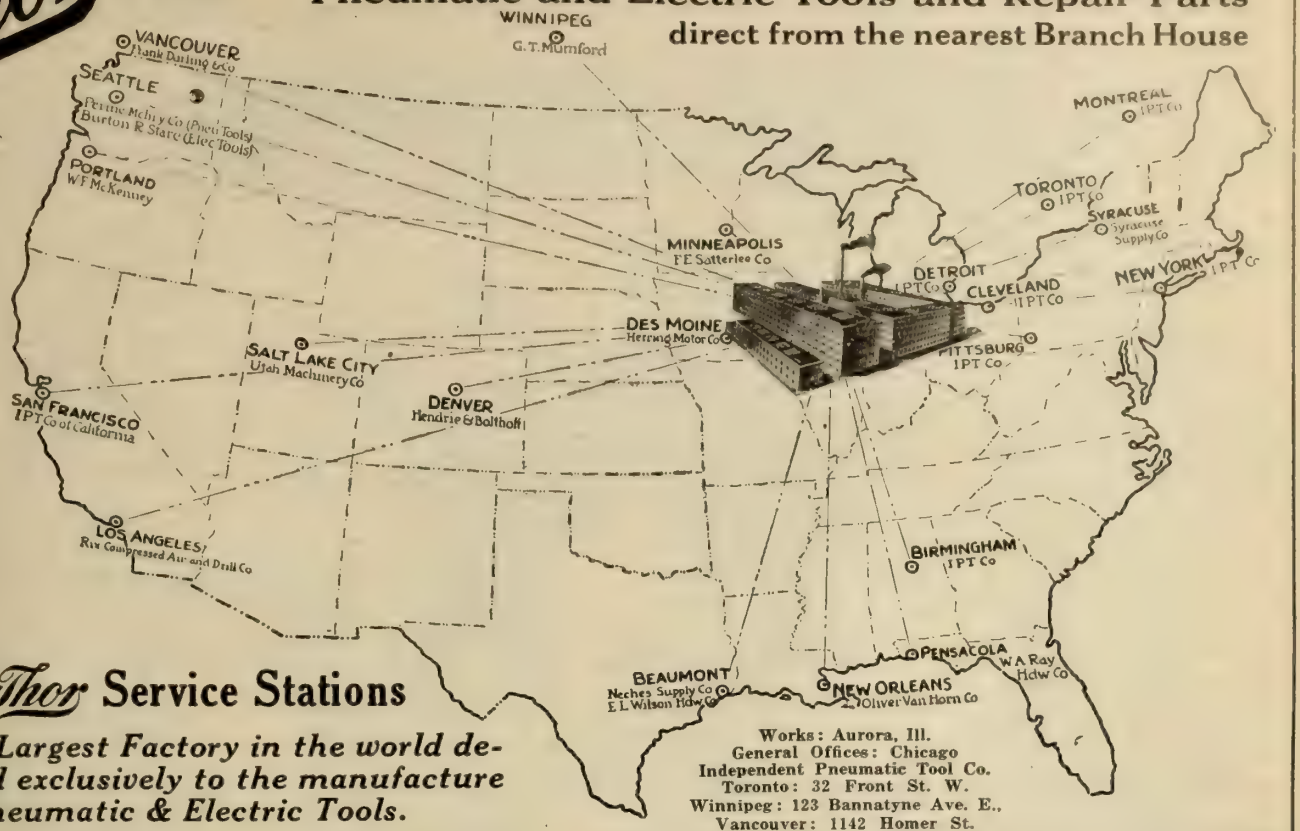
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

ELECTRIC FURNACES
Electro Furnace Construction Co., Philadelphia, Pa.
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Volta Manufacturing Co., Welland, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Williams & Wilson, Ltd., Montreal, Que.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Williams & Wilson, Ltd., Montreal, Que.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY AND EMERY WHEELS
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.

ENGRAVERS
Pritchard-Andrews Co., Ottawa.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Williams & Wilson, Ltd., Montreal, Que.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ontario.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLANGING CLAMPS
Wickes Bros., Saginaw, Mich.

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.

FORGINGS, STEEL AND IRON
Blancke Co., L. C., New York City.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Blancke Co., L. C., New York City.
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Williams & Wilson, Ltd., Montreal, Que.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Blancke Co., L. C., New York City.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
Gilbert & Barker Mfg. Co., Springfield.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gilbert & Barker Mfg. Co., Springfield.
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Standard Fuel Engr. Co., Detroit, Mich.
Williams & Wilson, Ltd., Montreal, Que.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES, FORGING
Gilbert & Barker Mfg. Co., Springfield.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

GALVANIZING FLUX
British Smelting & Refining Co., Ltd., Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Worth Engineering Co., Toronto, Ont.

GAUGES, THREAD
Bicknell-Thomas Co., Greenfield, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal,
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEAR-TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Wks, Rochester

GEAR BOXES, REDUCTION
Coventry Chain Co., Coventry, Eng.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.

GEARS, CUT, MORTISE, ANGLE, WORM
Baxter & Co., Ltd., J. R., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Illinois Tool Works, Chicago, Ill.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.
Wilson & Co., J. C., Belleville, Ont.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GEARS, SILENT CHAIN GENERATORS, STEAM TURBO
Can. General Electric Co., Toronto, Ont.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

GENERATORS AND CONVERTORS
Can. General Electric Co., Toronto, Ont.

GENERATORS, MOTOR
A. R. Williams Machry. Co., Toronto
Williams & Wilson, Ltd., Montreal.
MacGovern & Co., Montreal.

GERMAN SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa

GOVERNOR, WATER WHEEL
Wilson & Co., J. C., Belleville, Ont.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Wilson & Co., Inc., T. A., Reading, Pa.
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

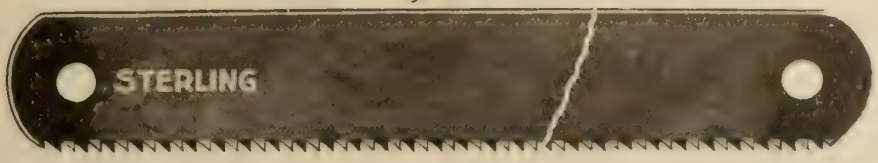
GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
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Wisconsin Electric Co., Inc., Racine, Wis
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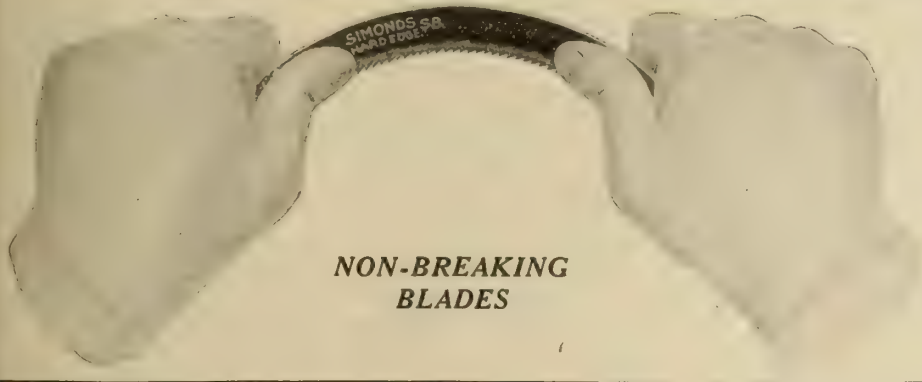


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LIMITED
MONTREAL
St. John Vancouver

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There will be ***no change*** in our ***policy*** during 1920. As in bygone years we will direct all our efforts to a ***large volume*** of business at ***small margins*** and a ***square deal*** to our patrons.

HOYT METAL COMPANY

MONTREAL TORONTO WINNIPEG

If interested tear out this page and place with letters to be answered.

Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Williams & Wilson, Limited, Montreal.

GRINDERS, CUTTER

Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal.

GRINDERS, DIE AND CHASER

Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK

Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING

Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL

Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams & Wilson, Ltd., Montreal.

GRINDERS, CYLINDER, INTERNAL

Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH

Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Electrical Tool Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Wisconsin Electric Co., Inc., Racine, Wis.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
United States Elec. Tool Co., Cincinnati
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING

Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND FACE AND DEEP HOLE

Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL

Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC

Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE

Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE

Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER

Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN

Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal.

GRINDERS, VERTICAL, SURFACE

Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME

Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford, Ont.
LeBlond Mch. Tool Co., R. K., Cincinnati
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Wisconsin Electric Co., Racine, Wis.
Williams & Wilson, Ltd., Montreal.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT

Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS

Aikenhead Hardware Co., Toronto, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER

Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE

Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
Page Steel & Wire Co., Adrian, Mich.
Strong, Kennard & Nutt Co., Cleveland.

HANDLES, BALANCE, CRANK AND MACHINE

Williams & Co., J. H., Brooklyn, N.Y.

GUTTERS AND SKYLIGHTS

H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES

Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Blancke Co., L. C., New York City.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Fry's (London), Ltd., London, England.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams & Wilson, Ltd., Montreal.

HACK SAW FRAMES

Aikenhead Hardware Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal.

HACK SAWS, POWER

Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal.

HAMMERS, FORGING

Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, HATCHETS

Whitman & Barnes Co., St. Catharines.

HAMMERS (DROP), MOTOR AND BELT DRIVEN

Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams & Wilson, Ltd., Montreal.

HAMMERS, HELVE POWER

Canada Machinery Corp., Galt, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams & Wilson, Limited, Montreal.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE

Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER

Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM

Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS

Oliver Mchry. Co., Grand Rapids, Mich.

HAND LEATHERS OR PADS

Graton & Knight Mfg. Co., Montreal.

HANGERS

Brown & Sharpe Mfg. Co., Providence, R.I

HANGERS, SHAFT

Algoma Steel Corp., Sault Ste. Marie.
Can. General Electric Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Standard Pressed Steel Co., Philadelphia
Williams & Wilson, Limited, Montreal.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY

Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS

Can. Blower & Forge Co., Kitchener, Ont.

HEAT TREATMENT OF STEEL

Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING

Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA

Strong, Kennard & Nutt Co., Cleveland.

HIGH SPEED STEEL

See Steel.

HINGE MACHINERY

Baird Machine Co., Bridgeport, Conn.
Illinois Tool Works, Chicago, Ill.

HINGES

Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS

Greenfield Tap & Die Co., Greenfield, Mass
Illinois Tool Works, Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTS, AIR

Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Williams & Wilson, Limited, Montreal.

HOISTS, ELECTRICAL

Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal.

HOISTS, ELEC., STATIONARY, MONO RAIL

Volta Mfg. Co., Welland, Ont.

HOLDERS, STEEL DIE FOR MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC

Electric Steels & Metals, Ltd., Welland.

HOOKS, BELT LACING

Clipper Belt Lacer Co., Grand Rapids.

HOPPERS

MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, PNEUMATIC

Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS

Int. Mach. & Supply Co., Ltd., Montreal.

HOSE, SAND BLAST

Pangborn Corporation, Hagerstown, Md.

HUMIDIFIERS

Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS

Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY

Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.
Williams & Wilson, Limited, Montreal.

HYDROMETERS, HYGROMETERS, HYGRODEIKS

Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES

Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Williams & Wilson, Limited, Montreal.

INDICATING INSTRUMENTS

Taylor Instrument Co., Rochester, N.Y.

INDUSTRIAL SITES

City of St. Johns, Quebec.

INGOT METAL

Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

INGOTS, STEEL

Nova Scotia Stl. & Coal Co., New Glasgow

INGOTS, FORGING AND ROLLING

Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS

Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING

Consolidated Optical Co., Toronto.

IRON ORE

Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG

Swedish Steel & Impt. Co., Ltd., Montreal

JACKS

Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Limited, Montreal.

JACKS, PIT AND TRACK

Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE

Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS

Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.

Brown Engineering Corp., Toronto.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Illinois Tool Works, Chicago, Ill.
Jones & Lamson, Springfield, Vt.
Marten Machine Co., Hamilton, Ont.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES

Canada Foundries & Forgings, Welland.

KEY SEATERS

Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Limited, Montreal.

KEYS, MACHINE

Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS

Can. Blower & Forge Co., Kitchener, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

KNIFE GRINDERS

Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS

Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY

Northern Crane Works, Walkerville.

LACING MACHINES

Clipper Belt Lacer Co., Grand Rapids, M.

LAMPS, ARC, INCANDESCENT

Can. General Electric Co., Toronto, Ont.

LAMPS, TUNGSTEN AND NITRO

Can. General Electric Co., Toronto, Ont.

LAG SCREW GIMLET POINTERS

National Machy. Co., Tiffin, Ohio.

LATH

Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING

Acme Machine Tool Co., Cincinnati, Ohio.
Wood Turret Machine Co., Brazil, Ind.
Williams & Wilson, Limited, Montreal.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS

Armstrong Bros. Tool Co., Chicago.
Curtis & Curtis Co., Bridgeport, Conn.

Heat Under Accurate Control

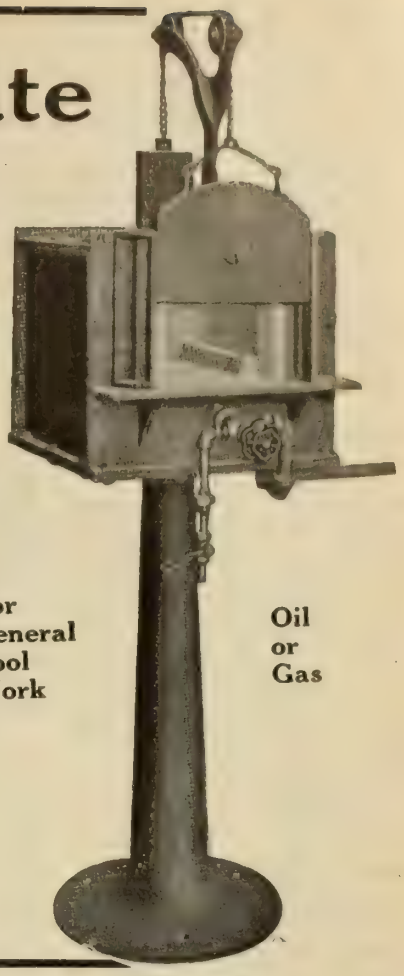
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

703 Bellevue Ave. - Detroit, Mich.

Representatives in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

Welding and Cutting Apparatus

Canadian Rights for Sale Covering Well-Known and Profitable Oxy-Acetylene and Oxy-Hydrogen Welding and Cutting Equipment.

An excellent opportunity is offered to established brass manufacturing shop or a small manufacturing company to be organized to produce in Canada complete line of welding and cutting apparatus.

This equipment was placed on the United States market early in 1918, is fully protected by United States patents, and Canadian patents have been applied for within the required time.

Already being sold in Canada to an extent which will insure success of Canadian manufacturing company. Can be handled either direct or through jobbers. Net profits very large.

Patents, complete blue prints and specifications of entire line, as well as initial services of designer and inventor may be obtained at a reasonable figure.

Box 631

Canadian Machinery and Manufacturing News

Toronto, Canada

Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC

Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE

Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING

Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, PRECISION, BENCH

W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, BRASS

Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, ENGINE

Acme Machine Tool Co., Cincinnati, Ohio.
John Bertram & Sons Co., Dundas.
Bridgeford Mach. Tool Wks., Rochester.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
Wickes Bros., Saginaw, Mich.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER

Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL

Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING

Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND

Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'

J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, POLISHING

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, SCREW CUTTING

Bertram & Sons Co., John, Dundas, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Wickes Bros., Saginaw, Mich.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, SPINNING

Bliss Co., E. W., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

LATHES, TOOL ROOM

Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.
Williams & Wilson Ltd. Montreal, Que.

LEAD, PIG AND BAR

British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING

St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS

Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING

Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES

Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL

Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS

Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE

Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING

See Belting, Chain.

LINOLEUM MILL MACHINERY

Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL

Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS

Cataract Refining & Mfg. Co., Toronto.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING

Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS

Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS

Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS

Katie Foundry, Galt, Ont.

MACHINE TOOLS

Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING

Peck, Stow & Wilcox Southington, Conn.

MACHINERY DEALERS

Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES

Knight Metal Products, Toronto.

MACHINERY, SPECIAL

Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS

Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS

Volta Mfg. Co., Welland, Ont.

MANDRELS

Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES

Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY

Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.

Strong, Kennard & Nutt Co., Cleveland.

MEASURING MACHINES

Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING

Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES

Chesterman & Co., Jas., Sheffield, Eng.

METALLURGISTS

See Chemists.

METAL CLEANERS

Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES

Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS

See Saws.

METAL SAWS, POWER

Hoefer Mfg. Co., Freeport, Ill
Lyman Tube & Supply Co., Montreal, Que.

METALS

British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL

Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.

Bowser Co., Ltd., S. F., Toronto, Ont.

MICROMETERS

Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 31st Stair Bldg., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MILLS, BRACE AND TUBE

Elec. Steel & Metals, Welland, Ont.

MILLS, SAND

Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY

Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS

Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.

MILLING ATTACHMENTS

Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Taft-Peirce Mfg. Co., Woonsocket, R.I.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, AUTOMATIC

Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

MILLING CUTTERS

Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Blancke Co., L. C., New York City.
Cleveland Milling Machine Co., Cleveland.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall Son & Bunney, Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, HAND

Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD

Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, HORIZONTAL AND VERTICAL

Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL

Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING MACHINES, PLATE

Marshalltown Mfg. Co., Marshalltown, Ia.

MILLING MACHINES, PROFILE

Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Williams & Wilson, Ltd., Montreal, Que.

MILLING TOOLS

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Williams & Wilson, Ltd., Montreal, Que.

MINE CARS

Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MIXERS, SAND

Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES

Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.
Can. General Electric Co., Toronto.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

MOTOR SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK

The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC

Cleveland Pneumatic Tool Co. Toronto.

MOULDS, RUBBER

Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES

Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,

Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES

City of St. John, Quebec.

MUNTZ METAL

Brown's Copper & Brass Roller Mills, New Toronto, Ont.

MUSIC WIRE

Blancke Co., L. C., New York City.

NAIL SETS

Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED

Matthews & Co., Jas. H., Pittsburgh, Pa.
Pritchard-Andrews Co., Ottawa, Ont.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS

Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL

Boker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL SILVER

Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

NICKEL STEEL

See Steel.

NIPPLE HOLDERS

Curtis & Curtis Co., Bridgeport, Conn.

NIPPLE THREADING MACHINES

Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN

Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED

Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

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National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

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NUT FACING AND BOLT SHAVING MACHINES

Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Ltd., Montreal, Que.

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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Ltd., Montreal, Que.

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Norton Co., Worcester, Mass.
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OIL STORAGE SYSTEMS

Bowser Co., Ltd., S. F., Toronto, Ont.

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Prest-o-Lite Co., Inc., Toronto, Ont.
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Welding & Supplies Co., Montreal, Que.

OXYGEN

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OXYGEN PLANTS (ELECTROLYTIC)

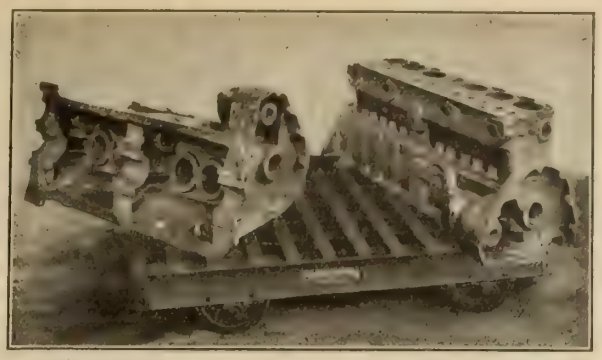
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New York, November 15, 1919

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Landis Machine Co., Waynesboro, Pa.
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Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Smalley-General Co., Inc., Bay City, Mich.

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Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co. Toledo.
Williams & Wilson, Ltd., Montreal, Que.

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Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
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Stoll Co., Inc., D. H., Buffalo, N.Y.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Consolidated Press Co., Hastings, Mich.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
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Toledo Machine & Tool Co., Toledo.
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Williams & Wilson, Ltd., Montreal, Que.

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Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
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Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
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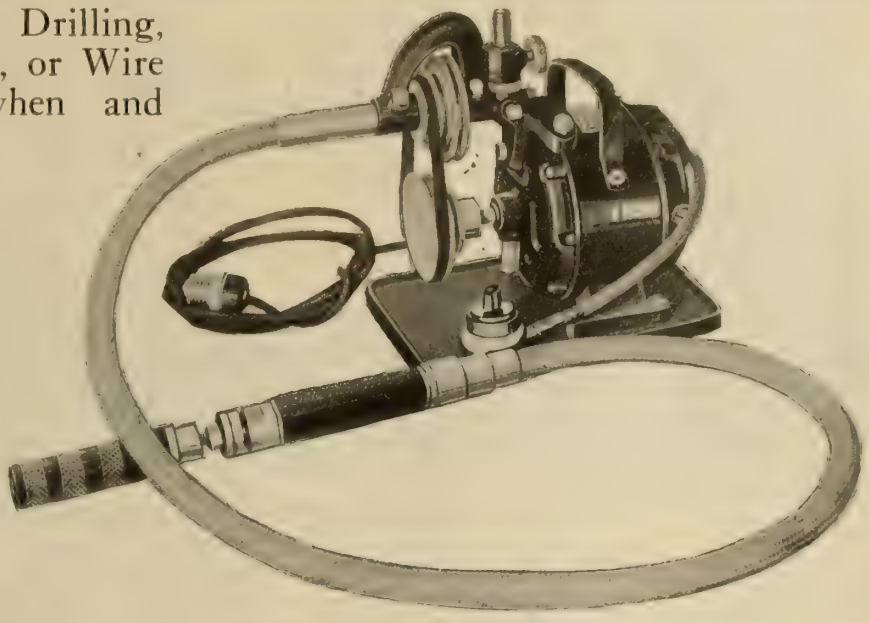
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Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

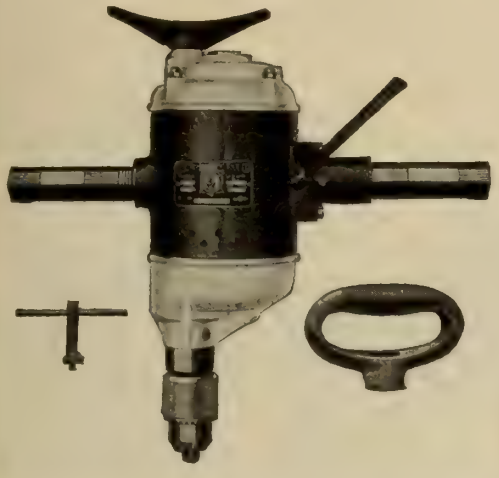
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Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
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Wells Bros. of Can., Galt, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

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Garvin Machine Co., New York.

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Electric Steels & Metals, Ltd., Welland.

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Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
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RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Williams & Wilson, Ltd., Montreal.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

RODS, HIGH SPEED AND CARBON DRILL
Blanchc Co., L. C., New York City.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.
Williams & Wilson, Ltd., Montreal, Que.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland.

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford.
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Dom. Steel Products Co., Ltd., Brantford.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland.

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDERS, DISC AND SPINDLE
Can. Sander Mfg. Co., Brockville, Ont.

SANDING MACHINES
Canada Machinery Corp., Galt.
Can. Sander Mfg. Co., Brockville, Ont.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis.
A. R. Williams Machy. Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS, CIRCULAR METAL
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW DRIVERS
Whitman & Barnes Co., St. Catharines.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co, Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Wood Turret Mach. Co., Brazil, Ind.
Williams & Wilson, Ltd., Montreal, Que.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton.
Milwaukee Shaper Co., Milwaukee, Wis.
Rae Mach. Tool Co., Ramilton.
Williams & Wilson, Ltd., Montreal.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
Wickes Bros., Saginaw, Mich.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams & Wilson Ltd., Montreal, Que.

SHEARS, ROTARY
Marshalltown Mfg. Co., Marshalltown, Ia.
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

SHEET METAL ROLLING MACHINES
Peck, Stow & Wilcox Co., Southington.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Marshalltown Mfg. Co., Marshalltown, Ia.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Marshalltown Mfg. Co., Marshalltown, Ia.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Williams & Wilson, Ltd., Montreal.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Ralph B. Norton, Agent, Montreal.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dumbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.
Jas. Steele, Ltd., Guelph, Ont.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Marten Machine Co., Hamilton, Ont.
Rae Mach. Tool Co., Ramilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
Wilson & Co., J. C. Belleville, Ont.
William R. Perrin, Ltd., Toronto.
Warmington & Co., J. N., Montreal, P.Q.

SPECIAL TOOLS, MACHINERY
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia.
Wilson & Co., J. C., Belleville, Ont.

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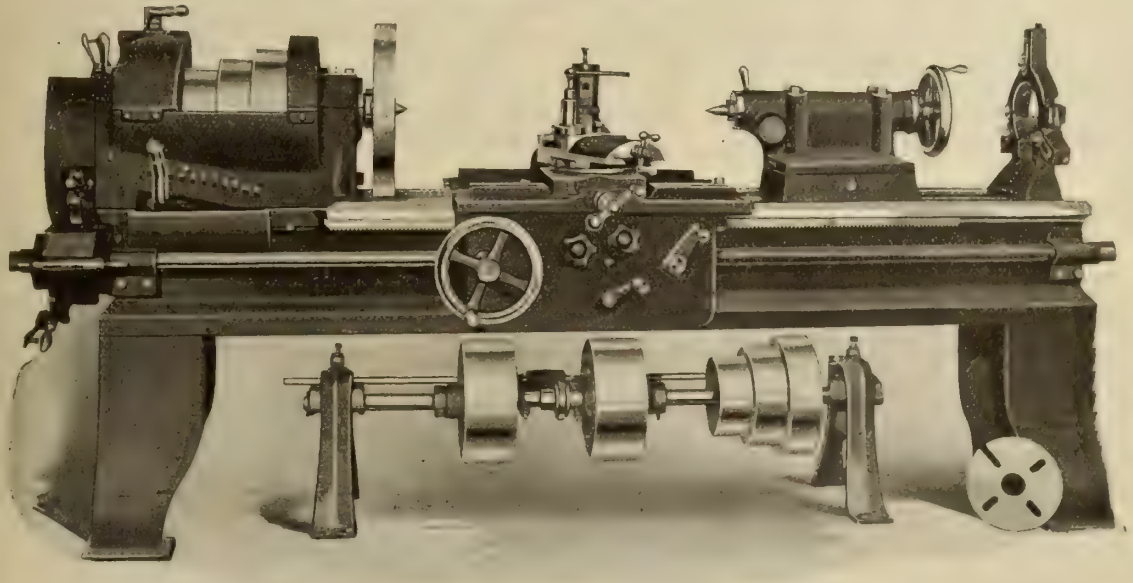
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Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Matthews, Jas. H & Co., Hartford, Conn.
Prittchard-Andrews Co., Ottawa, Can.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.
Geo. W. Cole, Ltd., Toronto.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Blancke Co., L. C., New York City.
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Jollette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.
Warmington & Co., J. N., Montreal, P.Q.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Blancke Co., L. C., New York City.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal.
Blancke Co., L. C., New York City.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Ralph B. Norton, Montreal, Que.
Plewes, Ltd. Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford.

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie.
MacKinnon Steel Co., Sherbrooke, Que.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Blancke Co., L. C., New York City.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto, Ont.
Norton, Ralph B., Agent, Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can Galt, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWEDGES AND WEDGES
Whitman & Barnes Co., St. Catharines.

SWITCHBOARDS
Can. General Electric Co., Toronto, Ont.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, GASOLINE, KEROSENE AND OIL
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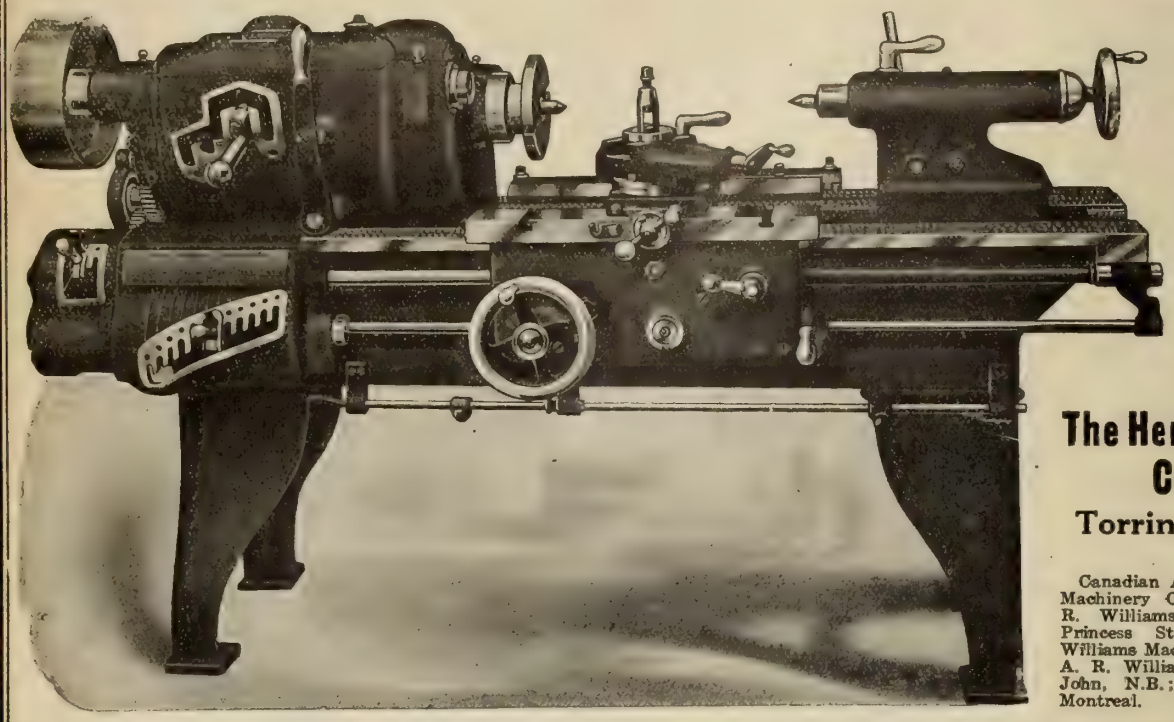
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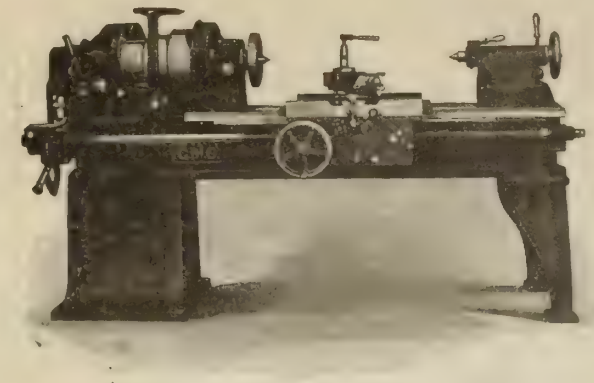
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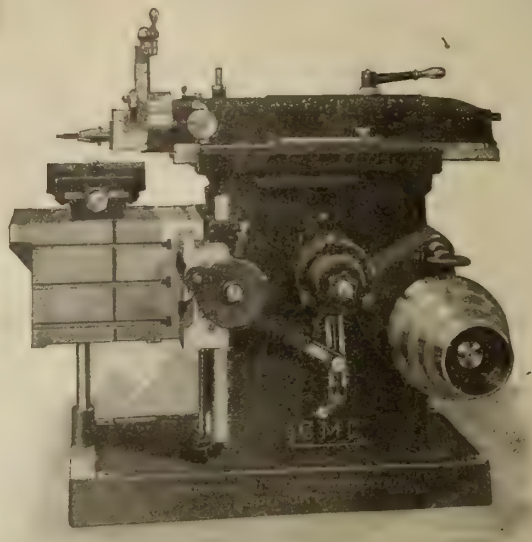
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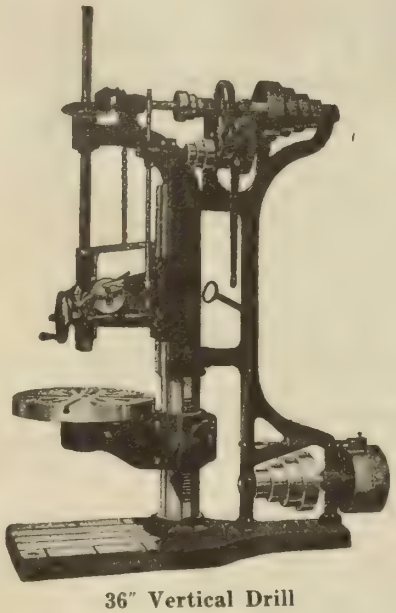
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16″ Engine Lathe with Q. C. Gears

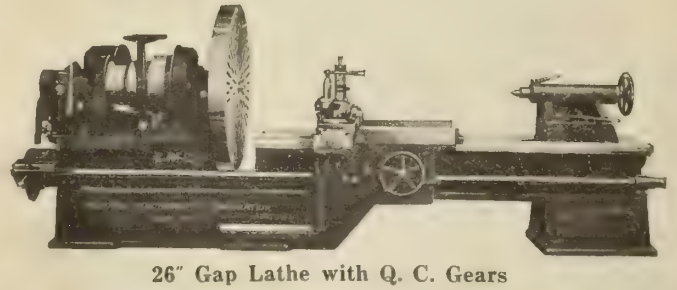


20″ x 22″ Shaper

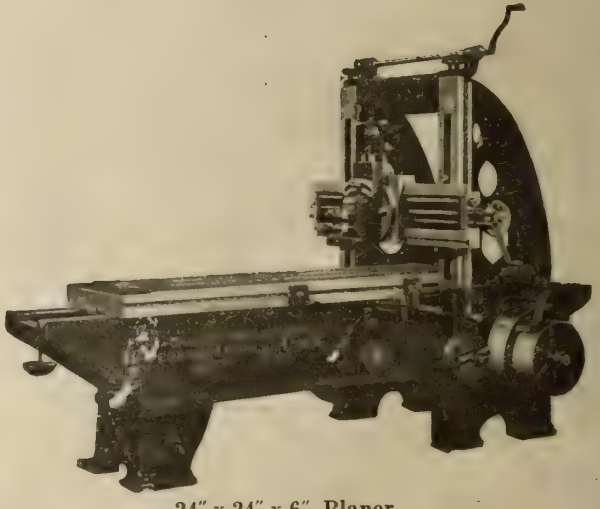


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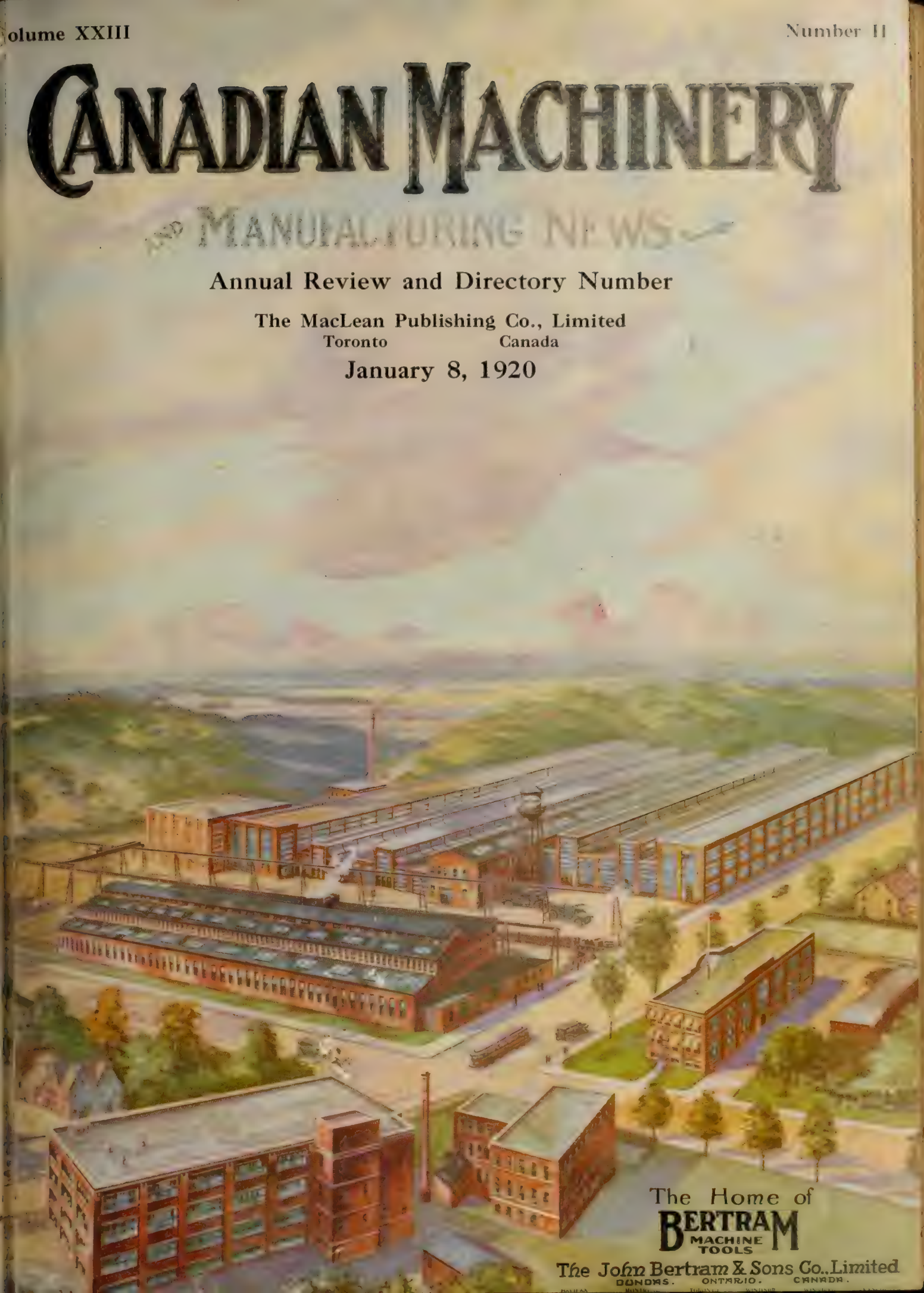
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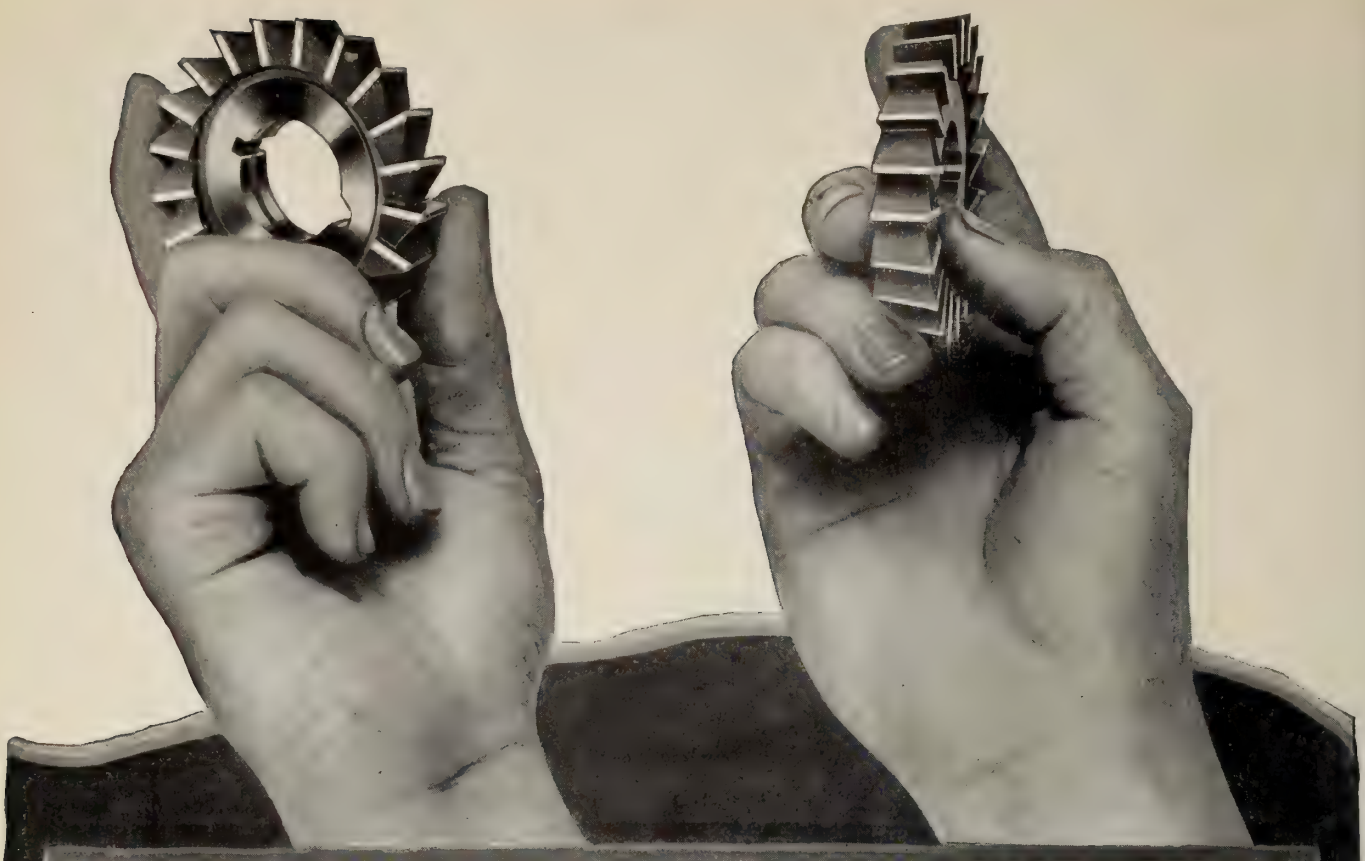
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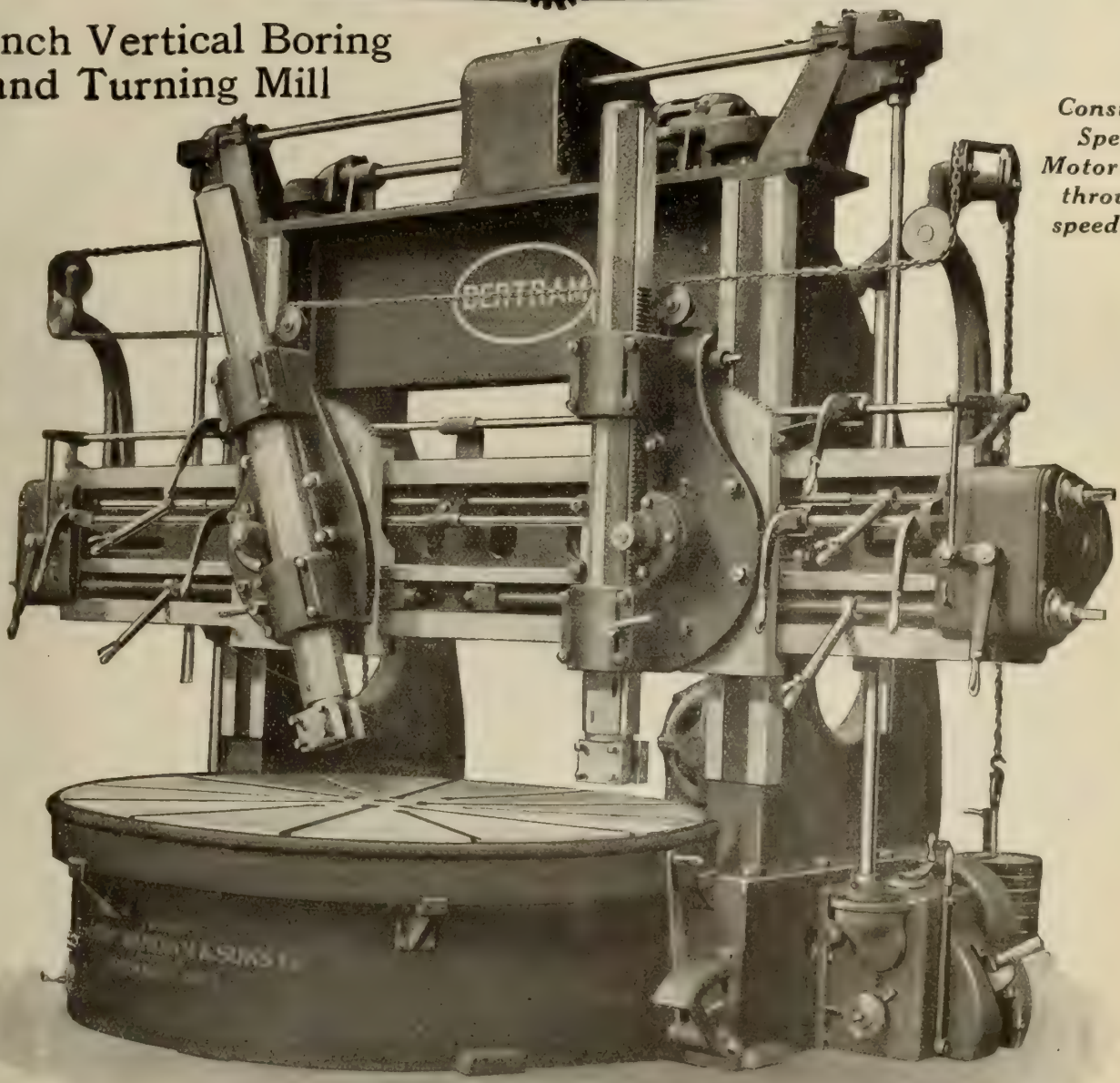
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The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



The John Bertram & Sons Co., Limited

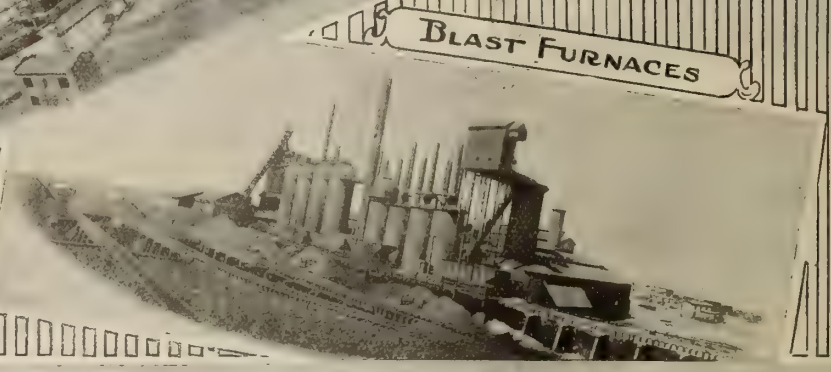
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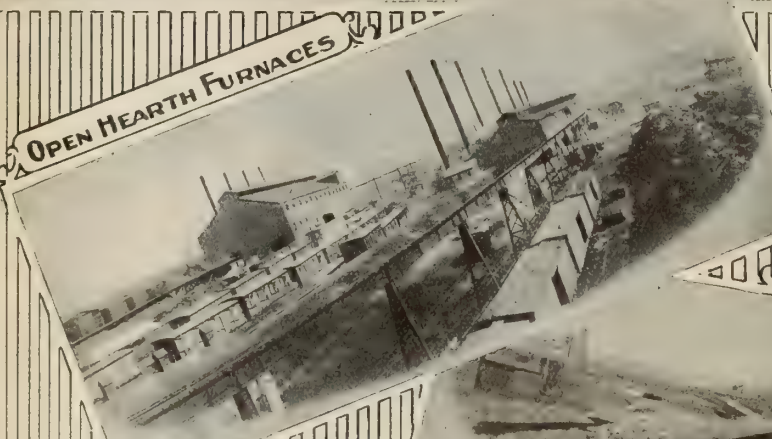
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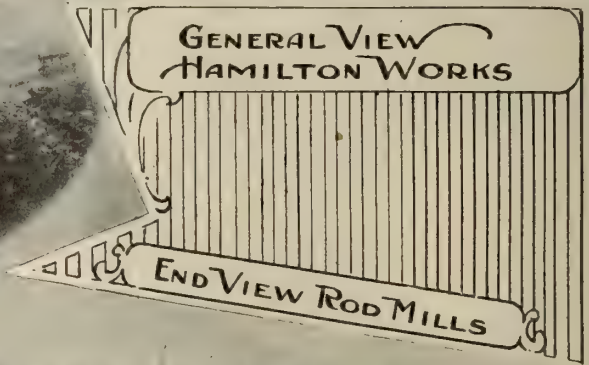
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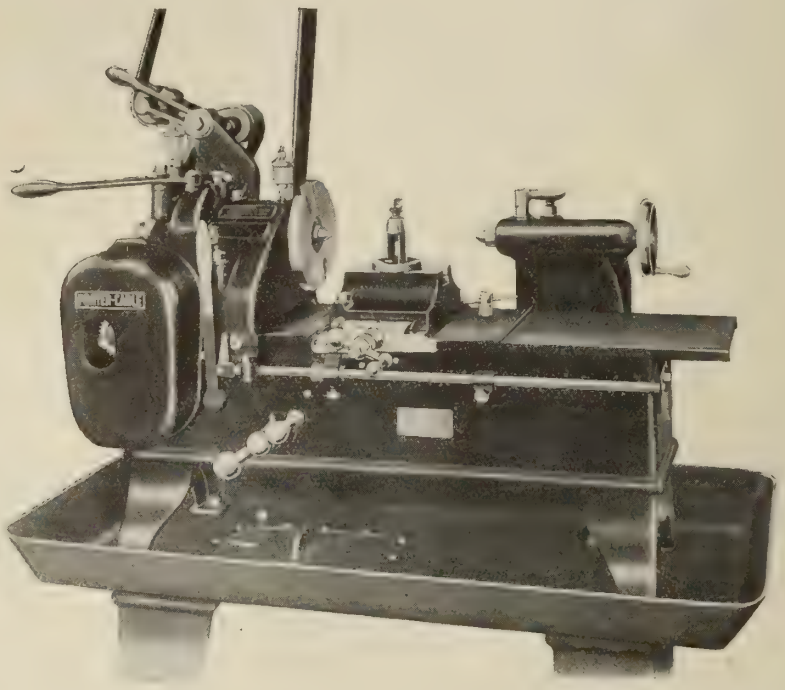


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Used with great success in production of such parts as Bushings—Pistons—Piston Rings—Twist Drill Blanks—Reamers and numberless other items less than 20 in. in length.

Many of the largest manufacturers report that comparison between former methods and the PORTER-CABLE shows a rate of increase which is *almost unbelievable.*

Ask for facts. Send sketch for estimate. Look over our catalog and illustrated circulars.

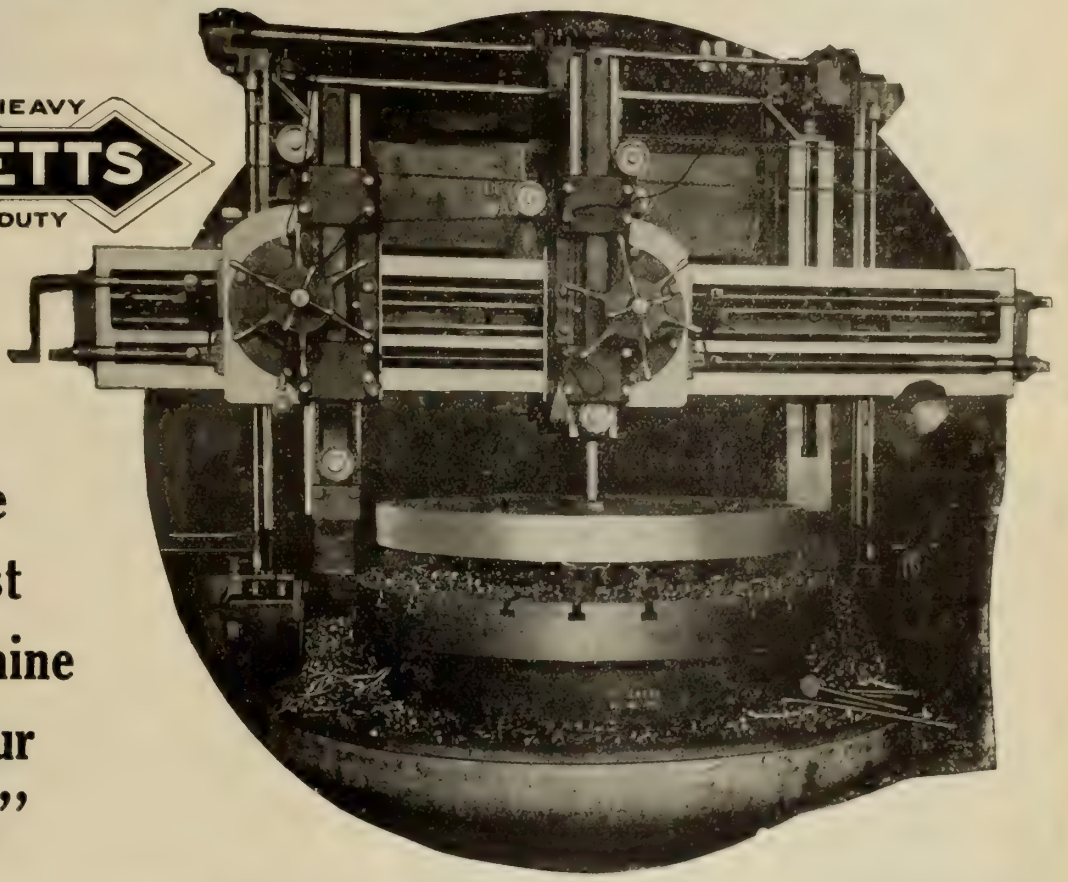
The Porter-Cable Machine Company

SYRACUSE, N.Y.

BETTS

Heavy Duty Boring Mill

HEAVY BETTS DUTY



"The Finest Machine in Our Shop"

That was the manager's verdict after this Betts Boring Mill had been put into service — and he wasn't talking about its looks either.

He meant "finest" accuracy in the machine itself and the work it turned out; "finest" in point of output; "finest" when operating conveniences were considered. And this man knows Boring Mills. He is running a big gear making plant, and he has used and is using many machines of many kinds. We value his opinion.

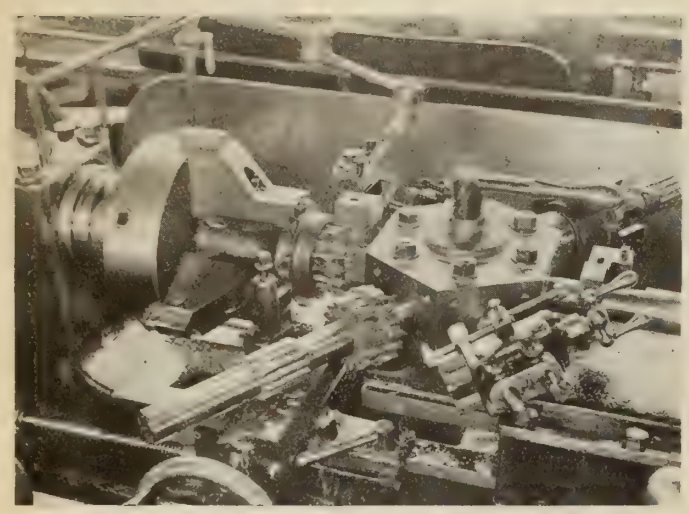
The photograph was snapped just as the machine was finishing a 76 in. diameter gear blank. The face of this blank was 6 in. Material, steel. The chips at the side of the table show the character of the cut being taken.

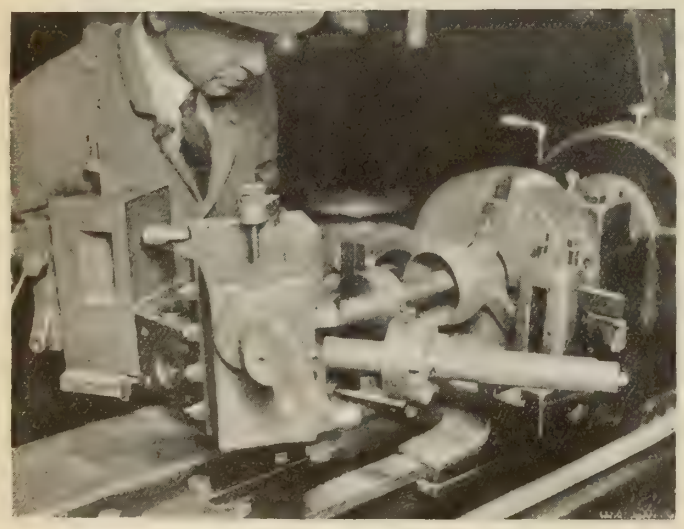
We'll be pleased to send more details of this 7 ft. Boring and Turning Mill—or any of our smaller or larger machines of this type.

We'd like also to have you see some of these machines in operation and to have you question their operators and owners. We'll send a list of installations in your locality. Write us.

BETTS MACHINE CO.
408 Blossom Rd. Rochester, N.Y.
Formerly of WILMINGTON, DEL.

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Standard for Automobile Parts





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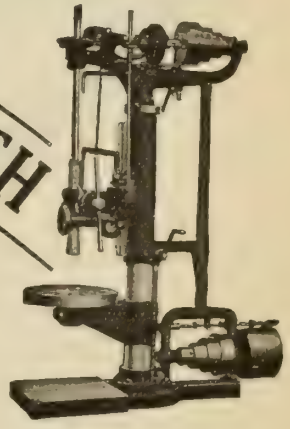
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SILVER DRILLS



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STRONG, speedy, accurate and dependable 20 and 25-inch drills, in which simplicity and convenience mark every feature.

They are in great demand for all modern machine shop practice.

Compact, Efficient, Economical

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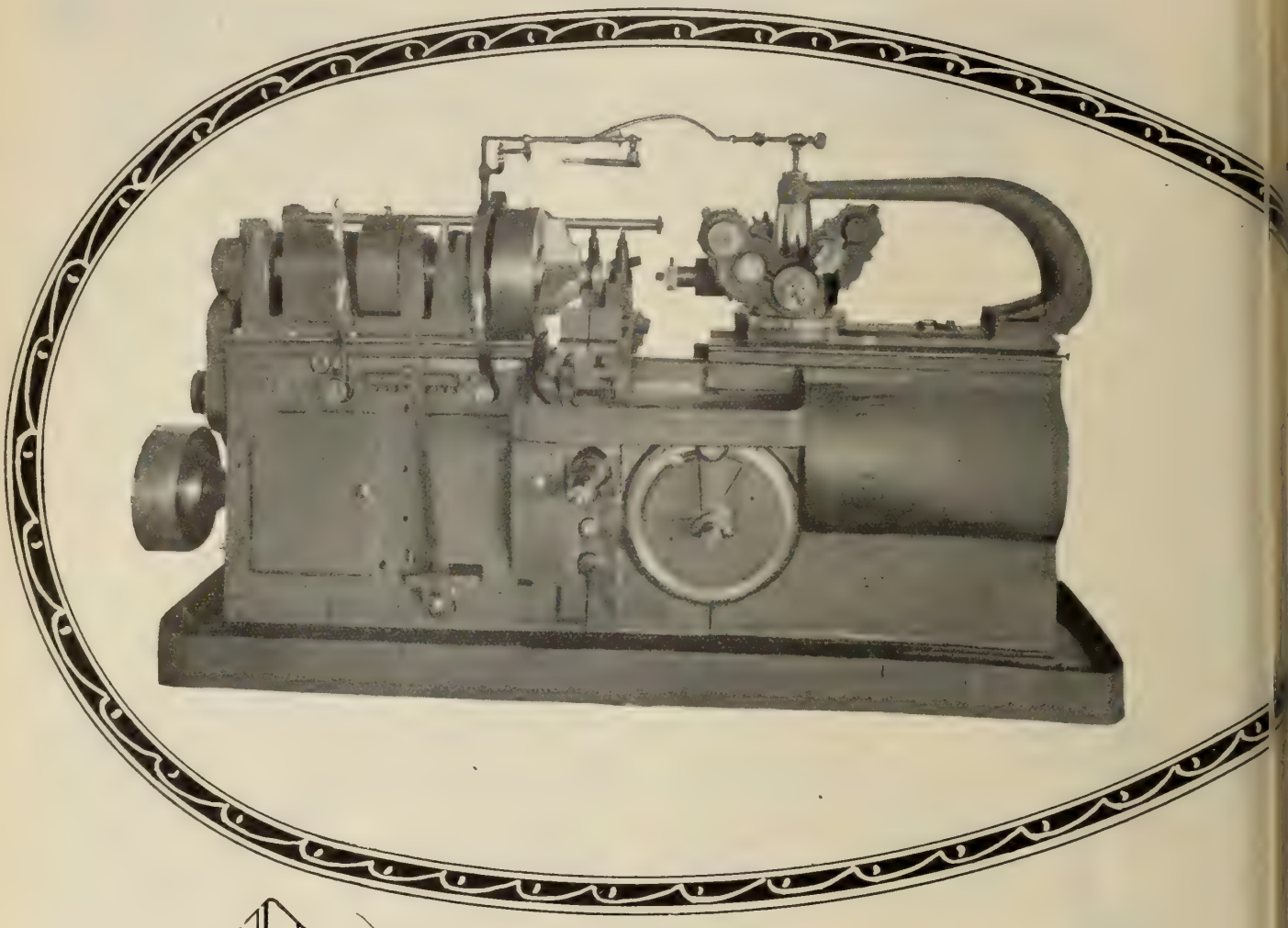
25-Inch

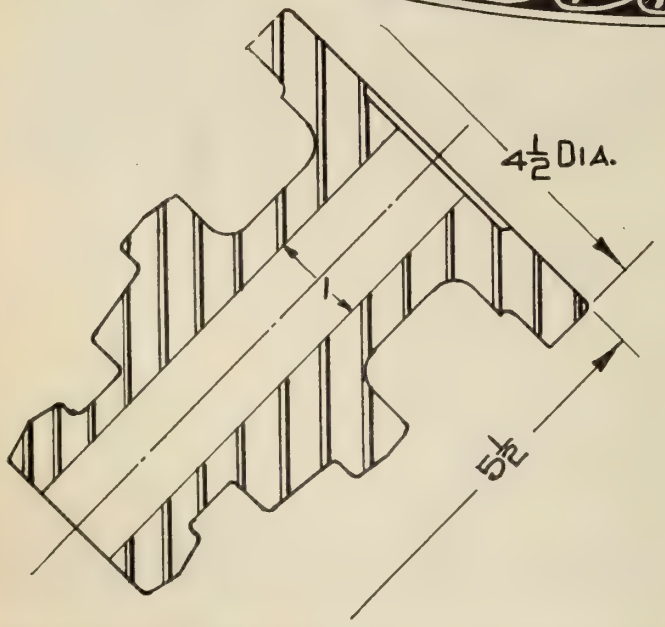
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Manufacturers also of the Silver Radials

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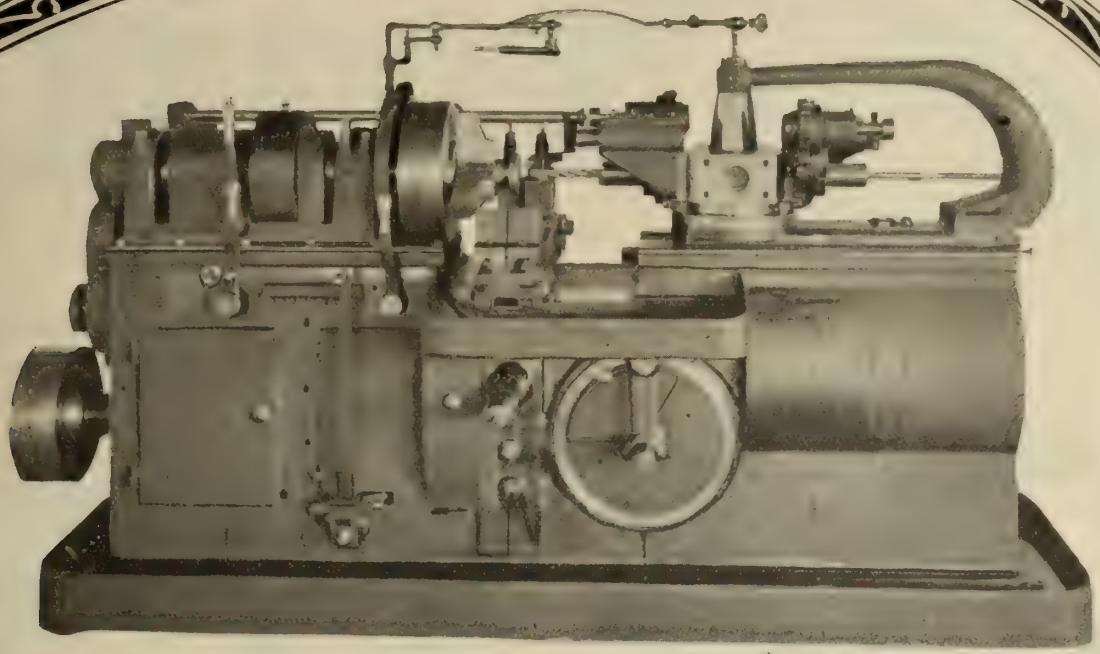
HERE is a typical example of work being machined on the Potter & Johnston 6A Manufacturing Automatic Chucking and Turning Machines in one of the largest automobile shops in the world.

The part shown is that of a Counter Gear and is made from a Drop Forging.

Use has been made here of the high speed drilling attachment for drilling the hole, which allows the surface speed to be correct for both drilling the hole and turning the outside diameter.

Get acquainted with the method.

—and your Accuracy



The operation is as follows:—

1st Turret Position—Spot hole and rough face.

2nd Turret Position—Drill hole, rough recess and turn 4½ diam.

3rd Turret Position—Blank.

4th Turret Position—Bore hole, finish recess, finish turn 4½ diam. and finish face.

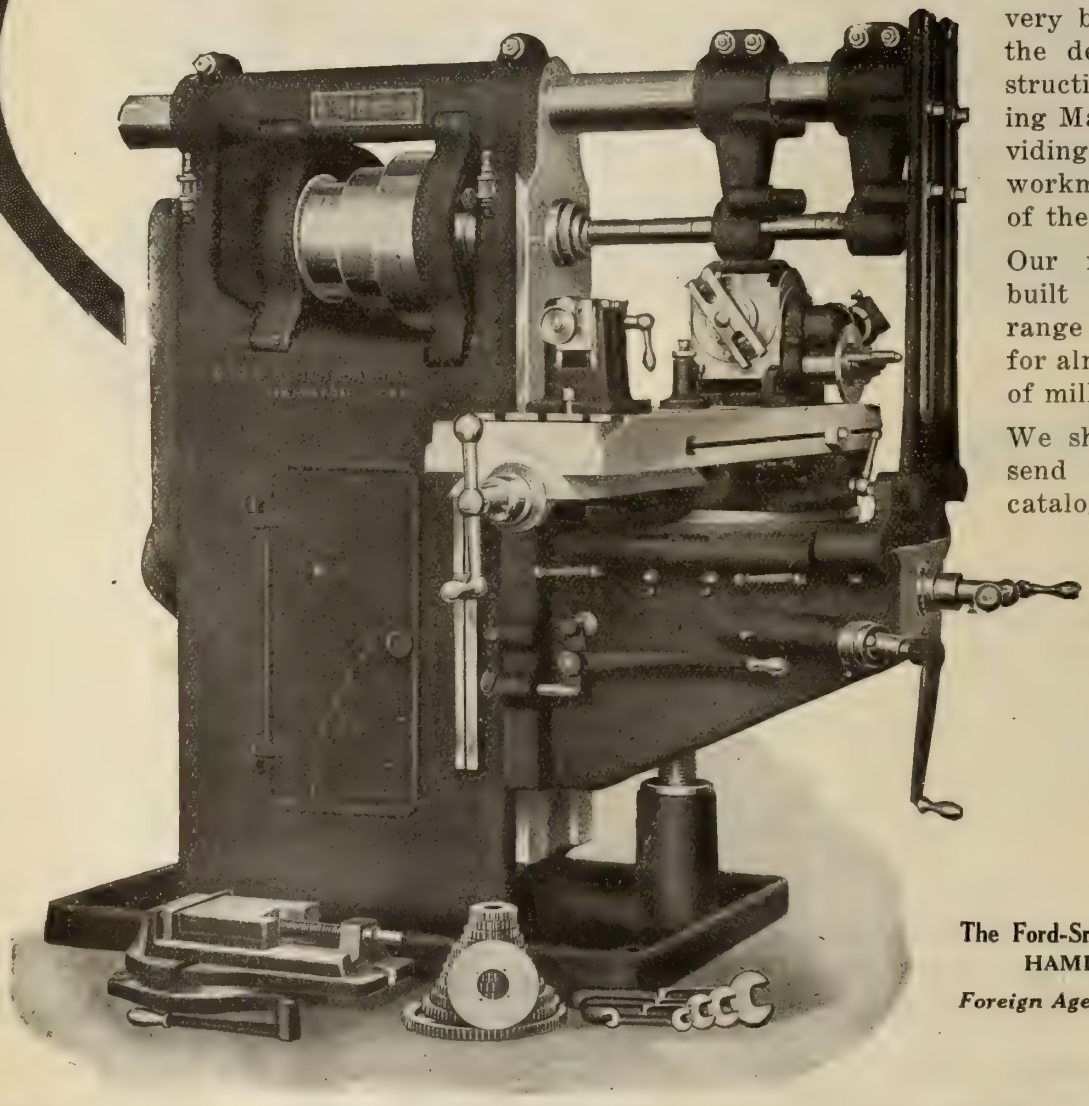
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Head Office: 1501 Royal Bank Building, Toronto, Canada
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Ford-Smith



We have followed the very best practice in the design and construction of our Milling Machines and Dividing Heads, and the workmanship is only of the highest grade.

Our machines are built in a suitable range and capacity for almost every class of milling.

We shall be glad to send you our latest catalogue.

The Ford-Smith Machine Co., Ltd.
HAMILTON, CANADA

Foreign Agents: **W. E. Storey, London, England**

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Melbourne, Australia

Plain and Universal Milling Machines



Fig. 160

FIG. 160 shows one test of the alignment for the knee, during the course of construction. This rigid inspection during manufacture ensures accuracy and the most careful work all the way through.

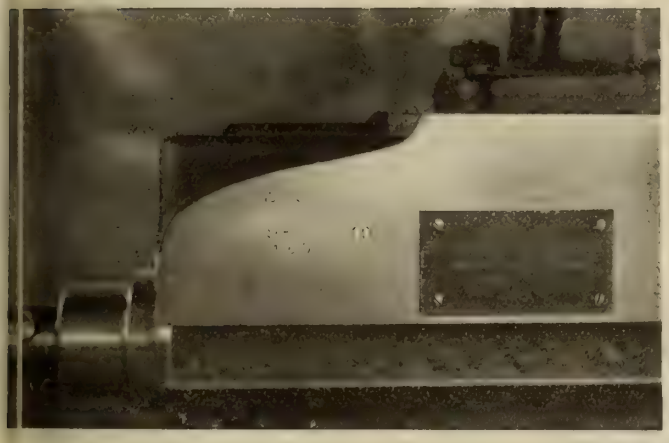
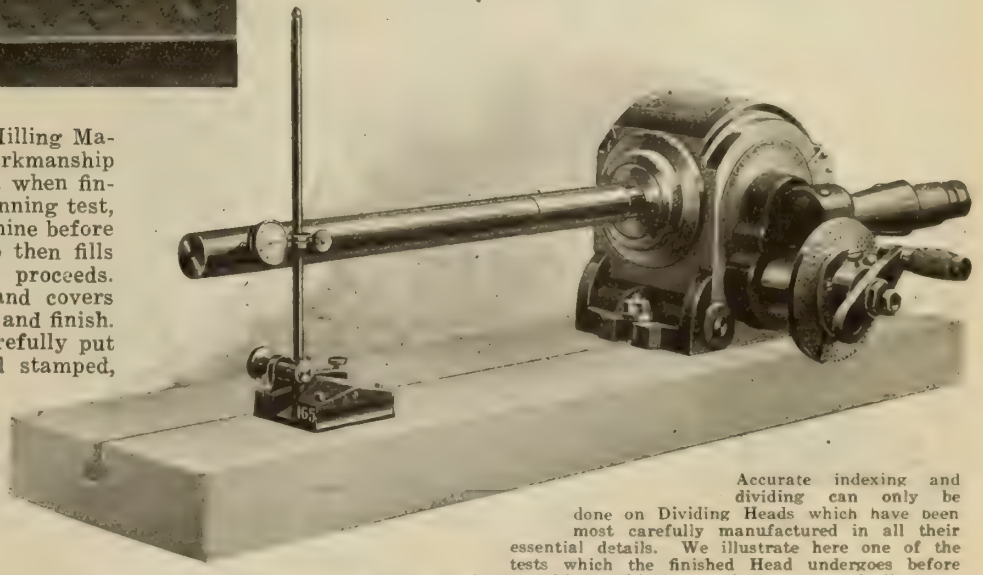


Fig. 162

The manufacture of a High Grade Milling Machine calls for the most accurate workmanship and rigid inspection. Our machines when finished are all given a most careful running test, and actual work is done on each machine before being passed by the inspector, who then fills out the special Test Cards as he proceeds. The inspection is quite elaborate and covers the Machine both as to its accuracy and finish. Any imperfections or errors are carefully put right, and the machine passed and stamped, as shown in cut No. 162.

DIVIDING HEAD ACCURACY



Accurate indexing and dividing can only be done on Dividing Heads which have been most carefully manufactured in all their essential details. We illustrate here one of the tests which the finished Head undergoes before being mounted on machine. This proves the accuracy of alignment of the spindle with the table and the allowable error at the end of a 18-inch test bar of .001 inches. This test is made again in conjunction with the tail stock.

Ford-Smith Machine Co., Ltd.
HAMILTON, CANADA

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Buffing and Polishing Machine



Plow Grinder



Heavy Type Polisher

FORD-SMITH

Grinding and Polishing Equipment

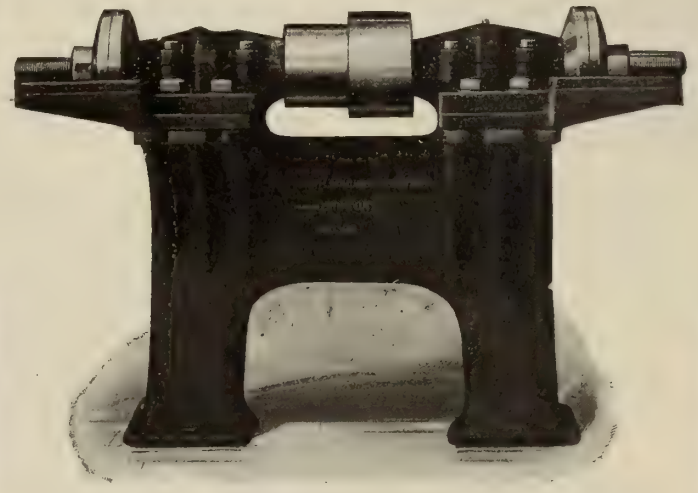
THESE illustrations show some of the types of Grinders and Polishers we manufacture. Most of these types are built in several sizes. We have a line that covers almost every class of work in machine shop, foundry and other industries. Write us about your requirements.



Light Type Floor Grinder



Swing Grinder



30" Double End Grinder



Water Tool Grinder



Heavy Type Floor Grinder

The Ford-Smith Machine Co.
LIMITED
HAMILTON, CANADA



ALOXITE—
The Wheel for Malleables

A busy battery of Aloxite Wheels in a big Buffalo foundry grinds thousands of small automobile malleable parts in a day. The wheels they use are Aloxite 20x3x2¾ 10 grit G grade—clean, fast, free cutting, wheels that make such production possible, that lessen grinding costs and satisfy the men who run them.

We would welcome the opportunity of putting the right wheel in the right place in your plant

THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.

New York Chicago Boston Cleveland Detroit Philadelphia
Pittsburgh Cincinnati Milwaukee Grand Rapids

Carborundum Products are:
Carborundum and Aloxite Grains and Powders, Grinding Wheels, Sharpening Stones, Paper and Cloth, Garnet Paper and Cloth and Carborundum Refractories

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Speed and Scienc

GIVEN the *added* advantage of weight, speed and science would be invincible---in *any* game or business.

Nichrome Castings have the advantage of speed and science ---plus weight. But it is not flabby weight. The walls of Nichrome Heat Treating Containers are lean and spare, like the body of the well-trained athlete. The heat penetrates the walls of Nichrome *readily*.

At 1800 degrees Fahrenheit Nichrome Containers have the ability to play a speedy, scientific game for thousands of hours.

Experience in the designing and casting of Nichrome Containers counts in heat treating results like training counts in athletics. In both cases, of course, there must be the proper basic material and a clear conception of conditions and requirements.

Cast Nichrome Containers give not only thousands of hours of service (guaranteed), but a more uniform quality in the heat-treated products in less time and with less labor and fuel.

ECONOMY IS ASSURED BY A NICHROME GUARANTEE.

Nichrome Castings

TRADE D-H MARK



Manufactured under Henderson Patents

CANADIAN DRIVER-HARRIS Co., Ltd.

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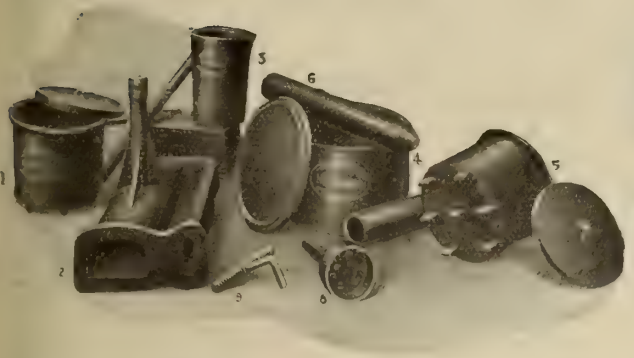
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Win Over Weight



Lighter in weight by 10 pounds to the man, yet the U.S. Navy football team wins over the Army 6 to 0.

Nichrome castings win in a ration multiplied many times.



Nichrome Castings

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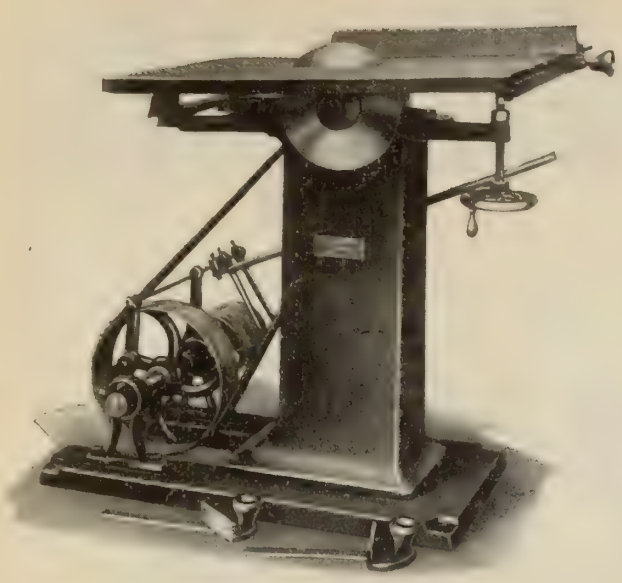
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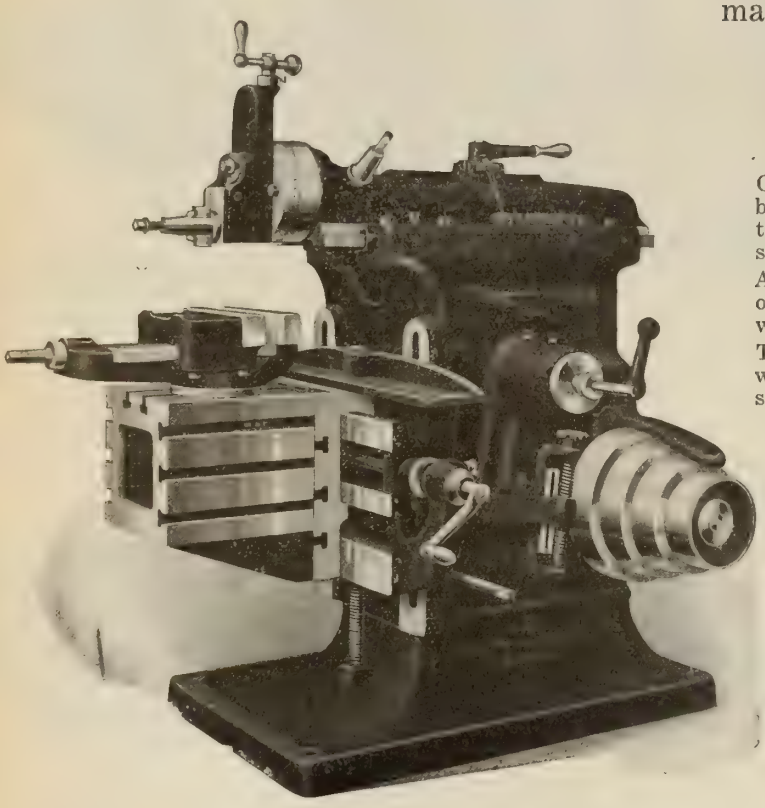
A new Saw Table

An invaluable machine for pattern shops, technical and manual training schools

Does same work as a larger dimension saw, yet it is only 23½" x 30". The distance from saw to ripping fence is 13". Floor space, 3' x 3'6".

Each machine furnished with belt, ripping fence, two mitre fences and a 9" saw.

This machine gives you large capacity for less money than a larger machine. Saves time and space.



15 Inch Back Geared CRANK SHAPER

Some Outstanding Features

Column is heavy and strong and is well braced and ribbed. All gears are cut from the solid, and small gears are made of steel.

All feeds have graduated collars. Changes of feed and position of ram are made from working side.

This machine is extra well built in every way. It will last long and while lasting save you efficiently and economically.

Other "McKENZIE" Lines

McKenzie Sensitive Column and Bench Drills—For rapid drilling (0—5 16) are designed and built from years of experience to meet the requirements of production. Only the best material and workmanship are used in construction of these machines.

The McKenzie Column Grinder—Very best material and workmanship go into the construction of this grinder. Made in one piece, giving it strength and rigidity. Equipped for fast and accurate work.

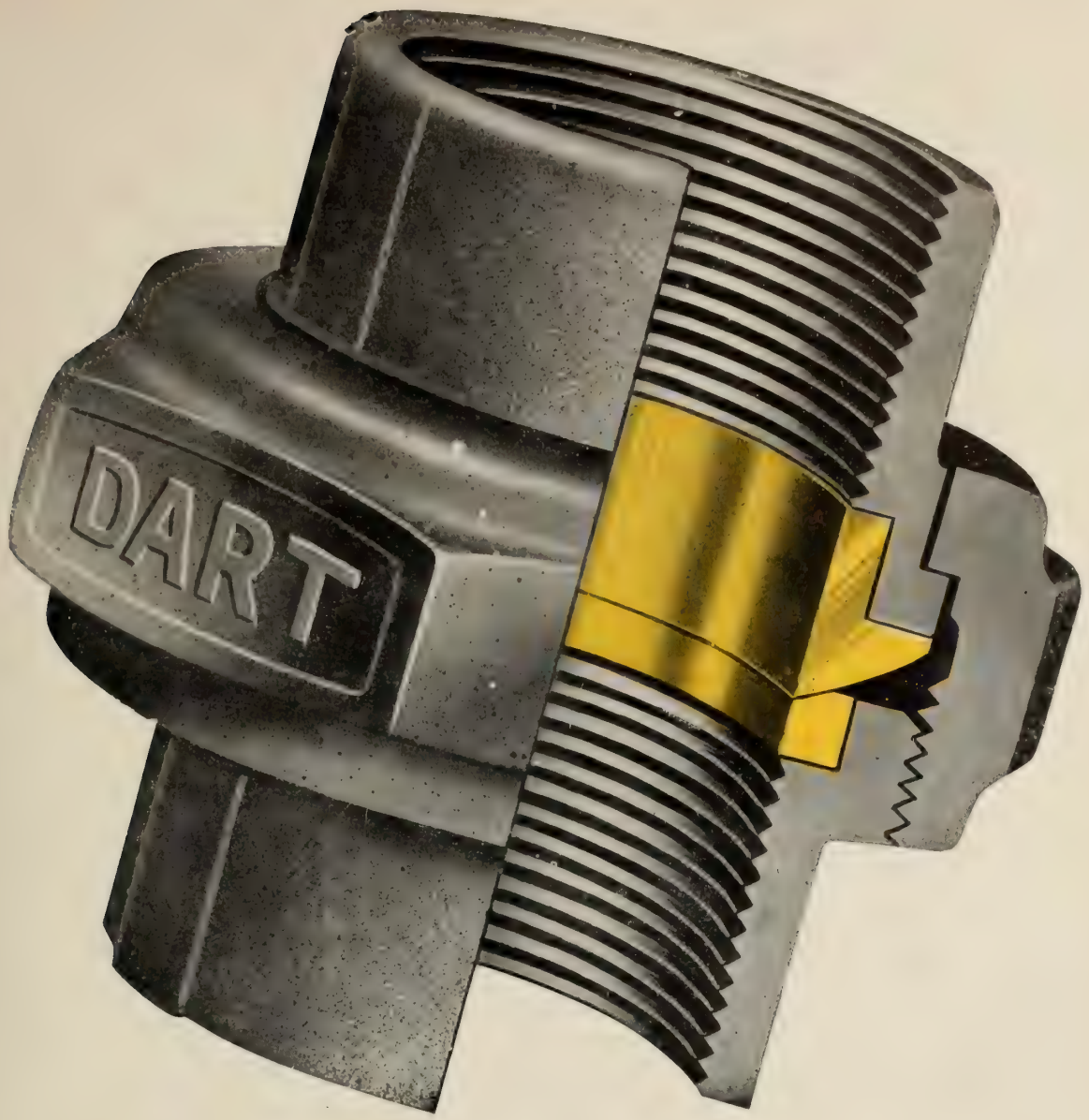
The McKenzie Improved Power Hack Saw—Very powerful and cuts bars 6 x 6 inches either round or square. It requires no attention after work is put in vice, and stops automatically when piece is cut off.

Special attention is called to the IMPROVED ARM and SAW GUIDE which keeps the saw perfectly in line at all times.

For Price and Further Particulars Apply to

THE D. McKENZIE MACHINERY CO.

Guelph, Ontario



The Union Pipe Couplings that are really Troubleproof and Economical

The Joint, BRONZE against BRONZE, Cannot Rust, Corrode or Deteriorate and STAYS TIGHT indefinitely. Repeated use does not affect the efficiency of the Union.

Trade DART *Mark*

Any Supply House Selling Fittings will supply you.

Manufactured by Dart Union Co. Limited, Toronto

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HIGH AND TWIST REAMERS MILLING
Where there
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The Secret of Success!
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QUALITY
NIFORMITY of high standard essentials.
CCURACY assured by scientific methods of manufacture.
ONG-service requirements fully met.
NSPECTED rigidly through every process.
EST must meet exacting conditions before finally passed.
OUR best interests the first concern in Wilt products.
Wilt Tools are Made in Canada
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XPERIENCED engineering staff for your consultation.

ELIABILITY guaranteed by correct design and skilled workmanship.

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NCREASED production by elimination of waste in work and material.

ONFIDENCE of employees inspired by dependable tools.

FFICIENCY secured in your plant by the use of Wilt products.

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PINK LINE

Logging Tools and Handles

Made-in-Canada products—headquarters for British Empire for all Lumbering Tools.

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

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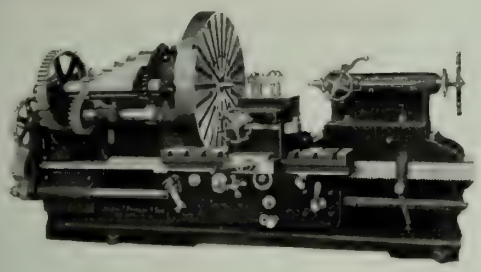
We ship all over the world the same good quality of lumbering tools that have made *Pink's tools* a by-word in the matter of good tools in all Canadian lumber camps and other industries. Enquiries cordially solicited.

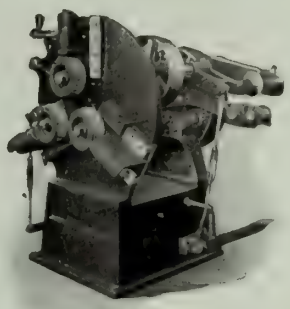
ALSO MAKERS OF CAR MOVERS

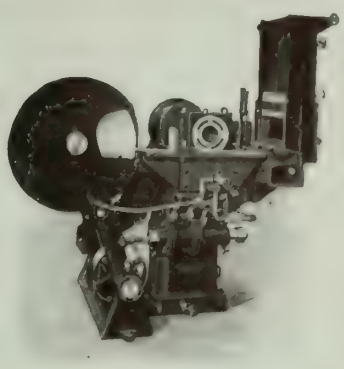
Sold throughout Canada by all wholesale and retail hardware merchants.
Long Distance Phone No. 87.

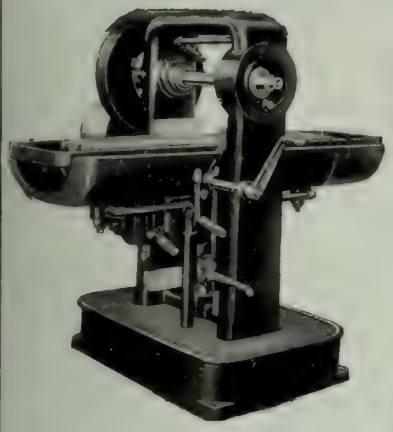
The Thomas Pink Co., Limited

Pembroke, Ontario, Canada



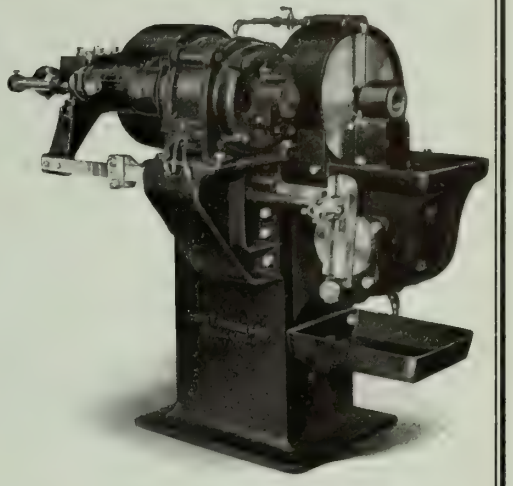






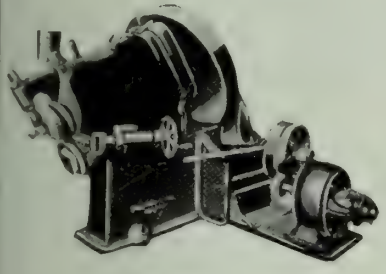
Metal Working Machinery

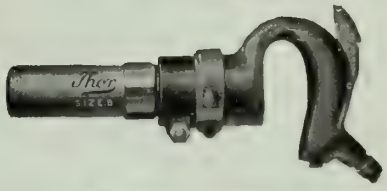
For Any Operation



Machine Tools

New or Used

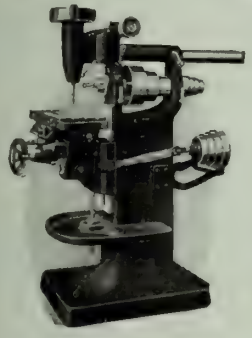


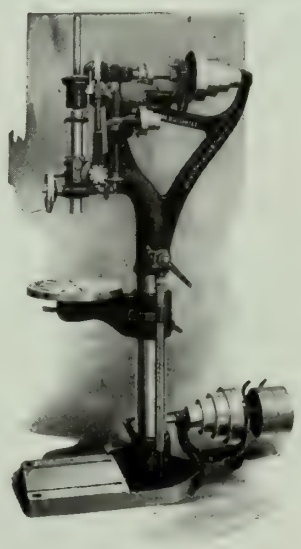


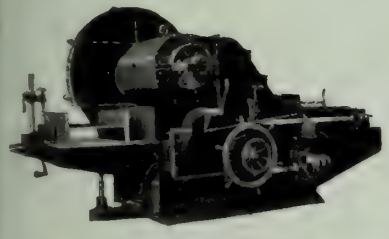
Complete equipment for Boiler Shops, Structural Steel Works, Railroad Spring Shops, Flue Shops and Woodworking Machinery of any kind.

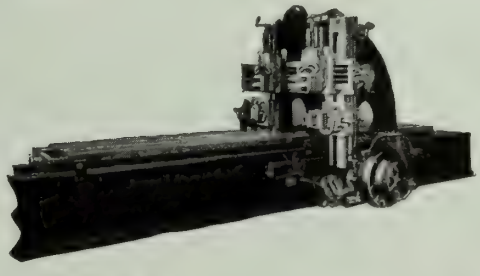
You are undoubtedly from time to time buying new equipment. You will profit by giving us an opportunity to submit specifications.

Illustrations show a few of our machines for immediate shipment.









Garlock-Walker Machinery Company, Limited

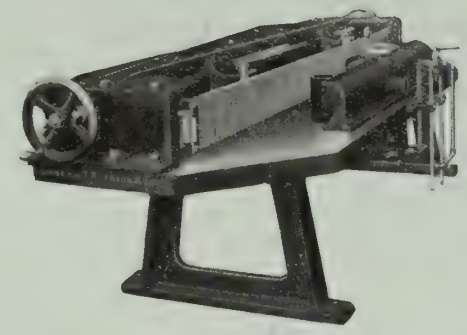
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MONTREAL TORONTO WINNIPEG

"Everything in Woodworking and Metal Working Machinery"

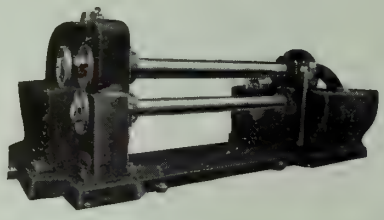
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RYERSON



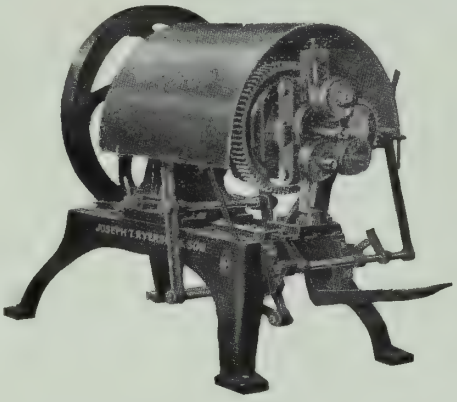
Ryerson Riegel Universal Elliptic Spring Forming Machine

This machine will form elliptic spring leaves of any size and curvature used in ordinary practice, requiring but one spring maker for its operation.



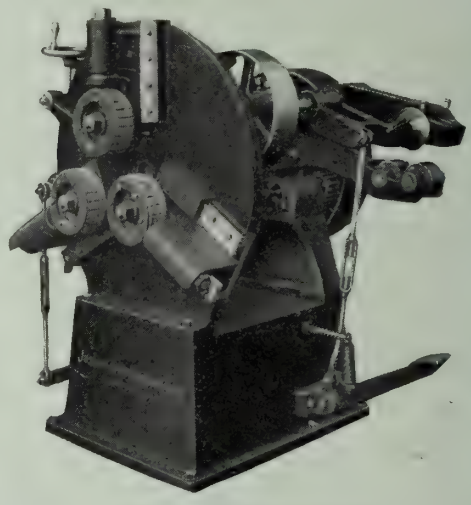
Lennox Double Housing Rotary Splitting Shear

This machine is designed for straight shearing of sheets and plates up to 1½" thick, and will cut through the centre of a 20' plate. It will also shear round, square or flat bars.



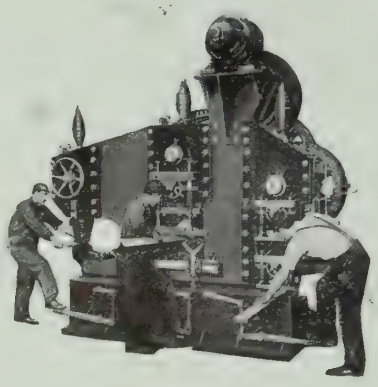
Hartz Flue Welding Machine

The Hartz Flue Welding Machine will handle either standard or superheater tubes with equal facility and economy. The tubes are welded on the roller principle and interchanging attachments can be furnished for the scarfing work.



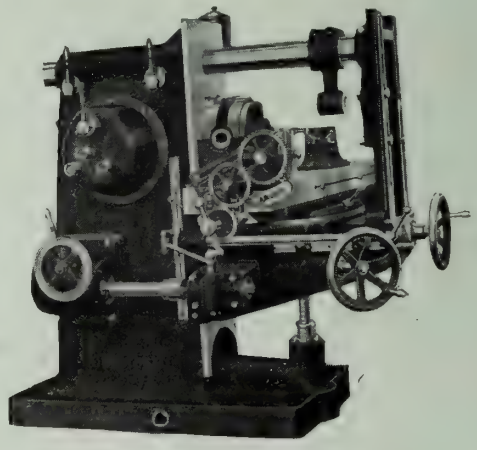
Ryerson Improved Universal Flue Cleaning Machine

This machine has been developed to meet the demand for a single flue-cleaning machine for standard as well as superheater tubes.



Ryerson Quintuple Combination Punching and Shearing Machine

These machines will handle the shearing of plates, round and square bars, coping and notching, section cutting and punching without changing any tools or attachments whatever



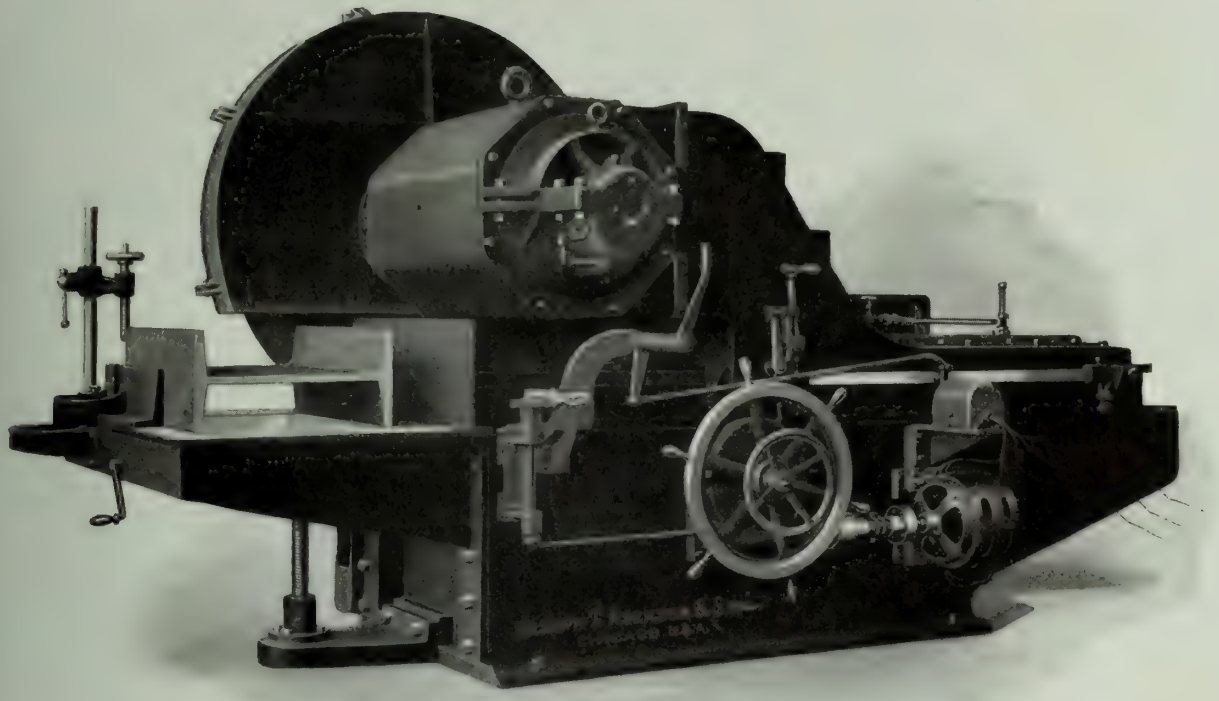
No. 3 Ryerson-Conradson High Power Universal Milling Machine

This is a high power milling machine, designed for accuracy and rapid production.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

RYERSON

Universal High Speed Friction Saw



The Ryerson High Speed Friction Saw is designed for rapid cutting of steel shapes of all descriptions. The use of the High Speed Friction Saw in railroad shops is a recognized necessity for the efficient and rapid cutting of rails, beams, angles, channels, tees, zees, round bars, etc., as well as the various special sections which are being employed in steel construction. This saw will cut different shapes in rapid succession without the necessity of interchanging any attachments or clamping the material. A 24″ I-beam can be cut in 50 seconds. This saw is made in various sizes, from No. 1 to No. 5, with capacity to cut from the smallest to the largest section rolled.

We manufacture a complete line of machinery comprising everything for the boiler, structural, bridge, railway and general machine shop, such as Friction Saws, Punches, Shears, Riveters, Bending Rolls, Lathes, Planers, Shapers, Millers, Drill Presses, etc. This standard line is supplemented by our well known special machinery, such as the Lennox Rotary Bevel Shear, Lennox Splitting Shear, Lennox Serpentine Shear, Ryerson-Conradson Radial Drill, Ryerson-Conradson Milling Machines, Ryerson-Conradson Selective Head Engine Lathes, Ryerson-Conradson Multi-Speed Planer, Combination Punching and Shearing Machine, Spring Shop Machinery and Flue Shop Equipment.
A bulletin on any particular machine or a complete catalog on all Ryerson Machines will be mailed at your request.

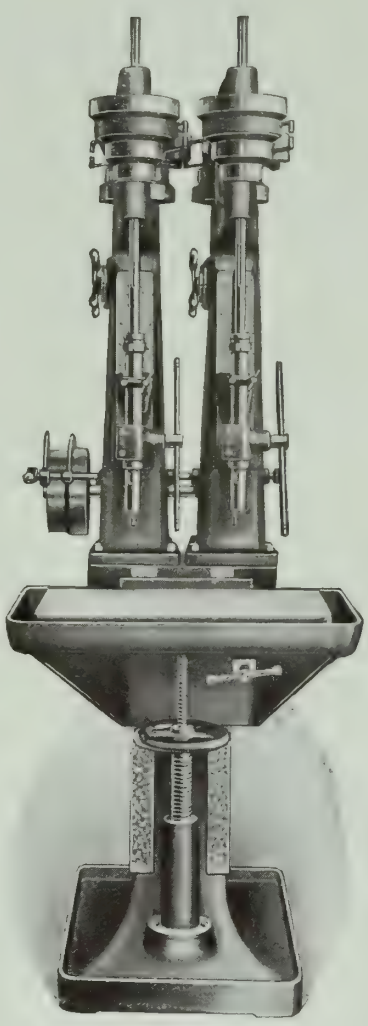
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RYERSON SPECIAL MACHINERY AND MACHINE TOOLS

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Write for Complete Descriptive Catalogue and Prices

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Edlund Drills



No. 2B

All desirable features in a Drilling Machine are combined in the Edlund Open Type.

Quick Change Speed—Straight, Endless Belt—Large Bearing Surfaces—Frame in One Piece Casting—S K F Ball Bearings throughout and many other important features.

The Durston Gear Co., of Syracuse, N.Y., have the following to say of our drilling machines:—

"We have a number of your Sensitive Drilling Machines in operation in our plant and so far they have not given us a particle of trouble and are producing away beyond our expectations. We like them so well that you can rest assured should we need any more machines of this nature, we will specify Edlund."

Write for catalogue

Edlund Machinery Co., Inc.
Cortland, N.Y., U.S.A.

Garlock-Walker Machinery Company Limited

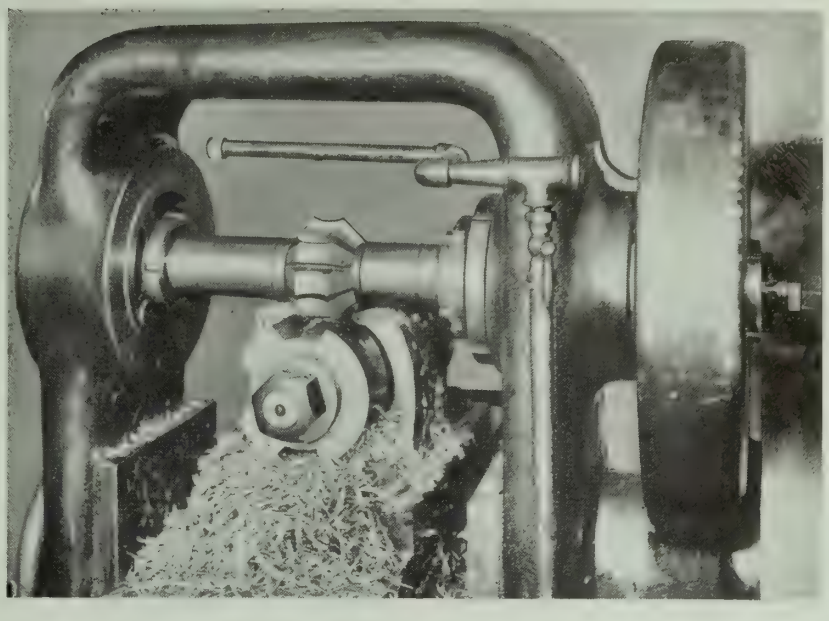
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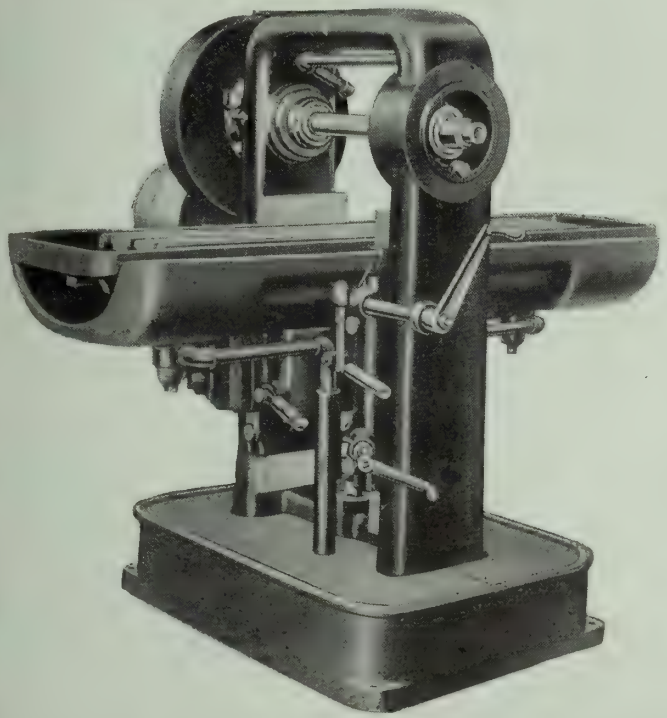
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"Everything in Machinery"

The Biggest Milling Machine in the Shop in Point of Output

THE Briggs Miller is a hustler on any work. These photographs prove it. The work is heavy; but look at the chips in front of the machine—the size of them. Consider the size of this cut and the time it takes to complete it and you'll appreciate the power and strength there must be in a machine which handles work like this. The piece under operation is a special punch, 4¾ inches outside diameter. The cut is 2 inches long by ½ inch deep—and it takes just 10 minutes to complete the four of them in each punch, 6 pieces each hour, 54 every nine-hour day.





The Briggs Miller handles work no other machine of its size can touch. It is a manufacturing machine—a radical departure from the conventional miller. The solid arch frame with heavy bed strongly gibbed to both sides of the frame gives ideal rigidity between arbor and table. Direct geared drive close to the end of the arbor, powerful screw table feed, eight changes of feed through two levers, quick return to table through rack, pinion and handwheel, and many other constructional advantages afford production over a wide range that cannot be equaled by any other small milling machine.

Let us tell you more about the Briggs—it will be worth while.

Gooley & Edlund, Inc. **Cortland, N.Y., U.S.A.**

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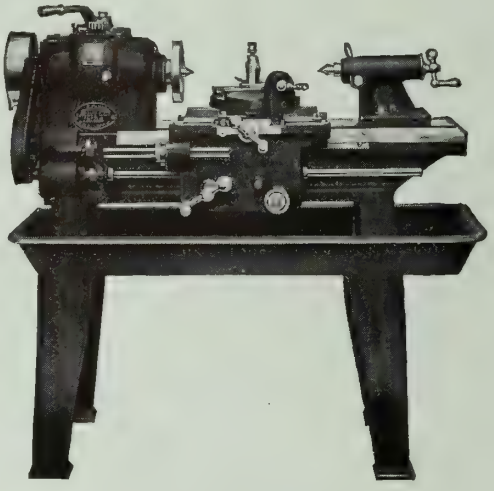
The Adams Short-Cut Lathe

For Rapid Production

A specialized machine for quantity production of short duplicate parts with the greatest possible economy.

Swings 13⅝″. Takes between centers 20″. Length bed 48″.
Six speed Geared Head, has power standard 16″ Lathe.

Accessories
Taper Attachment
Back Forming Attachment
Oil Pump and Piping
Drawing Chuck



Floor Space
54″ x 28½″
No countershaft needed

Manufactured by
ADAMS MFG. CO., Inc.
ROCHESTER, N.Y.

The Adams Short-cut Lathe is the most satisfactory in every way for the rapid production of short duplicate parts, thus releasing larger lathes for other work. Its first cost is lower, its upkeep and operation less, and it is manipulated more easily, quickly and economically for work within its range. It is simple, powerful and rugged.

Let us figure on your work.
Write for full particulars.

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"Everything in Wood-working and Metal-working Machinery"

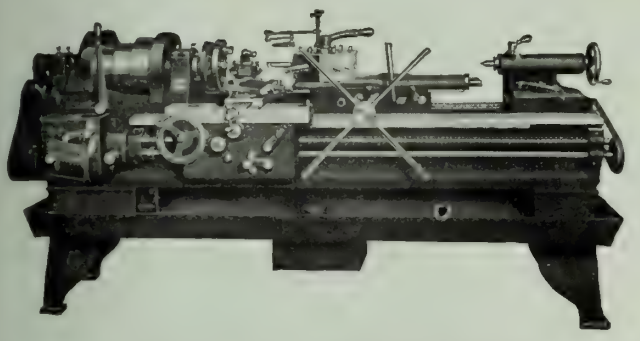
Lathes - Lathes - Lathes

Practical equipment for every modern plant. Sizes 16 in. to 28 in. Belt or motor drive. Cone type or geared head.

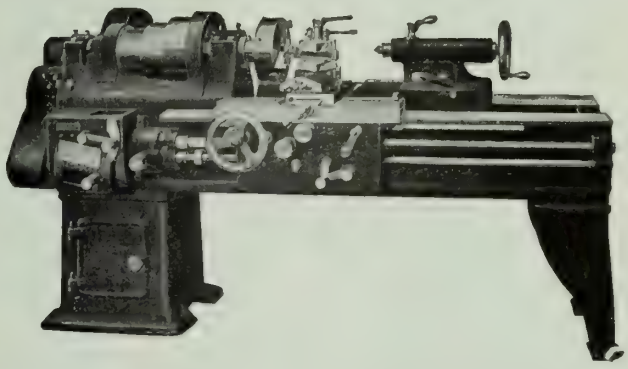
Features: Wide range quick change gear box; double wall apron.

Closing dial, automatic stop, cabinet leg, etc., etc.

"A Lathe for Every Purpose"



Severe Duty Manufacturing Lathe



Quick Change Gear Engine Lathe

All attachments, such as Taper, Relieving, Draw-in, Pump Connections, Turret on Carriage or on Bed, Metric Gears, etc., for all sizes. Special gears for coarser or finer pitches.

Cincinnati Lathes, though powerful in every detail, are neither complicated in construction nor cumbersome to handle on any work. They have none of the intricate mechanism that means endless repairs and short-lived efficiency.

"Results Count Everywhere"

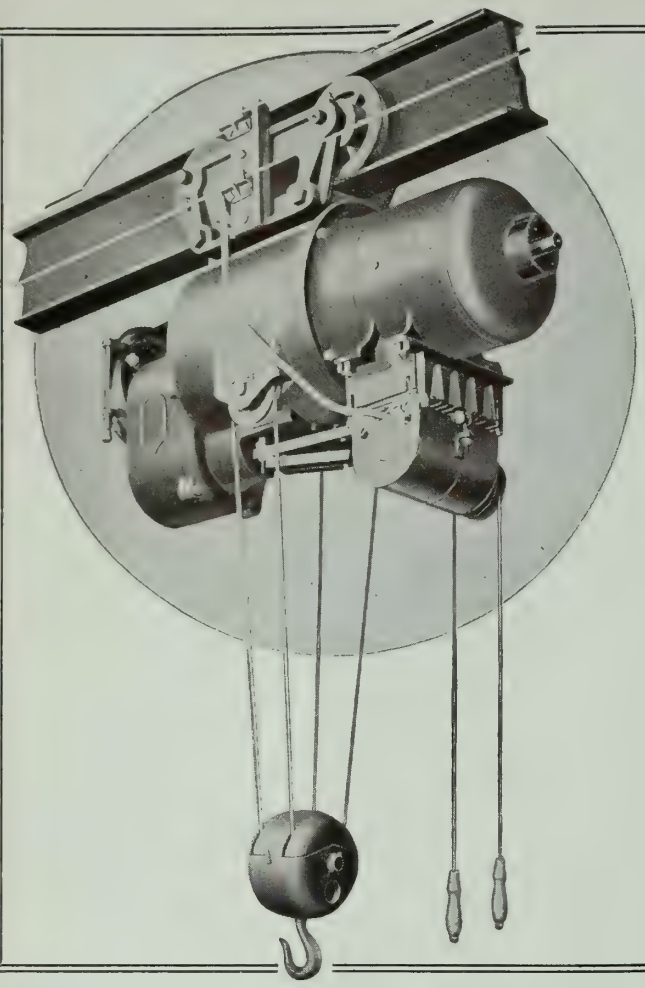
"Let us tell you about Cincinnati Lathes"

Garlock-Walker Machinery Company, Limited

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Standard, Electric, Travelling

Cranes. Wall, Jib and Gantry Cranes and Mono Rail systems to meet every requirement, or special cranes for your particular need.

No matter if your requirements are heavy or light, a Barber-Foster Crane will handle them better.

Send us particulars of your requirements, our factory engineers will submit complete estimates.

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GARLOCK-WALKER MACHINERY COMPANY, LTD.

Montreal — 32 Front St. W. Toronto — Winnipeg

"EVERYTHING IN MACHINERY"

Open Side Planers

The Big Capacity Machine

Your big, clumsy jobs can be planed on the

Lincoln Open Side Planer

with speed and accuracy. An open side planer as rigid as any two post planer.

Picture and particulars are yours for the asking.

GARLOCK-WALKER MACHINERY CO., LIMITED
TORONTO

Horizontal Boring

Drilling and Milling Machine

The Blomquist-Eck is the horizontal mill with the highest working efficiency. Has longer traverse of spindle, greater capacity, a heavier machine than any other of competitive size. Diameter of spindle 3⅛.

Full descriptive bulletin on request.

GARLOCK-WALKER MACHINERY CO., LIMITED
TORONTO

Place the Ohio Planer in any shop and watch the work speed up. Year after year they "weather the blasts" of heavy work. They ease you over the hard spots in rush times. They stand up to the job with the endurance that only quality workmanship can cause. The true test of any machine is the manner in which it stands the test of time.

"OHIO" PLANERS

Ohio Planers are designed for hard, continuous usage in machining the heaviest class of work at the maximum capacity of high speed steel. They combine every possible improvement for easy operation.

Made in sizes from 22 x 22 x 22 in. to 48 x 42 in. We also make quality shapers in sizes from 14 in. to 28 in.

Ohio Planers, since 1887, have been giving excellent service to their users.

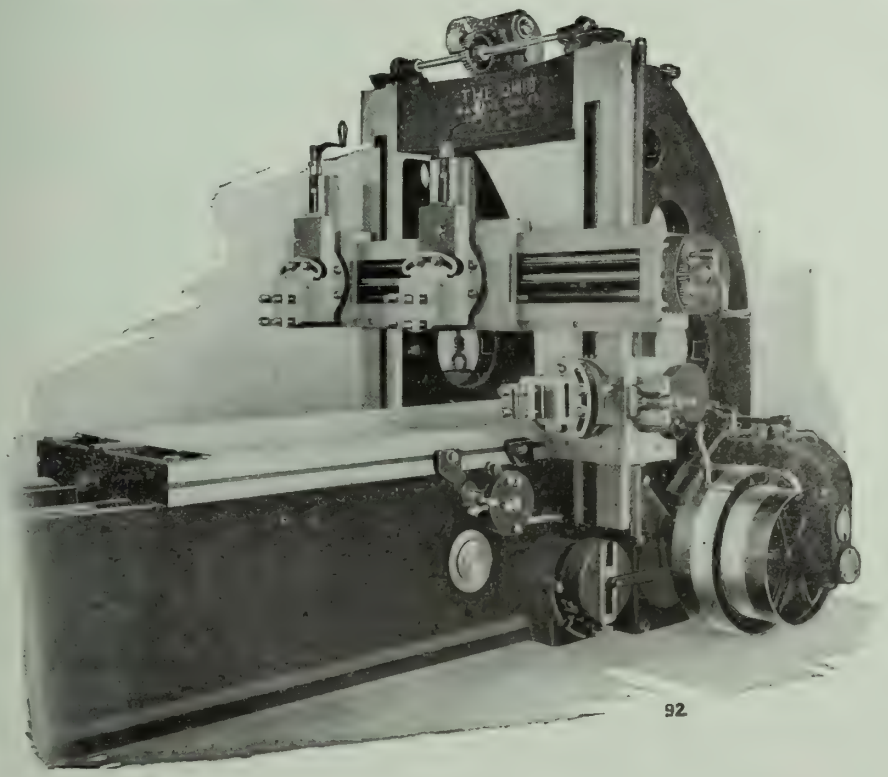
Regular equipment includes aluminum pulleys and two-speed countershaft. All countershaft hangers contain Hyatt Roller Bearing Boxes.

Deliveries:—

30 in. x 10 ft. heavy—Two Heads 30 in. x 6 ft. std.—Two Heads.. 36 in. x 10 ft. std.—Two Heads 42 in. x 10 ft. std.—Two Heads	Immediate
36 in. x 33 in. x 10 ft. widened— 36 in. x 12 ft. heavy..... 38 in. x 12 ft. heavy..... 38 in. x 14 ft. heavy..... 42 in. x 14 ft. standard.....	Three weeks
24 in. x 10 ft. standard..... 36 in. x 10 ft. standard..... 36 in. x 12 ft. standard..... 36 in. x 14 ft. standard..... 36 in. x 16 ft. standard..... 48 in. x 42 in. x 10 ft. widened..	Three weeks
30 in. x 6 ft. standard..... 36 in. x 8 ft. standard..... 42 in. x 16 ft. standard..... 42 in. x 10 ft. standard..... 48 x 42 in. x 16 ft. widened..	Four weeks

WRITE US FOR DELIVERIES NOT SHOWN

The characteristic features of Ohio Planers is detailed in our circulars. Don't fail to ask for yours.



The Ohio Machine Tool Co.
KENTON, Ohio

Agents:
Garlock-Walker Machinery Company Ltd.
TORONTO

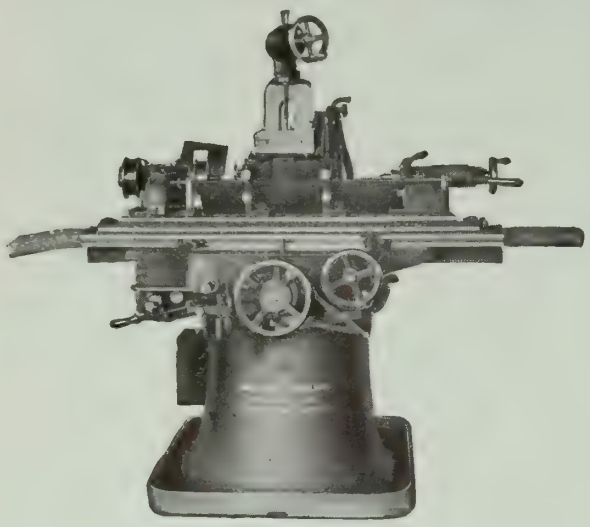
MONTREAL - WINNIPEG

"Everything in Machinery"

If interested tear out this page and place with letters to be answered.

BATH UNIVERSAL GRINDERS

(UNIVERSAL GRINDING MACHINE CO., FITCHBURG, MASS.)



THE BATH No. 1, No. 2, No. 2½ UNIVERSAL GRINDING MACHINE

will do your

Cylindrical, Internal, Surface, Disc, Tool and Cutter Grinding accurately and productively up to the capacity of the wheel.

MADE IN 3 SIZES

No. 1. 10″ Swing, 20″ between centres, Wheel 10x ¾
No. 2. 10″ Swing, 25″ between centres, Wheel 12x1½
No. 2½. 10″ Swing, 36″ between centres, Wheel 12x1½

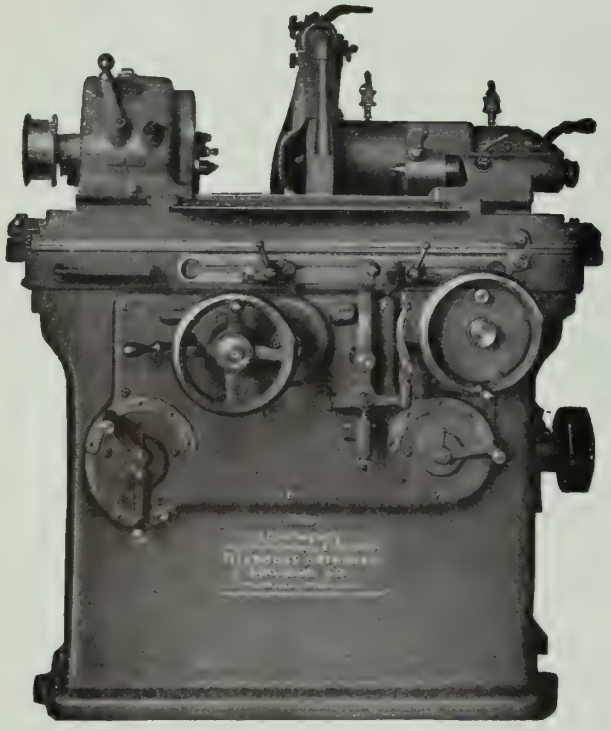
NOTE—Bath No. 2 machine will grind surfaces 20 x 9 x 7½″ high.

Get further particulars from

Garlock-Walker Machinery Company, Limited

32 Front Street West, Toronto, Canada

MONTREAL TORONTO WINNIPEG



Fitchburg Plain Cylindrical Grinders

are carefully designed to meet the great variety of cylindrical grinding requirements. It will meet all the present day demands for accuracy and high speed production and, owing to its compact construction, **occupies just half the floor space of the larger cumbersome machines.** It is most rigid and powerful. Construction is on the unit system, each unit being entirely independent of any other and can quickly be removed from the machine. Lubrication throughout is designed to reduce wear and friction to a minimum.

Made in following sizes:

6 x 20	6 x 30
8 x 36	8 x 54
12 x 36	12 x 54

Equipped with all automatic feeds and arranged for motor drive on request.

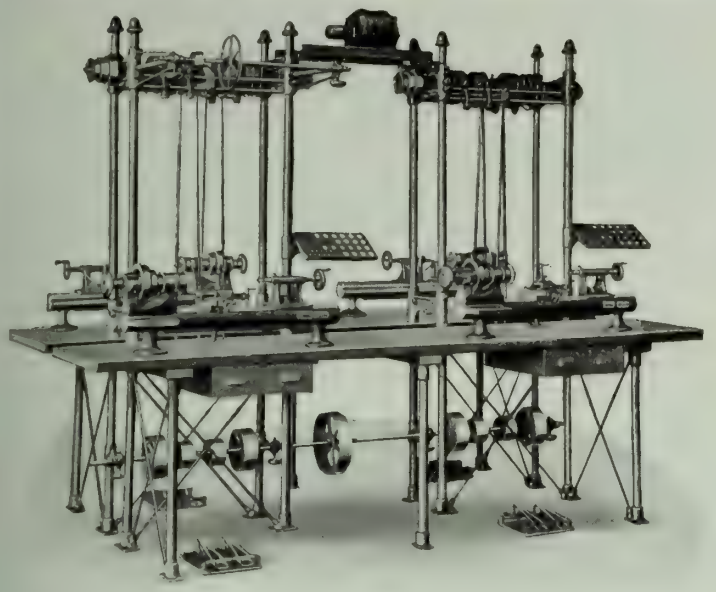
Ask us for complete specifications on this machine.

Fitchburg Grinding Machine Co., Fitchburg. Mass

Garlock-Walker Machinery Company, Limited

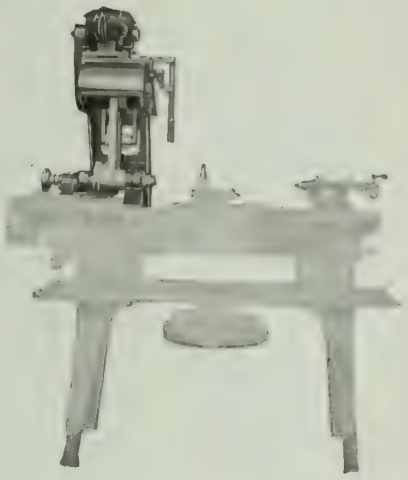
32 Front St. West

Montreal TORONTO Winnipeg

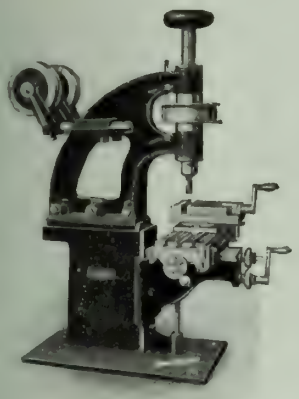


Cataract R-4 Double Bench Unit with Under-Drive.
(Details in No. 15 Catalogue.)

The equipment shown to the left being self-contained, is particularly well adapted for tool room work or manufacturing of duplicate parts both in first and second operations.



Cataract Quick Change Swing Precision Lathe, with Motor Drive.

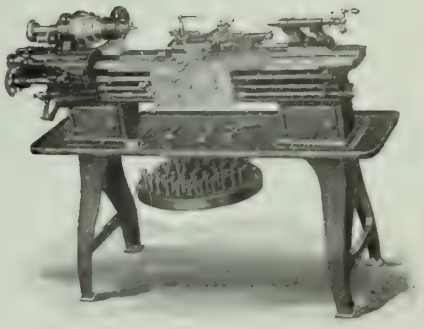


Cataract Bench Miller, with Vertical Head.
(Details in No. 15 Catalogue.)

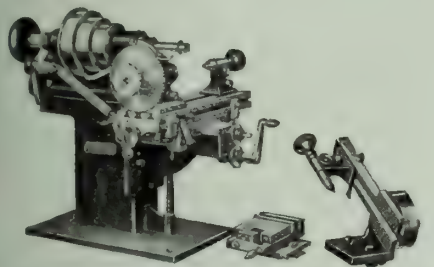
"CATARACT"

Throughout the entire line of tools manufactured by Hardinge Brothers, Chicago, U.S.A., means best material, first-class workmanship, unexcelled finish, accuracy and interchangeability of fixtures that really interchange.

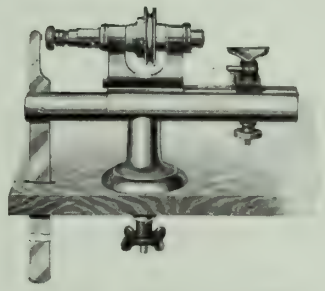
Write us for detailed information.



Cataract Quick Change Swing Precision Lathe, with Cone Drive.
(Details in special Catalogue.)

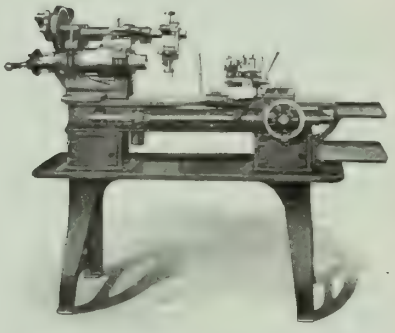


Cataract Bench Miller, with Horizontal Head.
(Details in No. 15 Catalogue.)



Cataract Filing and Polishing Head, with Lever Chuck Operating Device.

CATALOGUE NO. 15 FREE ON REQUEST



Cataract Turret Tool Post Lathe, manufactured in collet capacities from 1" to 5" inclusive.
(Details in special Catalogue.)

Garlock-Walker Machinery Company, Limited

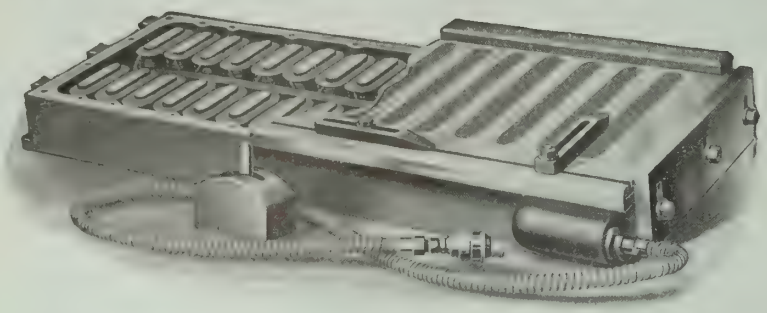
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MONTREAL TORONTO WINNIPEG

"Everything in Woodworking and Metal Working Machinery"

If interested tear out this page and place with letters to be answered.

WHAT A MAGNETIC CHUCK IS FOR



"What Do I Want A Magnetic Chuck For?"

To reduce the time required to set work up and the cost of special fixtures. To increase the production of your machines and operators. To handle work, impossible with mechanical fixtures.

"Where Can One Be Used?"

For holding any iron or steel work that has a flat surface that is fairly smooth on millers, planers, grinders, shapers, etc.

"Will It Hold Work Of Any Shape?"

Work having a flat, smooth surface is held best, but irregular shapes can be held by using an auxiliary top plate machined to fit the work.

"Will It Hold All Material?"

Any Magnetic metal can be held and some non-magnetic metal by using auxiliary steel pieces.

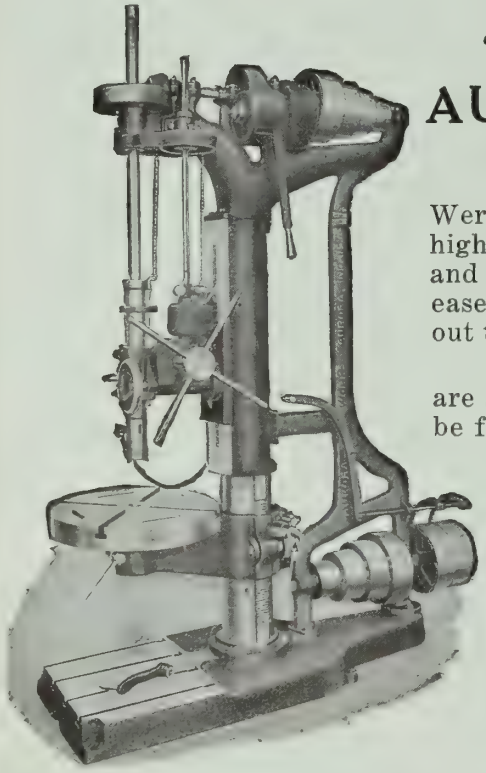
"Does A Chuck Magnetize The Work?"

Not cast iron or soft steel, but hardened steel retains its magnetism. This is quickly removed with a demagnetizer.

Having learned why you should buy a chuck, write for a catalogue and learn why you should buy a HEALD.

HEALD MACHINE CO., - - WORCESTER, MASS.

Sales Agents: GARLOCK-WALKER MACHINERY CO., LIMITED



Column and Spindle and all Shafts are ground true to size. All Gears fully enclosed

"Economy" is the Nation's Slogan To-day

AURORA DRILL PRESSES WILL SAVE YOU TIME AND MONEY

Were designed and are built to meet the demand for a heavy duty, high-speed drilling machine, having a wide range of adjustment and embodying features that assure efficiency and rapid production, ease of manipulation, heavy pulling power and accuracy throughout the life of the machine.

THESE DRILLS

are supplied with back gear, geared feed, automatic stop, and can be furnished with either one or all of the following features, viz.:

Tapping Attachment **Drill**
Compound Table **Lubricating Outfit**
and Motor Drive

DELIVERIES: 24 in., 26 in., 36 in., 24 in. and 32 in. with tapping attachments—IMMEDIATE; 28 in. and 32 in.—TWO WEEKS. Other sizes on application.

Let Us Send You Details—You'll be Interested

THE AURORA TOOL WORKS

AURORA - - - INDIANA

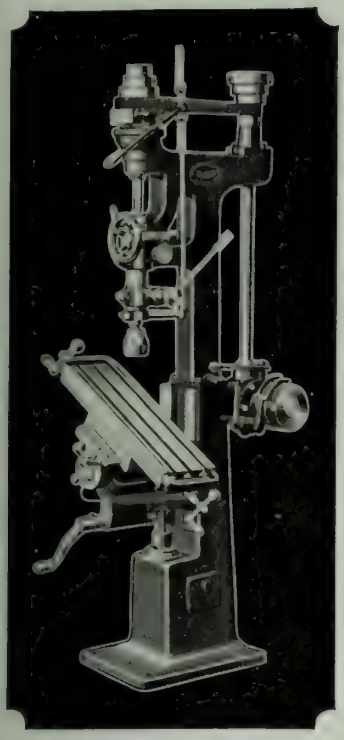
GARLOCK-WALKER MACHINERY COMPANY, LIMITED

WINNIPEG 32 Front Street, West TORONTO MONTREAL

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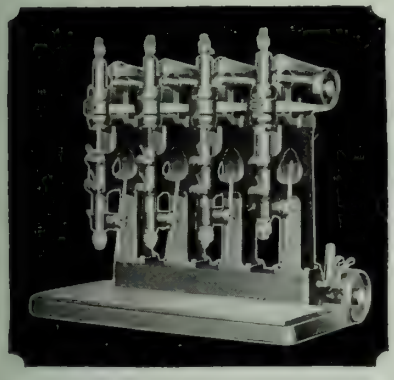
Demco Dependable Drills

DEMCO Drills represent the highest attainment in this type of equipment. They incorporate many improved features and refinements and are built to the highest standards. The perfect balance of all moving parts and the ball bearing equipment give ease of operation and long life without vibration. The combination of two or three features as found in some Demco machines effects a great saving of time and speeds up production appreciably. Read the following descriptions and then write for the new Demco Catalog.



No. 40

A compact combination-milling, drilling and tapping machine which is a great time and labor-saver. Especially adapted for the quick and accurate production of jigs, dies, tools, etc. Change for different operations is made almost instantly without shifting belt. Wick oiling system on main spindle is an exclusive feature of this machine.



No. 34

Four-spindle bench type drill with all moving parts carefully balanced and equipped with annular ball bearings. Made with 1, 2, 3 or 4 spindles. Incorporates a number of Demco improvements and is capable of a large volume of high quality work.



No. 38

A drilling and tapping machine which combines facilities for drilling at high speed and tapping at low speed. Change is almost instantly made, without shifting belt. Made in 1, 2, 3 or 4 spindles. Wick oiling is also a feature of this machine.

NO. 36

Heavy model floor type ball bearing drill having every facility for high speed and accurate production. A rigid, compact and wholly practical machine that is used to great advantage in the busiest factories. Made in 1, 2, 3 or 4 spindles.



Garlock-Walker Machinery Co., Limited

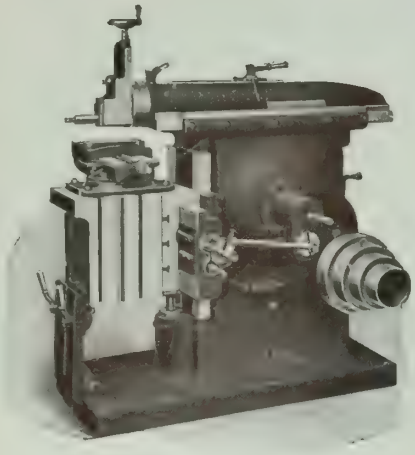
Toronto, - Ontario

Agents for

The Demco Machine Tool Co.
Cleveland, Ohio.

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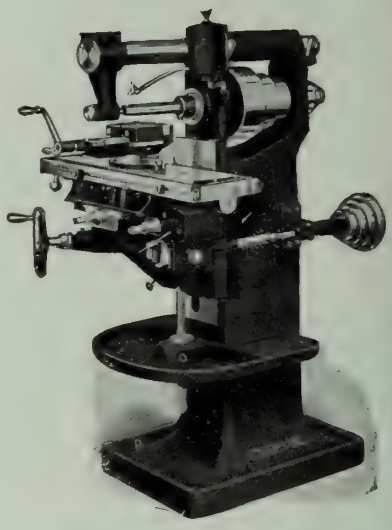
Steptoe Shapers and Milling Machines



are built with a knowledge gained through seventy-four years' experience in the manufacture of high grade machine tools.

Shapers: 14 in., 16 in., 20 in., 24 in. equipped with ordinary belt drive or single pulley drive through gear box.

Milling Machines: 10 in., 15 in. and 19½ in. by 6¼ x 12, hand or power feed, with or without back gears. Can be equipped with vertical attachment.



Get particulars from

Garlock-Walker Machinery Company, Limited

32 Front St. West, Toronto

MONTREAL - - WINNIPEG

"Everything in Woodworking and Metalworking Machinery"

WING SURFACE GRINDER



Not a big costly machine, but a capable moderately-priced grinder whose every part is extra strong.

The grinding surface is as rigid as it should be for accurate work.

Parts are easily adjusted.

Power is ample for rapid, economical accomplishment.

The large tray and water pot combined is a feature every operator appreciates.

Manufactured by

J. E. Wing & Son

HAMILTON ONTARIO

Garlock-Walker Machinery Company, Limited

32 Front Street West, Toronto, Canada

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"Everything in Wood-working and Metal-working Machinery."

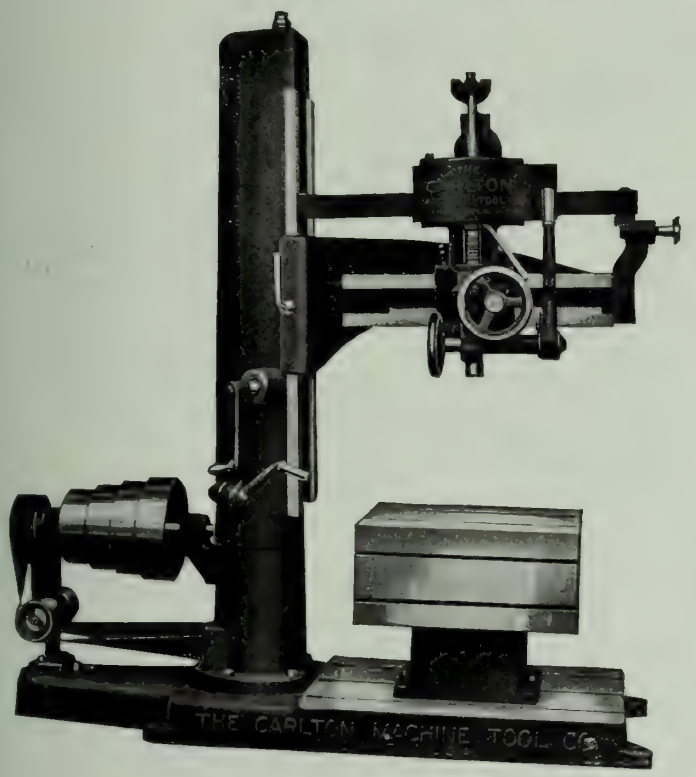
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Here's an example

of the money-saving possibilities of the Carlton Radial on speedy production work.

THINK of 340 holes tapped and 20 reamed in one hour! The work is transmission cases in a large automobile factory — seventeen tapped holes and one reamed hole, some 3/8", others 5/16", spread over five sides of the case. It may sound like a fairy tale, but the steady, every-day production of the Carlton on this work is 20 cases per hour.

"Speedy Sensitive"
Carlton Radials



The sensitive, accurate control which permits economical tapping and reaming at this speed is the same quality which permits the accurate drilling of deep, long holes in tough metals without drill breakage.

Accuracy, range, power, speed, sensitive control—the five distinctive features of Carlton Radials that mean profitable production when speed is essential.

The Carlton Radial may be belt or motor driven and may be had with a 2½', 3', 3½' or 4' arm; capacity to 1" solid steel. Description on request.

The Carlton Machine Tool Co.
CINCINNATI, OHIO

Garlock-Walker Machinery Co., Limited

32 Front Street West,

MONTREAL TORONTO WINNIPEG

"Everything in Woodworking and Metal Working Machinery"

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Pattern Shop Machinery seen at the American Foundrymen's Convention at Philadelphia



Canadian visitors at the Philadelphia Convention will remember the fine display of Pattern Shop Machines made by American Wood Working Machinery Co., of Rochester, N.Y.

We represent this Company and have always on hand a stock of their machines for immediate shipment. There are none better.

A New Catalog

A catalog of Woodworking Machinery for the Pattern Shop has just been issued by the American Wood Working Machinery Co. A copy is yours for the asking.

Garlock-Walker Machinery Company, Limited

32 Front St. West, TORONTO, CANADA

"STELLITE"

The essential need for production in shell work during the war has educated the manufacturer to demand more from his plant in times of peace.

As STELLITE was used in over 90 of the shell plants in Canada and Europe, and increased the production to a considerable extent, it is evident that to obtain maximum results from your machines it will be necessary to use this MASTER METAL.

STELLITE is just as valuable in ordinary engineering work as on shells, as our demonstrators can prove to you if permitted.

WRITE US

Deloro Smelting & Refining Company, Limited

DELORO, ONTARIO

Branch Warehouses :

200 King St. West
TORONTO, Ont., Can.

74 Corporation St.
BIRMINGHAM, Eng.



STELLITE

Not Steel But Its Master

DIRECTIONS FOR GRINDING STELLITE

FOR CAST IRON

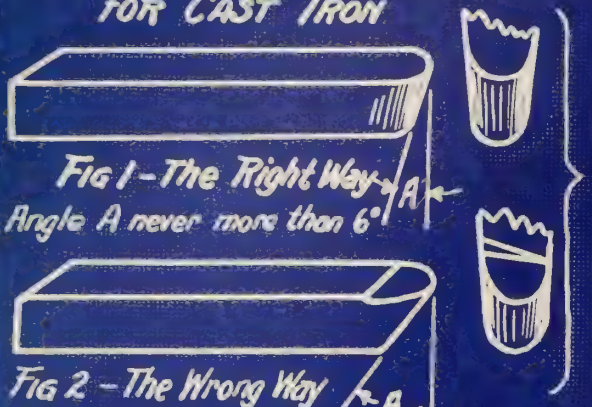


Fig 1 - The Right Way
Angle A never more than 6°

Fig 2 - The Wrong Way
Angle A too great
not enough support to cutting edge

FOR 20 to 100 Point Carbon Steel



Fig 1 - The Right Way
Angle A never more than 6°

Fig 2 - The wrong way
Angle A too great



Fig 1 - The Wrong Way

Fig 2 - The right way



Fig 3 - The result of wrong Way

Fig 4 Result of right way

ADDITIONAL COPIES OF THIS CHART CAN BE PROCURED, ON REQUEST FROM THE DELORO SMELTING AND REFINING COMPANY, LIMITED, 200 KING STREET WEST, TORONTO, CANADA

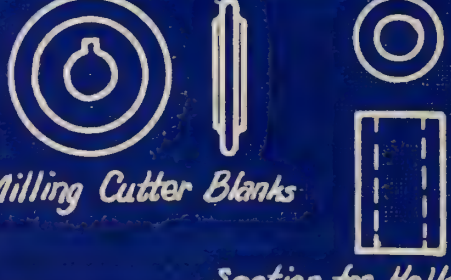
A FEW SPECIMEN SHAPES TO WHICH STELLITE HAS BEEN CAST TO SUIT CUSTOMER'S REQUIREMENTS



Sections cast to any desired shape



Form Tool Shapes of all kinds can be made



Milling Cutter Blanks

Section for Hollow Mills

DOMINION PRODUCTS DOMINATE

RUBBER
MANUFACTURING
MACHINERY
Rolls, Calenders, Presses, Cores, Moulds, etc.

ROLLING MILL EQUIPMENT

POWER UNITS
Heavy Oil Engines
Electric Light and Power Plants
1, 3 and 5 K.W. Direct-Connected Electric Light and Power Plants
(Gasoline and Kerosene)

MARINE
Line and Propeller Shafting, Stern Tubes, Glands, Rudder Stocks, etc.

LATHE CHUCKS
Four-Jaw Independent Chucks,
10 to 24 inches
Steel or Cast-Iron Bodies

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DOMINION
BRANTFORD CANADA

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BRANTFORD, ONT. - - - CANADA
Cable Address: "DOMINION, BRANTFORD" Codes Used: A.B.C., 5th Edition

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MORRISON'S



Quality



Boiler Mountings

Engine Supplies

Steam Specialties



The Guarantee J.M.T. TRADE MARK REGISTERED *of Quality*

A Partial List of Our Lines:

Stop Valves	Steam Gauges
Check Valves	Vacuum Gauges
Gate Valves	Ammonia Gauges
Safety Valves	General Boiler Mountings
Relief Valves	Gauge Board Oufits
Reducing Valves	Lubricators
Steam Traps	Pipe Fittings
Injectors	Steam Whistles
Ejectors	Engine Indicators
Inspirators	Pipes, Tools, etc.
Jet Pumps	

STEAM goods and specialties that meet every requirement of the engine and boiler room, stamped with the Morrison Hall Mark of quality and reliability.



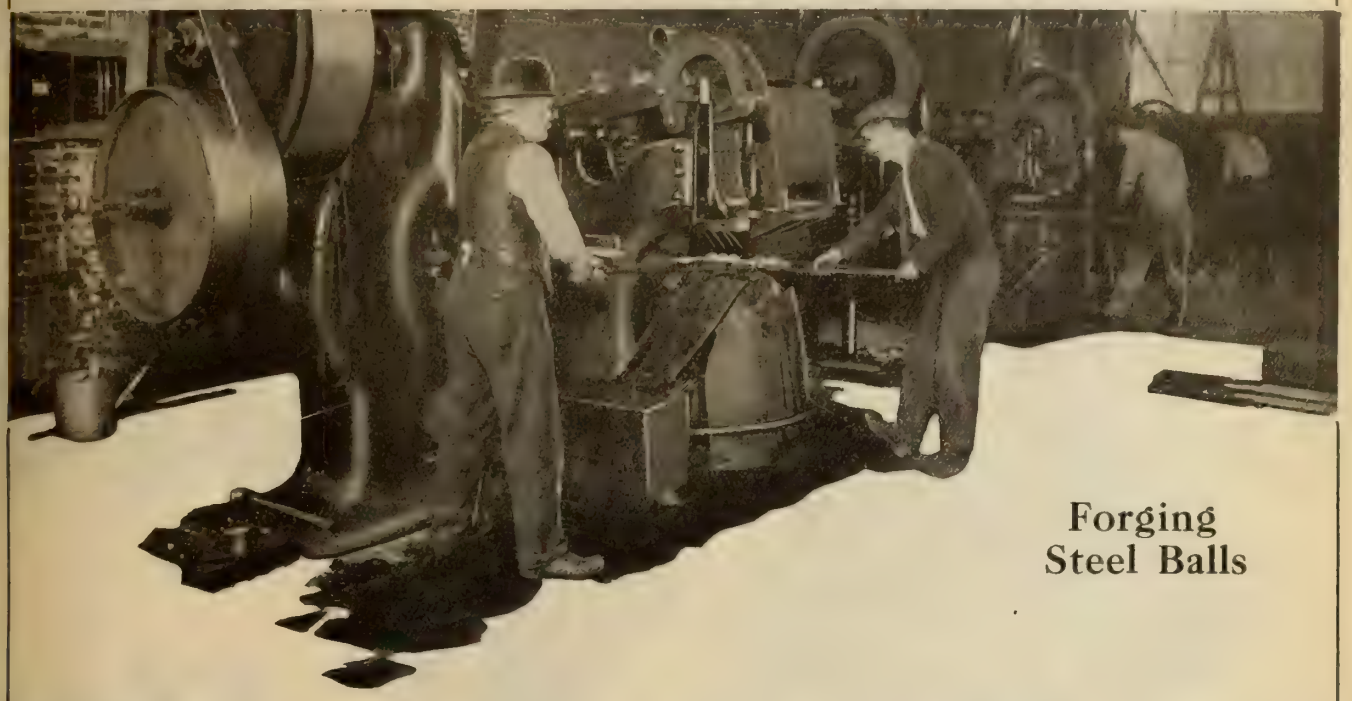
Every Article Factory Tested and Guaranteed



The James Morrison Brass Mfg. Co., Limited

93-97 Adelaide St. W., Toronto, Ont.

THE BRADLEY
Upright Strap Hammer



Forging
Steel Balls

—"The Blows of the Hammer Must Be Properly Regulated to Give the Balls a Homogeneous Grain"—

This—a feature of the ATLAS BALL—whose makers guarantee in language not to be mistaken, the accuracy and fidelity of their product.

Bradley Hammers are serving the ATLAS people—to their full satisfaction—that goes without saying.

The Bradley method of forging high chrome carbon steel balls from round bars means a great saving over forming on a screw machine, where there is a big loss in the stock cut away. Balls forged under a Bradley Hammer, out of a solid bar, are as here shown—and are afterwards separated and ground to size.

YOU CAN "MACHINE" FORGINGS UNDER A BRADLEY HAMMER. ACCURACY TO 0.005″ IS EVERY DAY WORK FOR A "BRADLEY". "FORGE AHEAD WITH A BRADLEY HAMMER."

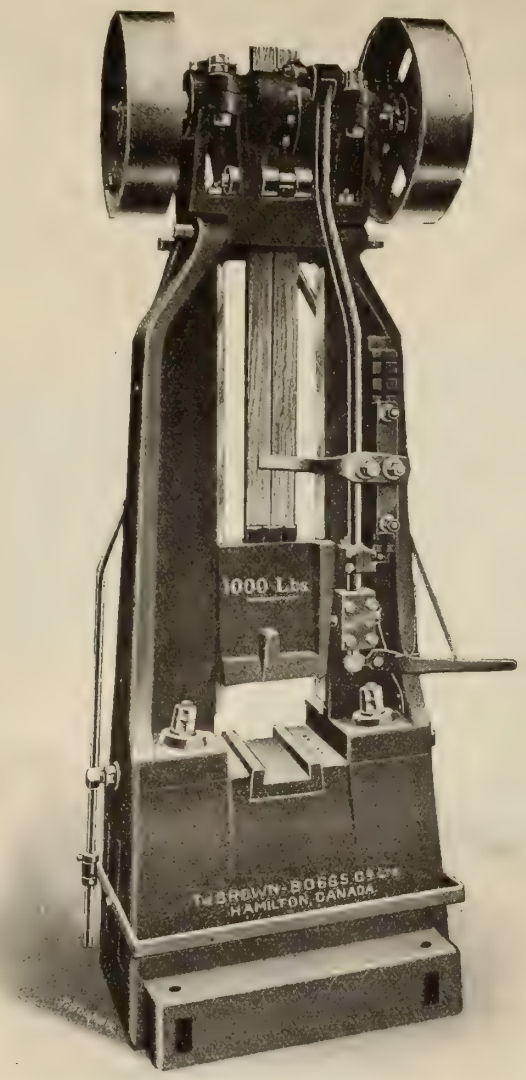
Our printed matter is yours for the asking.

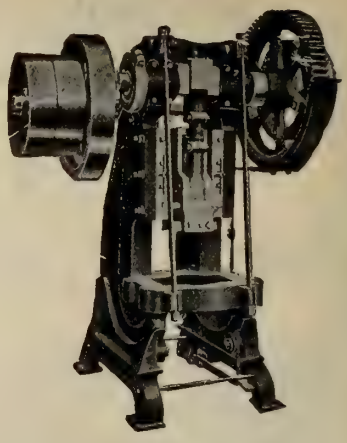
C. C. BRADLEY & SON, INC.
SYRACUSE, N.Y., U.S.A.

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ESTABLISHED IN 1832

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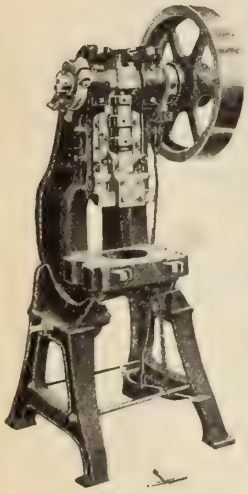




No. 215—Power Press

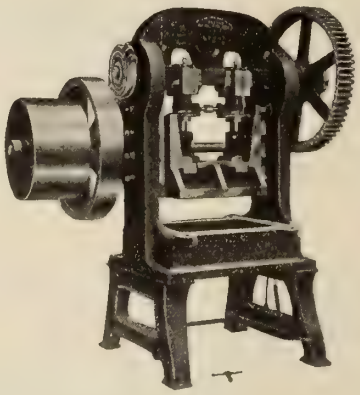
Bro

Sheet

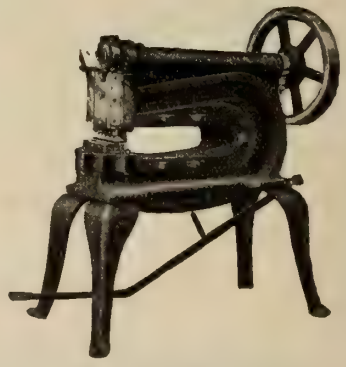


Forty years' practical experience in this line is concentrated in every "B.B." Tool.

B B Co Ltd.

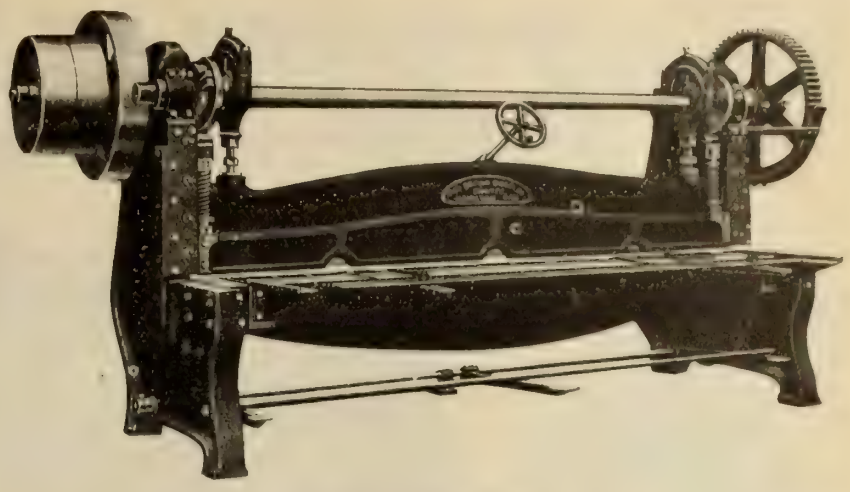


No. 20½—Power Press



No. 126—Deep Throat Power Punch





No. 956—Square Shear

wn-Boggs

Metal Workers' Tools

Our line comprises shears of all kinds, power presses for punching, forming, embossing, blanking, etc. Tinsmiths' tools and sheet metal working machines of every description, also canners' and evaporators' machinery.

"B-B" Quality and Service pave the way to economical production everywhere.

Orders for export receive our special attention.

The Brown, Boggs Co., Limited

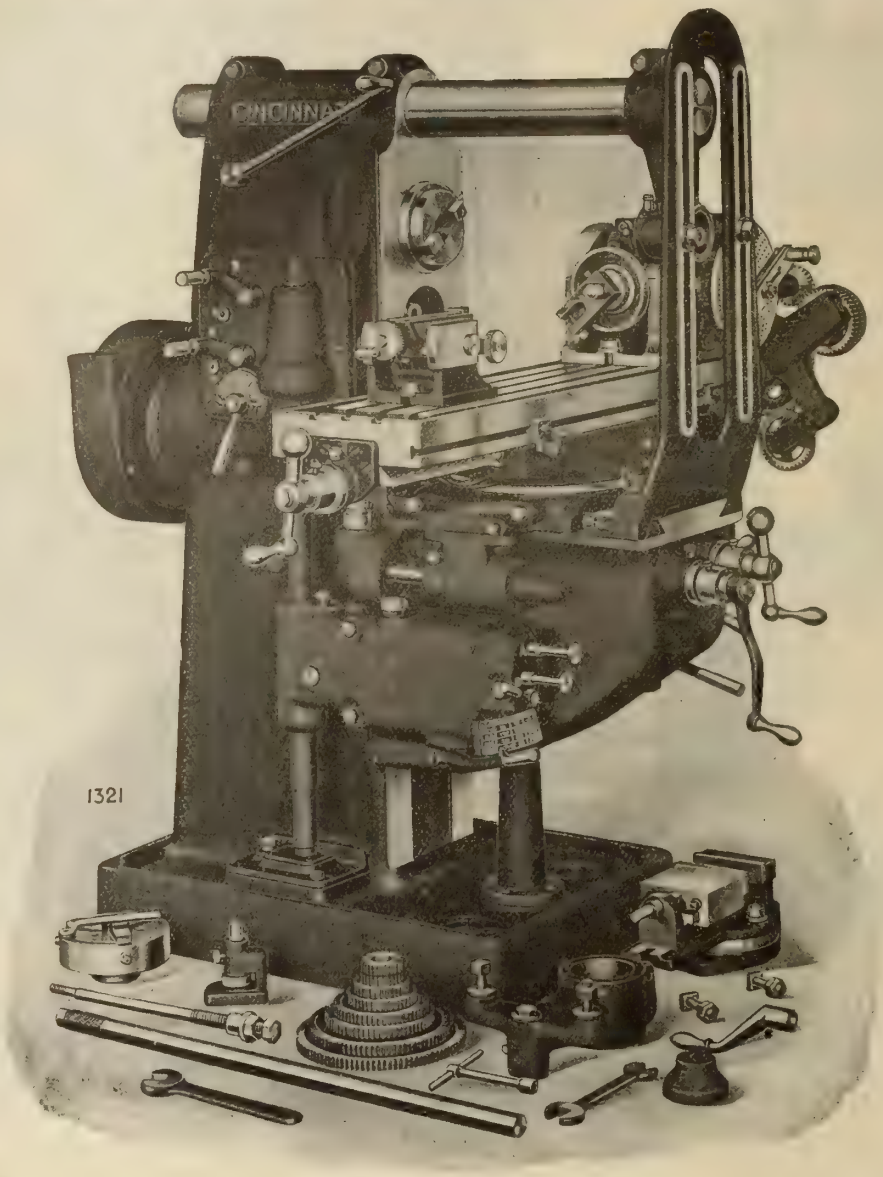
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Announcing a new line of

Small Constant Speed Drive Millers



Patent Rights Fully Reserved

1 M and 2 M
Plain, Universal and Vertical

ASK US FOR CATALOG OF THESE NEW M-TYPE MILLERS

THE CINCINNATI MILLING MACHINE COMPANY

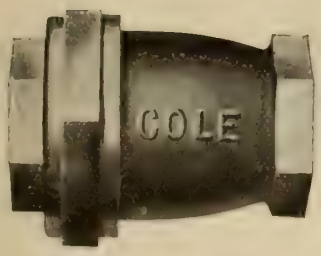
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H. W. PETRIE, LTD., TORONTO, ONT.
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Check Valves Are Always Required Around Your Plant

When Buying, Why Not Buy the Best ?



Straight Way Valve.



Interior View.



Angle Check Valve.

This is a three-piece Union Check Valve, combining Valve and Union.

Taken apart easily for regrinding. Valve section can be used until entirely worn out. Thrown away, and renewed at trifling cost. Two-thirds of the valve remains in service. Figure out the saving.

The Angle Check Valves can be used at any angle. Right hand, left hand, descending or rising discharge.

When you next need Check Valves, ask us for prices and particulars of this Valve.

An Automatic Boiler Feeder and Condensation Return Trap buys itself in a steam plant in thirty to ninety days through the savings it effects in steam production.



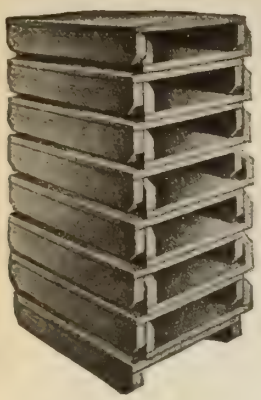
This is the best appliance of its kind in the market to-day. Effective in operation, economical in upkeep. Easy to install and suitable to any heating or process work where condensation is to be handled economically.

Ask us for information relating to its use in your plant.

GEO. W. COLE, LIMITED

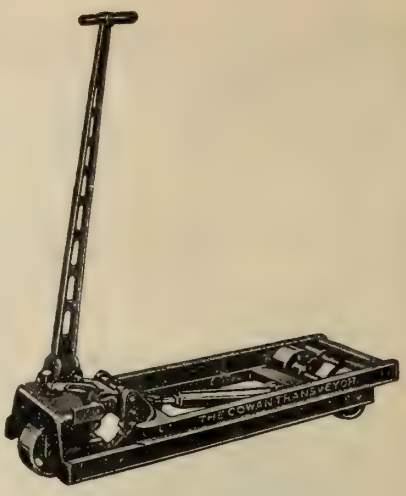
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Cowan Transveyor System

Moving "Production" the easy way. Transveyor moves and stores all kinds of material, saves 35 per cent. floor space, increases "production" 75 per cent., eliminates ONE to FOUR truckers, keeps your material off the floor, thus saves spoilage; reduces insurance rates, and above all, puts PEP in the men.
Built to LAST. 40 different sizes or built to your order. Full particulars upon request. Write to-day for our booklet on "How to Apply the Transveyor to Your Business."



"Read Our Guarantee"

COWAN TRUCK COMPANY'S GUARANTEE
OF TRANSVEYOR NO._____ TYPE_____ CAPACITY 5000 lbs.

THE COWAN TRUCK COMPANY guarantees this ALL STEEL TRANSVEYOR against defective workmanship and defective materials for a period of five years from date.

This TRANSVEYOR is guaranteed to be ALL STEEL with the exception of its wheels and release check.

THE COWAN TRUCK COMPANY agrees to replace any defective parts, or this entire ALL STEEL TRANSVEYOR, with a new ALL STEEL TRANSVEYOR, as it may elect, provided defective material or workmanship are shown. It is a part of this guarantee that all claims in this agreement are to be forwarded for exhibit, to the COWAN TRUCK COMPANY, HOLYOKE, MASS., for consideration and decision.

The ALL STEEL TRANSVEYOR bearing serial number indicated above is a product of the highest engineering skill obtainable and is guaranteed to operate correctly when handling loads not in excess of the capacity indicated above.

This guarantee is made possible because the COWAN TRUCK COMPANY has built into this ALL STEEL TRANSVEYOR the best procurable in design, workmanship and materials.

If this ALL STEEL TRANSVEYOR is given reasonable care it should be a source of as much satisfaction, economy and gratification to you, its purchaser, as we wish it to be to us, its manufacturer.

COWAN TRUCK CO.
HOLYOKE, MASS.

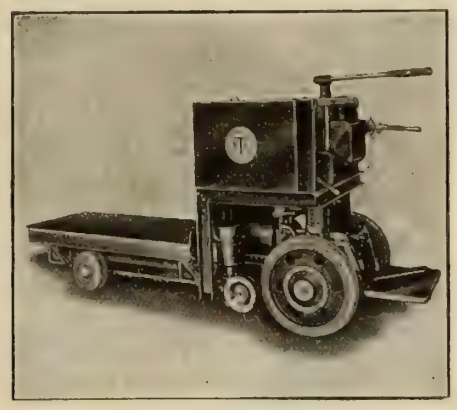
Canadian Agent
G—1—M

R. B. SMILEY

120 Glenholme Ave., Toronto, Ont.

THE I. T. C.
ELEVATING TYPE

E. L. Type



E. L. Type

ELECTRIC

QUALITY SERVICE

Promote "Efficiency" in your plant by eliminating all unnecessary re-handling of materials, by having one man and an Electric do what ten "hand" truckers are now doing, by using 35% less floor space, by increasing production 75%.

SAVE TIME AND LABOR

The E.L. truck runs smoothly and quickly over all kinds of floors and will negotiate a 30% grade. Inexperienced operators soon become experts. This type of truck will pay for itself within 3 to 9 months.

The I.T.C. electric trucks are made from A-No. 1 material only; built to stand the wear and tear; workmanship of the highest quality. The I.T.C. stamp on an electric means "PERFECTION." Experienced engineers at your service. Investigate this truck to-day.

Write to Truck Headquarters for full particulars

COWAN TRUCK CO.
HOLYOKE, MASS.

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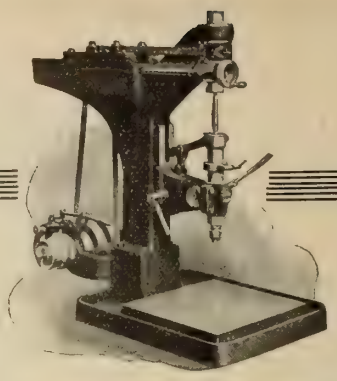
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EL-3M

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Ball Bearing Drilling Machines



The Avey

SIZES, SPEEDS, CAPACITIES

to suit each specific job.

HIGH SPEEDS, CLEAN HOLES

Our No. 3 machine provides maximum speeds for work up to 1⅛-inch.

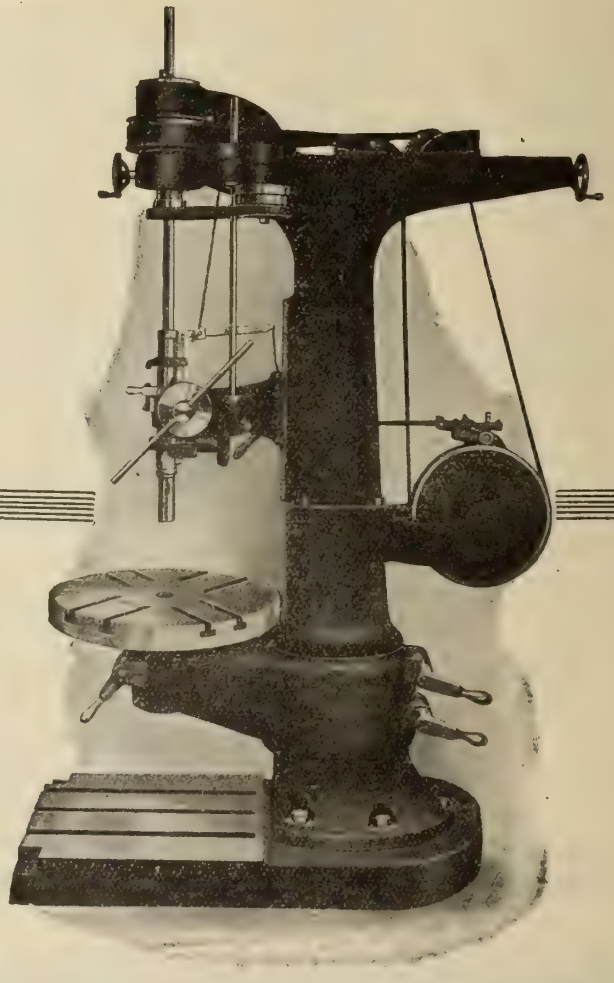
Our No. ½ machine for light work may be run at 12,000 r.p.m.

Other Sizes for Intermediate Work

Real Manufacturing Means Specializing

Get the Right Machine

The Avey Makes Big Jobs Look Small

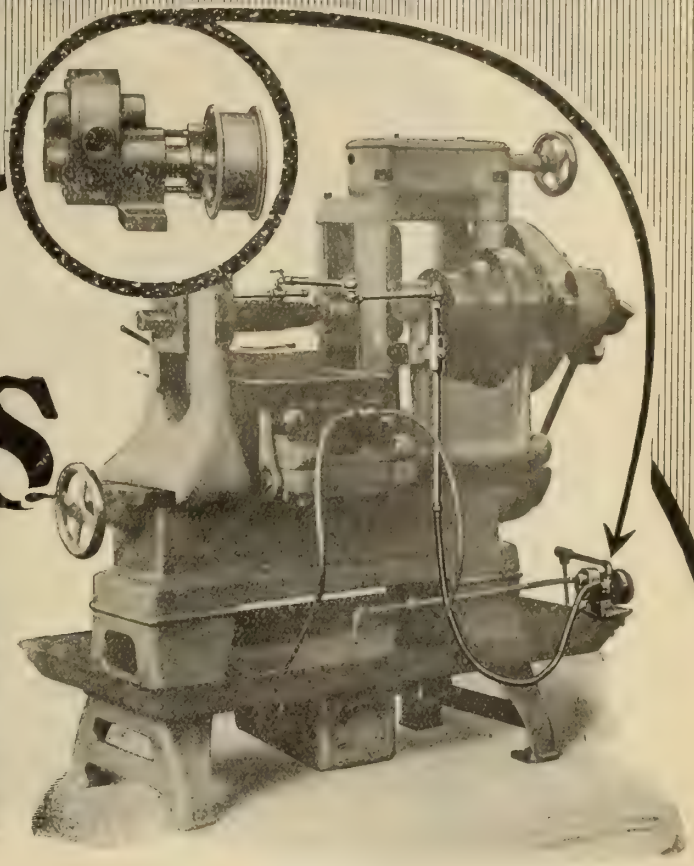


The Cincinnati Pulley Machinery Company

CINCINNATI, OHIO, U.S.A.

TRAHERN

Rotary Geared Pumps



AFTER YEARS

of competition still stand out as the logical installation for circulating lubricant on machine tools. Pumps are reversible, will operate against 100 lbs. pressure, at low speed (long life) and shoot heavy, continuous, forceful streams of water and oil. If installed as directed, guaranteed not to lose there prime.

PLAY SAFE

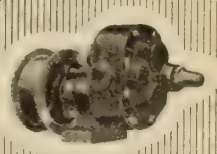
and insure your product against undue criticism by equipping it with TRAHERN ROTARY GEARED CIRCULATING PUMPS. A good pump on a machine tool is a fine talking point for your salesmen and also a good point to advertise.

Besides this you can feel sure that the good reputation of your machine is in safe keeping if you install a TRAHERN to supply its cutting tools with coolant.

Write for Bulletin No. 44 at once

TRAHERN PUMP DIV.
Geo. D. Roper Corp.
Rockford, Illinois, U.S.A.
Represented in Canada by
A. R. Williams Machinery Co.

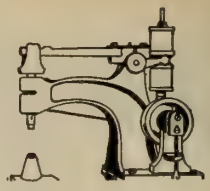




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THE PRINCIPLE IS RIGHT
THE HAMMER WITH THE HUMAN STROKE



SHOULDERING THE WORLD'S RIVETING

THE HIGH SPEED WAY; DOING THE WORK OF FIVE HAND RIVETERS





THE HIGH SPEED HAMMER COMPANY, Inc.

ROCHESTER, N. Y., U. S. A.

The High Speed Hammer

HEAD RIVETS COLD

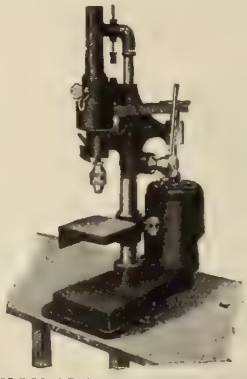
Flush or Countersunk at the rate of

A rivet a second up to 3-16".
A rivet in 2 seconds, ¼" to 5-16".
A rivet in 3 seconds, ⅜" to ½".
A rivet in 5 to 8 seconds, ⅝" to ¾".
A rivet in 10 to 20 seconds, ⅞" to 1½".

Finished any shape desired, tight or loose.

BUILT IN 8 SIZES

Send us B/P of your work.



HIGH SPEED DRILL PRESS

MODEL E-50 HIGH SPEED

MOTOR-DRIVEN
BALL-BEARING

Sensitive Bench Drill Press

SPECIFICATIONS:

Height Over All	24"
Base	7½ x 18"
Diameter of Spindle	7/16"
Spindle Feed	2¼"
Weight	62 lbs.
Capacity	From Smallest to ¼" Drills

Exclusive Arrangements Considered Only With Organizations Prepared to Carry, At All Times, Representative Stocks

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

MADE IN CANADA



DOMINION

DOMINION grinding wheels made of abrasives from our own plant.

The only manufacturer of wheels in Canada controlling their product, from the raw material to the finished wheel.

Quality and uniformity guaranteed.

Let us quote prices and submit samples.

Dominion Abrasive Wheel Co.
Limited
MIMICO, ONT., CANADA

Grinding Wheels

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True File Insurance

COMES with the use of

P X H TRADE MARK AND IMPERIAL TRADE MARK

FILES

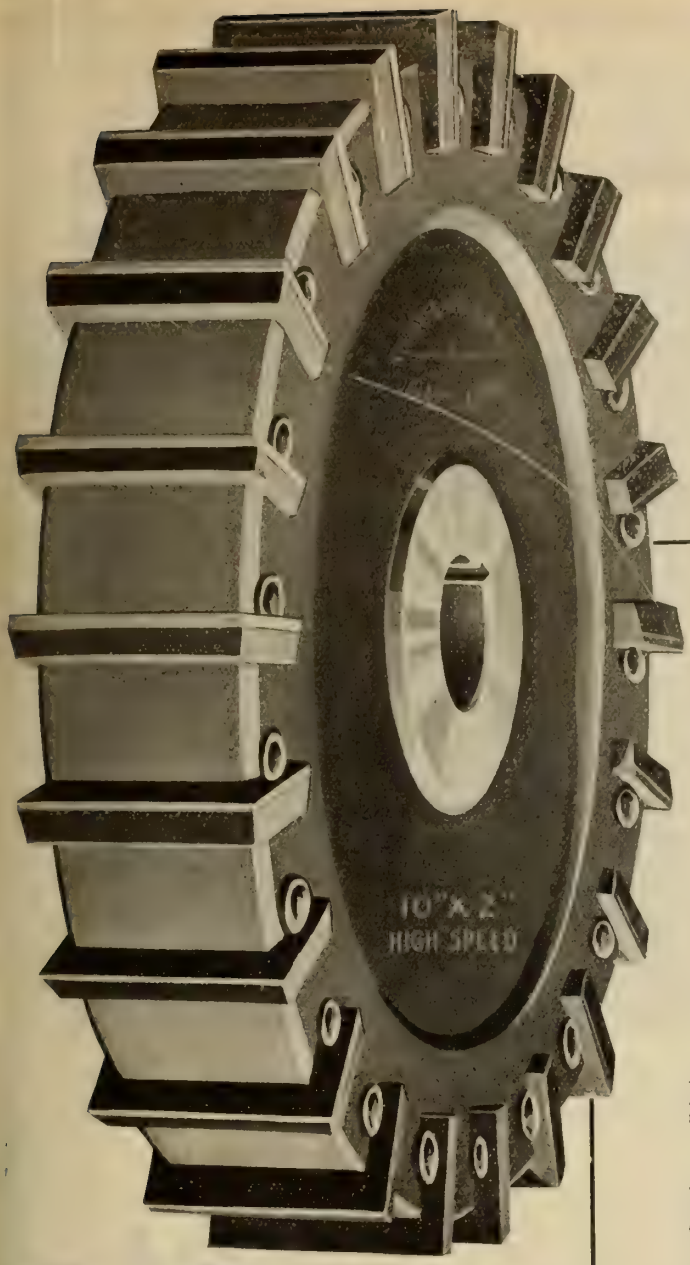
"They Cut Faster and Wear Longer"

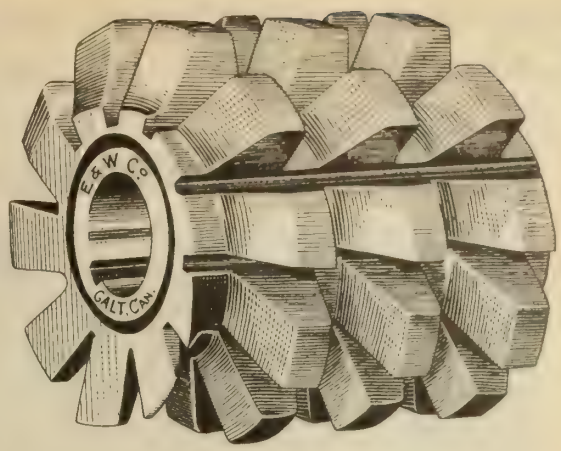


Ingersoll File Co., Ltd.
Ingersoll, Ontario

John Morrow Screw & Nut Company, Limited
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SOLE DISTRIBUTERS







High Grade

Milling Cutters

and

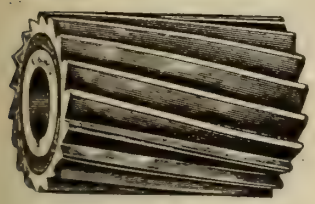
Small Tools

Plain and Side Milling Cutters, Inserted Tooth Cutters, End Mills, Interlocking Side Cutters, Angular, Concave and Convex Cutters; Gear Cutters, Hobs, Special Cutters, etc.

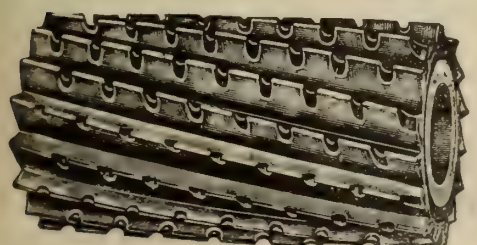
Hand Reamers, Chucking Reamers, Taper Pin Reamers; Lathe Mandrels and Arbors; Gauges, Jigs and Fixtures; Metal Stamping Dies, etc. May we send you a copy of our New Catalogue?

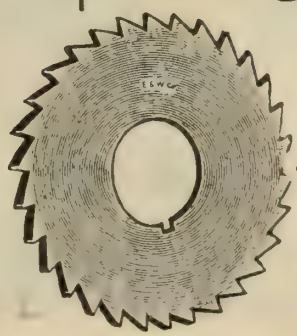












Elliot and Whitehall Machine & Tool Co.

GALT, ONT., CANADA

A trial of our tools will convince you that they have the quality that will put you on the road to reduced overhead and increased profits.



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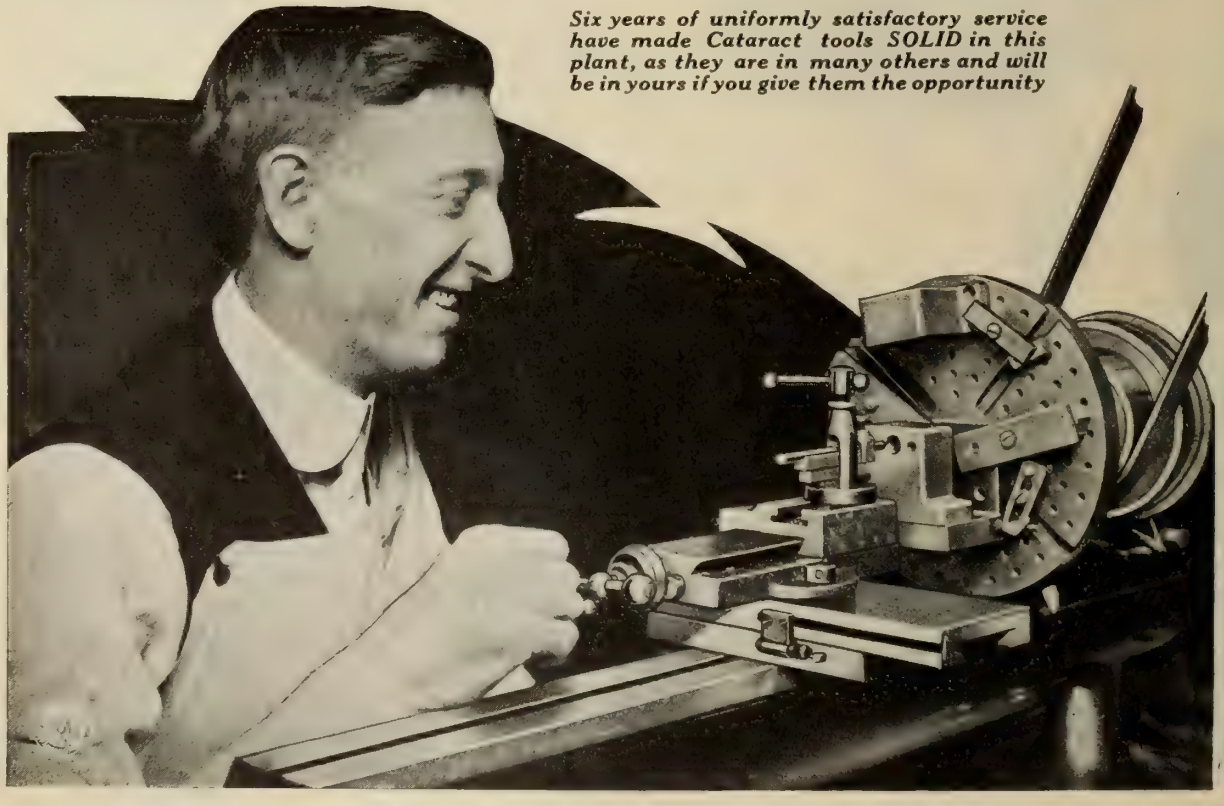
Cataract Bench Lathes and Attachments

are accomplishing remarkable results in shops of Canada and United States and Europe



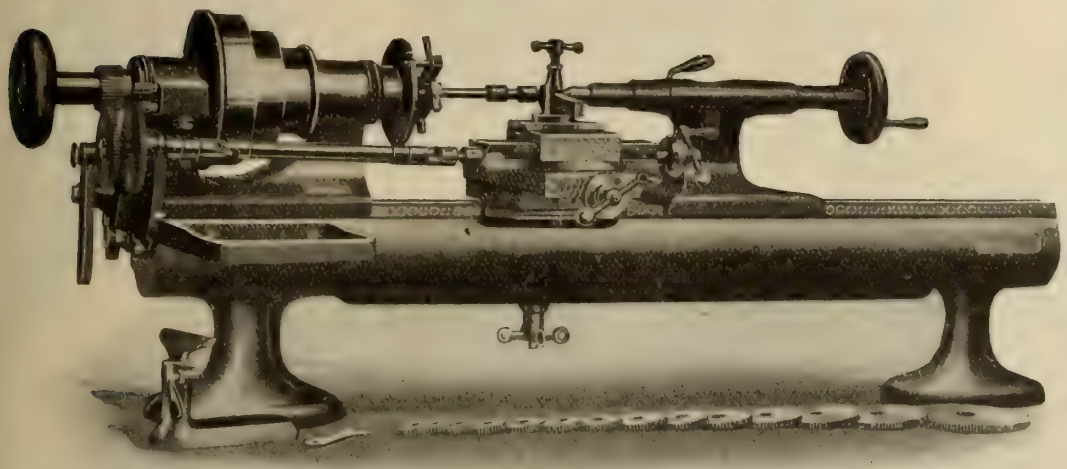
Study these illustrations closely. They indicate possibilities of CATARACT PRECISION TOOLS on special work and in general manufacturing. Past performances in numerous plants have proven their decided superiority. Let's show YOU.

Six years of uniformly satisfactory service have made Cataract tools SOLID in this plant, as they are in many others and will be in yours if you give them the opportunity



Cataract Bench Lathes and Attachments

Are Standard for Precision Work in Canada's Best Shops

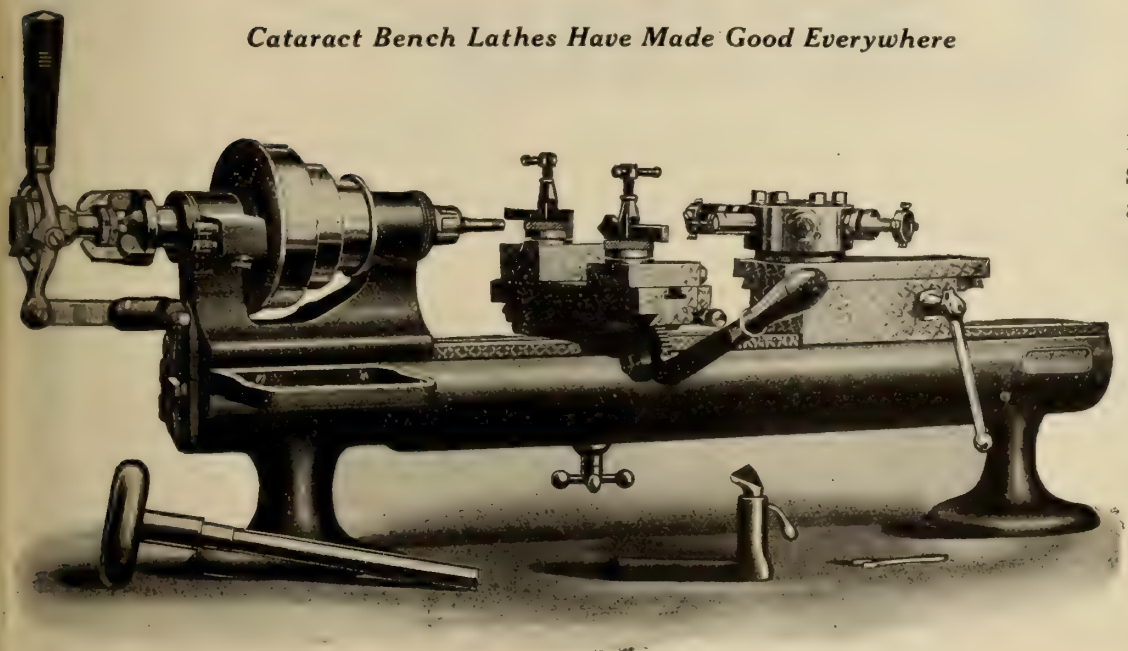


WRITE DIRECT TO US OR TO CANADIAN REPRESENTATIVES FOR PARTICULARS

THE CATARACT Quick Change Swing Precision Lathe for Tool Makers.
THE CATARACT Turret Tool Post Lathes.
THE CATARACT Precision Bench Lathes of which there are SIX SIZES.
THE CATARACT Automatic Gear Cutting Machine.
Draw Back Chucks and Screw Machine Collets of ALL SIZES

Cataract Bench Lathes are finely constructed precision tools, with responsive controls, simple adjustments and numerous convenient attachments adapting them to a wide variety of work. **Study this illustration.** Note the base, the circular bed, the sliding tool post, massive head stock (indicating strength), range of gears, special tailstock, arrangement of gears.

Cataract Bench Lathes Have Made Good Everywhere

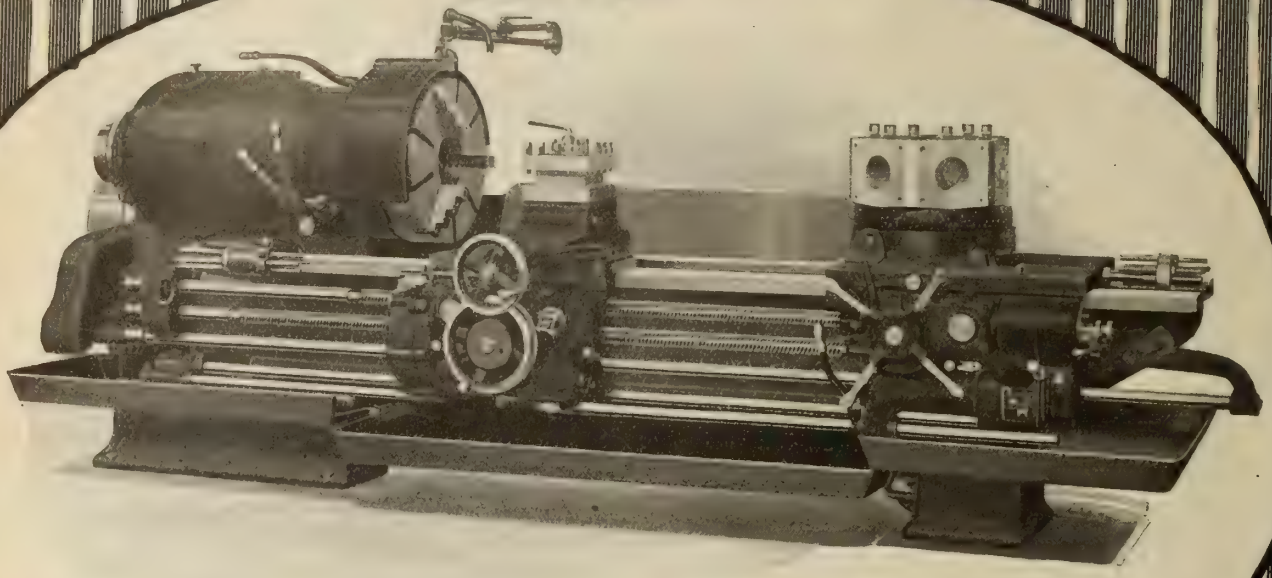


Our catalogue is gotten up in a most attractive manner and aptly illustrates and gives details that you will be interested in studying. We invite you to write for one.

HARDINGE BROS., 1770 Bertau Avenue, Chicago, Ill.

Canadian Representatives: Garlock-Walker Machinery Company, Limited
Montreal - Toronto - Winnipeg

Libby Turret



Lathes

THE "LIBBY" Lathe is built in a shop that makes nothing except "LIBBY" Lathes and the attachments and tools that go with "LIBBY" Lathes. Handles bars up to 7½ in. in diameter, and chucked parts up to 26 in. in diameter.

THE "LIBBY" Heavy Duty Turret Lathe has proven by actual practice, in shops everywhere, for the last twelve (12) years that it has no peer in HEAVY BAR and CHUCKING WORK where strength, power, rigidity and accuracy are required.

THE INTERNATIONAL MACHINE TOOL CO. maintains an engineering force of specialists on heavy turret lathe work. It costs you nothing to find whether this force can help you with your heavy bar and chucking work problems. Consult with us.

Send for catalog of this proven up-to-the-minute modern production machine. Do it now. Write us.

International Machine Tool Company

Indianapolis, Indiana, U.S.A.

KELLY PRODUCTION TOOLS



ON MOTOR TRUCK PARTS

THEY ALL USE

KELLY TOOLS

IN

MOTOR PRODUCTION

It will be difficult, if not impossible, to find an American made Automobile, Truck or Tractor, which does not have some of its parts machined with Kelly Tools.

From the highest grade, and price, to the cheapest thing on wheels—they are all connected with the Kelly Tool family in some way.

We design and manufacture special boring and reaming tools and line bars for all kinds of machinery production.

Engine Cylinders
Gear Blanks
Crank Cases— Cam and Crank Bearings
Transmission Cases
Auto Parts, Hubs
Connecting Rods

KELLY CO-OPERATIVE SERVICE

The unlimited number of combinations that may be obtained in our Reamers and Production Tools makes it impossible to illustrate and list more than a small portion of them in our catalog, and we, therefore, offer the trade the services of our engineering department, to assist in making up combinations adapted to various machines and fixtures, submitting detailed drawing of proposed tools, prices, etc. A drawing or sketch of the parts will enable us to do this and does not place prospective purchasers under obligation.

Our new catalogue, K-4, just off the press, will interest all engineers and production men.

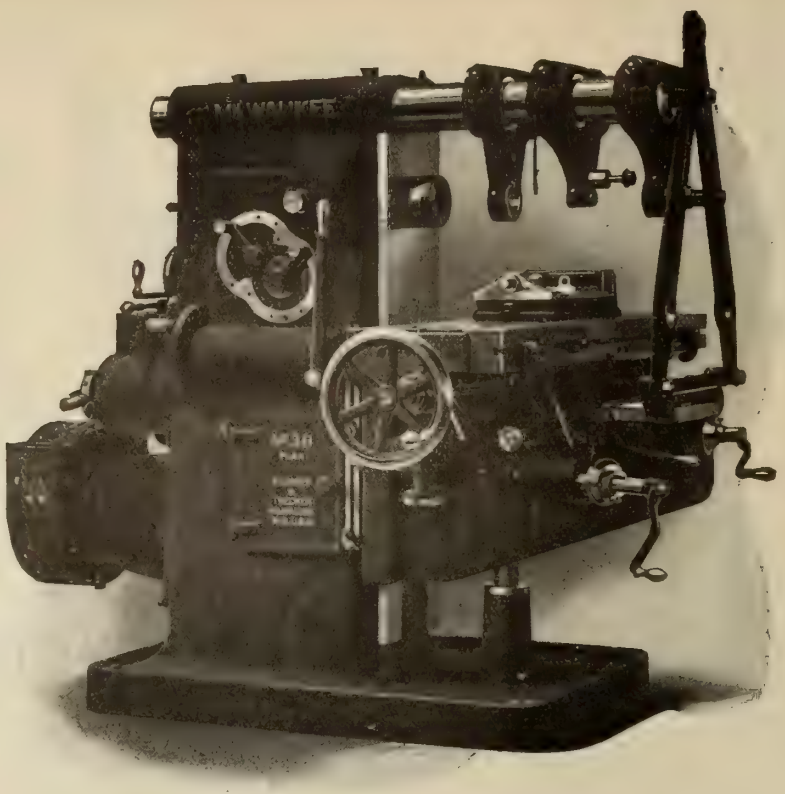
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THE KELLY REAMER CO.

1544 Columbus Road

Agencies in Principal Cities
CLEVELAND LONDON, BURTON-GRIFFITHS & CO. OHIO, U.S.A.
PARIS, BURTON FILS

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MILWAUKEE MILLING MACHINES

Double Overarm maintains alignment.

It is impossible for the operator to place the arbor supports on the arbor and double overarm in any other way than in line. Arbor cannot be pounded out of line when using large, coarse pitch cutters on rough, heavy work.

Other Distinctive Milwaukee Features:

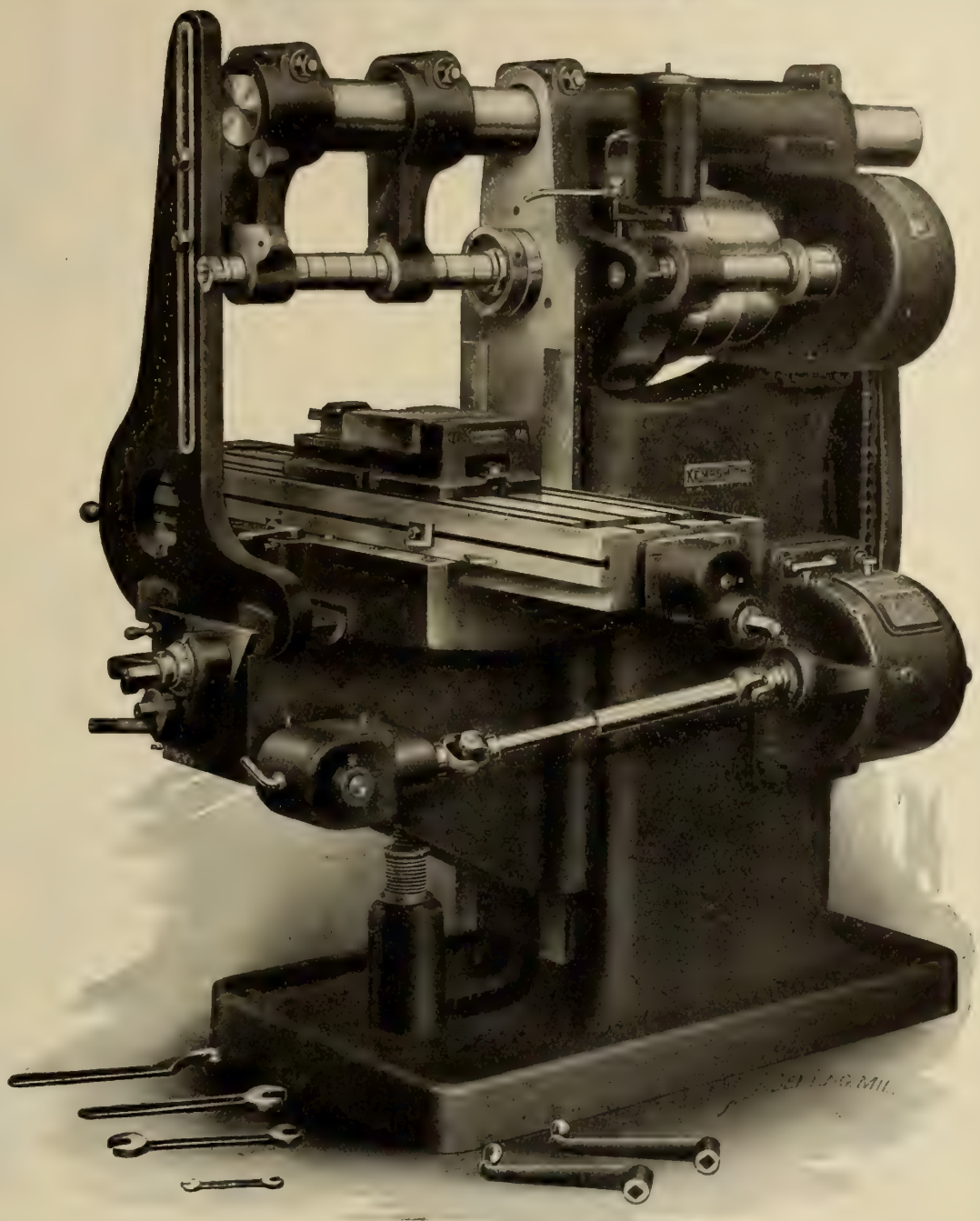
Solid top knee—hardened steel gearing and shafts in the column and feed box—automatic flooded lubrication — one and one-half gallons of oil per minute pouring over all gears and bearings in the column and feed box, insuring lubrication at all times—flanged spindle with hardened steel collar for driving arbors—constant speed drive, reverse being self-contained.

Send for our No. 21 Catalogue. Illustrating and describing Milwaukee Milling Machines and accessories in detail

KEARNEY & TRECKER CO.

MILWAUKEE, WIS. U.S.A.

KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared.

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

THE KEMPSMITH MANUFACTURING CO.

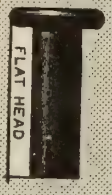
MILWAUKEE, WIS., U.S.A.

FOREIGN REPRESENTATIVES:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada. Barandiaran & Co., 3 Alameda, San Sebastian, Spain. Bevan & Edwards, Pty., Ltd., 117-29 King St., Melbourne, Australia. Edgar Bloxham, 12 Rue du Delta, Paris, France. D. Drury & Co., 1-2 Central House, Main St., Johannesburg, South Africa. Roku-Roku-Shoten, 3 Shinsakanacho, Kyobashiko, Tokyo, Japan. Nielsen & Winthers, Blegdamsveg, 60. Copenhagen, Denmark, Parke & Lacy Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia. Selson Engr. Co., 19 Via Botero, Turin, Italy, and 85 Queen Victoria St., London, E.C., England. Spliethoff, Beeuwkes & Co., Leuvehaven, W.Z., 159, Rotterdam, Holland.

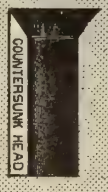
P & B RIVETS













MEET YOUR EVERY NEED

Copper and coppered belt rivets and burrs, tubular rivets, bifurcated or slotted rivets—rivets in every design and every size, from 5/8 inch to the smallest made.

You will find all P. & B. rivets of reliable quality and our service the kind you like. *Write.*

Parmenter & Bulloch Company LIMITED

Gananoque, Ontario

THE "RACINE"

HIGH SPEED METAL CUTTING MACHINE

"Standard the World Over"

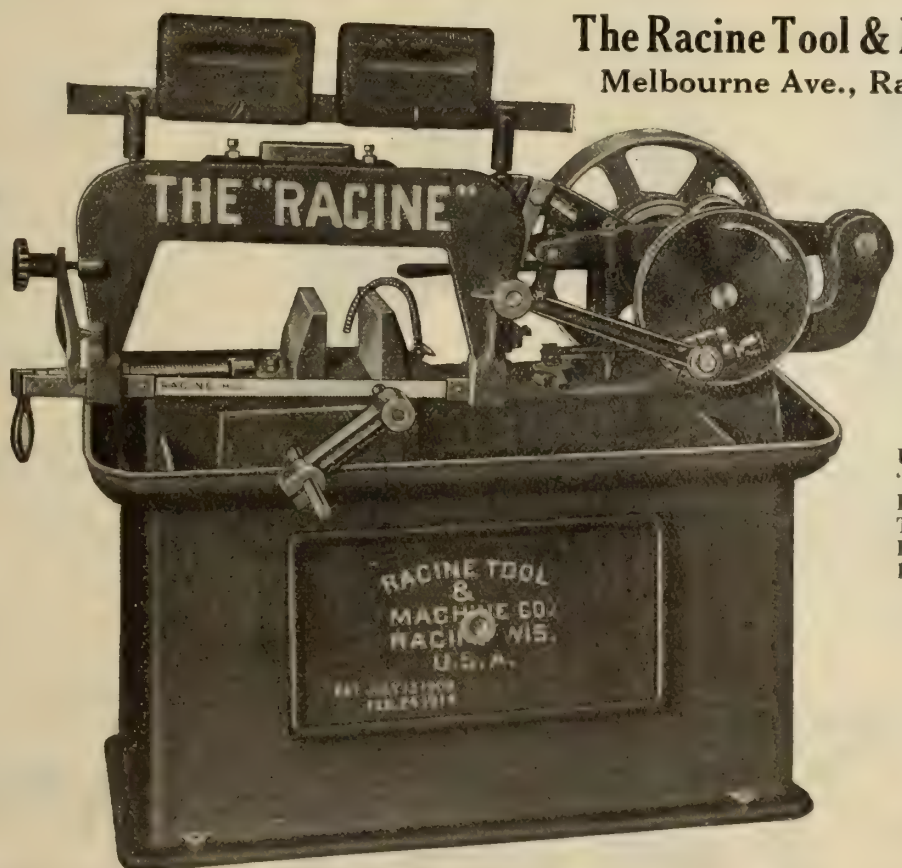
This is a machine for your shop which is capable of cutting — not hacking — the hardest, meanest jobs in the shortest possible time.

It is a consumer of *work*. It is a machine of simple — yet sturdy — construction, which is equipped to withstand the wear and tear of modern times.

It is the *only machine* which positively *lifts* the blade free and clear of the work on every non-cutting stroke.

These machines are built in 30 types and sizes.

Write to us for details about them.



The Racine Tool & Machine Company
Melbourne Ave., Racine, Wis., U.S.A.

Use "Racine" H.S. Tungsten Power Blades.

Sheldons Systems

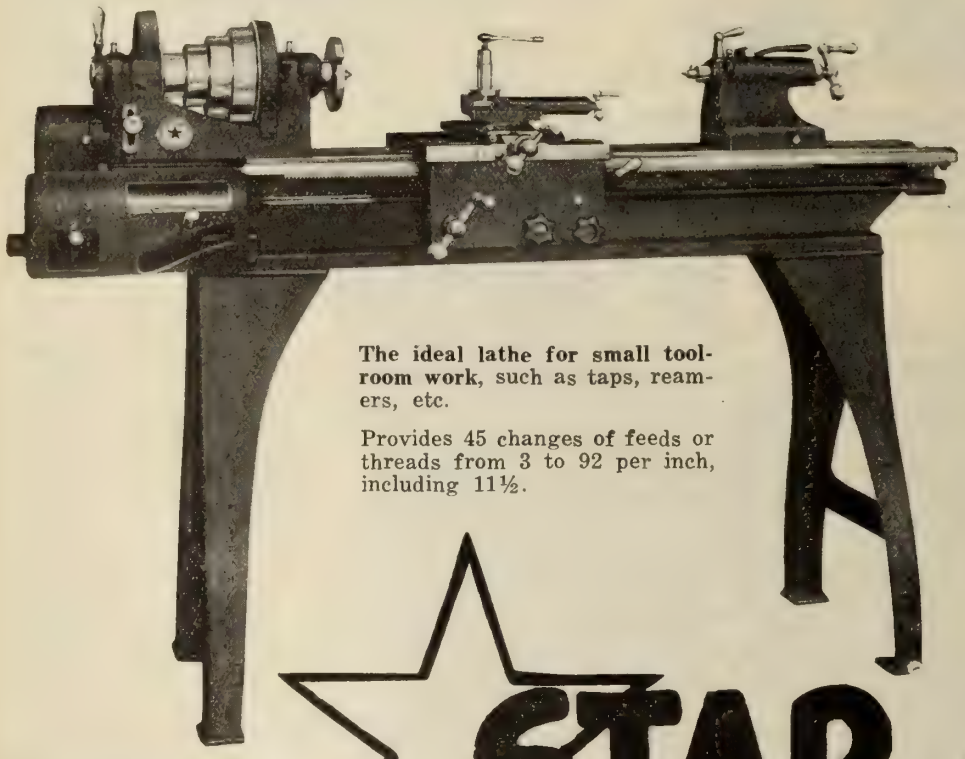
Heating --- Ventilating --- Drying and Shavings Exhaust

Sheldon Systems have proved their value to manufacturers throughout the entire breadth of the Dominion. We have installed systems in factories, plants, mills and buildings in every province, from Halifax to British Columbia. This country-wide demand for Sheldon Systems can therefore mean but one thing—supreme worth and assured reliability of service.

And as installation is every bit as important as the building of these appliances, we maintain a competent engineering force to give reliable information and advice. They ensure our customers getting the maximum of service out of every Sheldon System installed.

Sheldons Limited, Galt, Ont., Canada

Sales Offices—Sheldons, Limited, Kent Bldg., Toronto; Ross & Greig, 400 St. James St. Montreal; Walkers, Limited, 259 Stanley St., Winnipeg; Gorman, Clancey & Grindley, Calgary and Edmonton; Robt. Hamilton & Co., Bank of Ottawa Bldg., Vancouver.



The ideal lathe for small toolroom work, such as taps, reamers, etc.

Provides 45 changes of feeds or threads from 3 to 92 per inch, including 11½.

"STAR"

11-Inch Quick Change Engine Lathe

Replace your larger and more expensive machines with "Star" lathes and you'll automatically reduce your manufacturing cost.

Try one "Star" and you'll soon want more. Sizes 9", 11", 12" and 13" swing.

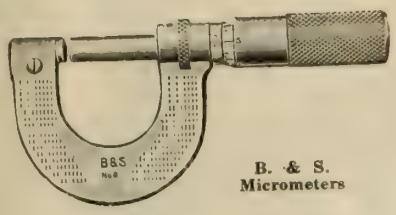
May we send catalogue?

STAR

LATHES

The Seneca Falls Mfg. Co., Ltd.
366 West Fall St.
SENECA FALLS, N.Y.

Machine Shop, Foundry and Construction Supplies



B. & S. Micrometers



Machinists' Tool Chests

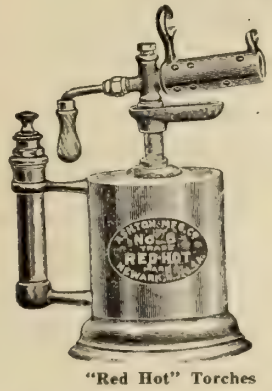
In addition to the tools shown, our line includes Set Screws, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files (extra large stock) and a complete line of machinists' tools (Starrett, Brown & Sharpe, etc.).



"Vulcan" Pipe Vises and Pipe Wrenches

We also carry a heavy stock of **Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.**

Pleased to quote prices and time of delivery.



"Red Hot" Torches

RICE LEWIS & SON, Limited

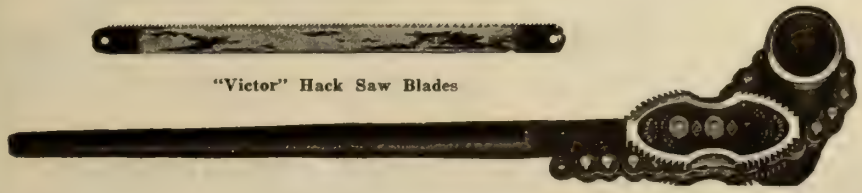
Established 1847

19 Victoria Street
TORONTO, ONT.

RICE LEWIS & SON LIMITED TORONTO

HARDWARE

ESTD 1847



"Victor" Hack Saw Blades

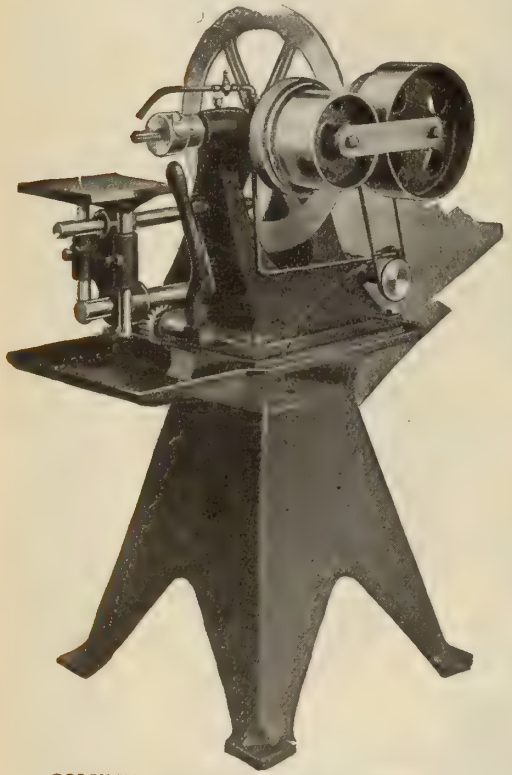
"The House of the Padlock"

If interested tear out this page and place with letters to be answered.

R-S TOOLS

TAPPING MACHINES

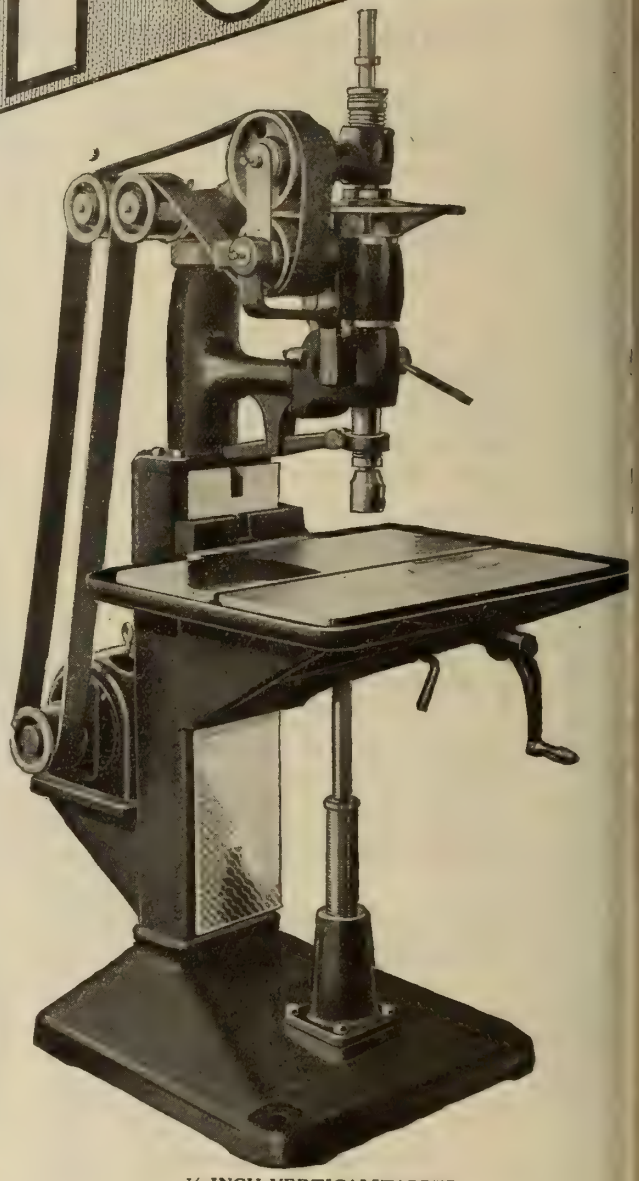
Faster tapping and quicker assembling—these are **claims** we make and claims we are prepared to prove for **R-S** Tapping Machines.



HERE'S THE PROOF—friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on ⅝-in. work —50 % faster than the usual tapping speed for that size. Uses but 1 h.p.

The smoother drive also reduces the strain on the taps. They wear longer—fewer delays from taps breaking in the work.

For assembling threaded parts (valve stems, spark plugs. instruments, couplings), R-S Tappers result in quicker assembling and a decidedly larger output from every operator.



¼-INCH VERTICAL TAPPER

COLUMN TYPE HORIZONTAL TAPPER

R-S OIL FEEDER

The ⅝" Tapper is featured by the continuous oil feed which allows greater speed, increased efficiency and output and longer life.

All enquiries quickly attended to.

Rickert-Shafer Co.

ERIE, PENN., U.S.A.

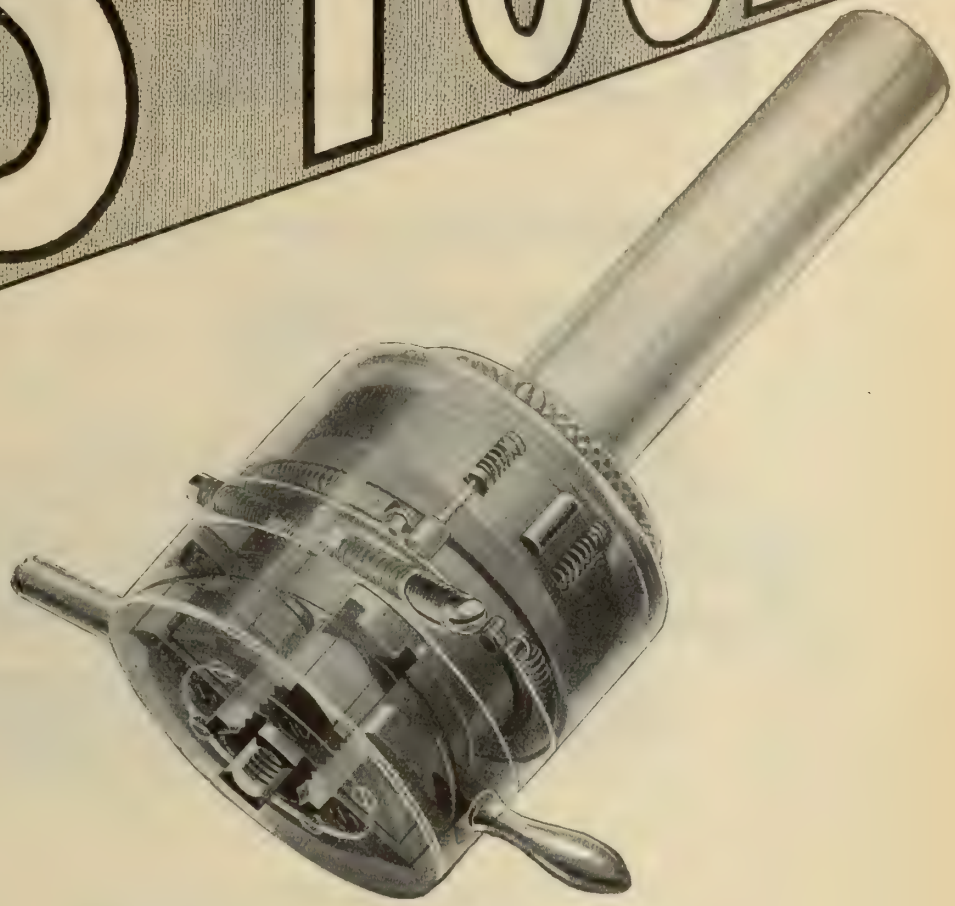
This is our Address—How Can We Serve You?

ALFRED HERBERT, COVENTRY, ENG.

Tappers Only

50 Church Street, New York City
1231 Rockefeller Bldg., Cleveland
501 Book Bldg., Detroit, Mich.
Machinery Hall, Chicago, Ill.

R-S TOOLS



AUTOMATIC DIE HEADS

This R-S Tool, with its new construction (in which are embodied several practical improvements) offers you **more efficient** and **more economical** service than is possible with any other automatic die head.

The hardened and ground guides for the chaser is something new and better. Further, it has a positive opening and closing cam action. The chasers have the necessary radial movement to enable the die to open after the threading operation has been completed. They are supported by a cam ring throughout their entire length and width.

The chasers slide between hardened and ground guides, and are supported by carriers which have a groove in the outer end for the positive opening cam. This cam. the locking pins, and the "float" have features that add to the distinctiveness of this "Boehm" Tool.

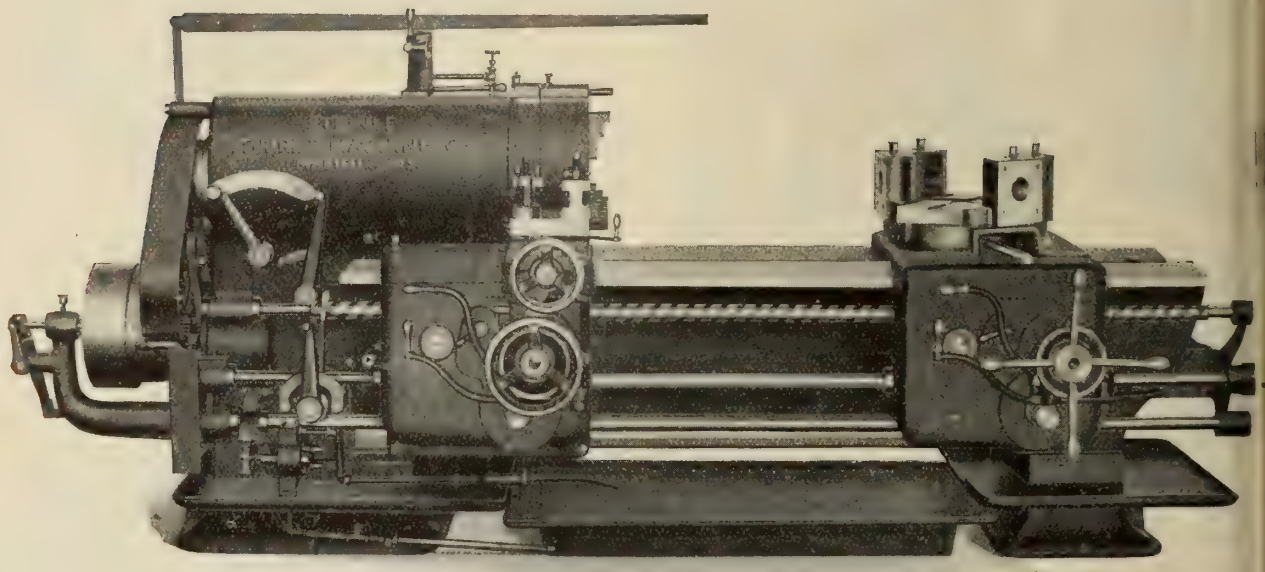
Built in sizes to cut from 3/8 to 9" diameter, or larger if so order, and with taper attachment and roughing and finishing attachment.

Rickert-Shafer Co., Erie, Penn.

This is Our Address--How Can We Serve You?

If interested tear out this page and place with letters to be answered.

STEI



Standard 24" Full Swing Side Carriage Turret Lathe with 6¼" hole through spindle and equipped with three - jaw chuck, oil pans pump and piping, arranged for belt drive.

Steinle Turret Machine C

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

NLE

The Name That Stands for

HEAVY DUTY
FULL SWING
SIDE CARRIAGE
TURRET LATHES

THE Steinle heavy duty general purpose turret lathe is a master producer, consistently turning out duplicate work rapidly, accurately, and economically, for many of the leading manufacturers of trucks, tractors, farm implements, machine tools and other industrial equipment.

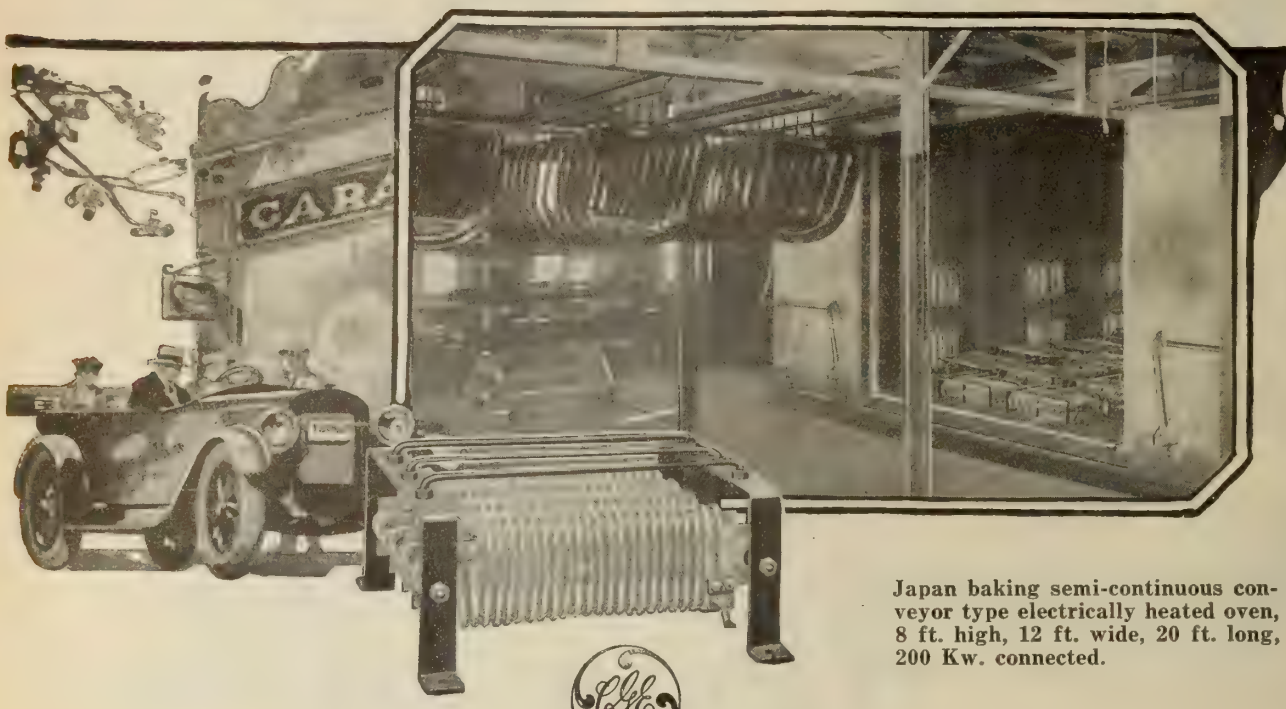
The general massive construction, the ease of operation of all parts, the single pulley drive and thirty reversible spindle speeds, the rapid power traverse of both carriages, the power cross feed of side carriage and general adaptability to special tooling equipment enabling satisfactory quantity and quality production---these are strong points well worth considering.

Why not communicate with us for further information ?

ladison, Wisconsin, U. S. A.

If interested tear out this page and place with letters to be answered.

The cheapest method of heating is that which reduces to a minimum the total cost of a satisfactory product.



Japan baking semi-continuous conveyor type electrically heated oven, 8 ft. high, 12 ft. wide, 20 ft. long, 200 Kw. connected.

Japan Baking the Modern Way

MANY of the principal manufacturers of automobiles have installed electrically heated ovens and in all cases great improvement in results has been realized.

Electricity can be used to supplant fuel in practically all heating operations and not only accomplishes better work, but more of it in a given time.

It has been repeatedly demonstrated that the installation of C.G.E. industrial heating equipment will effect many advantages, such as improved quality, increased production, saving in time, elimination of seconds, improved working conditions and reduced fire hazard.

The electric way is the modern way—the proven economical way.

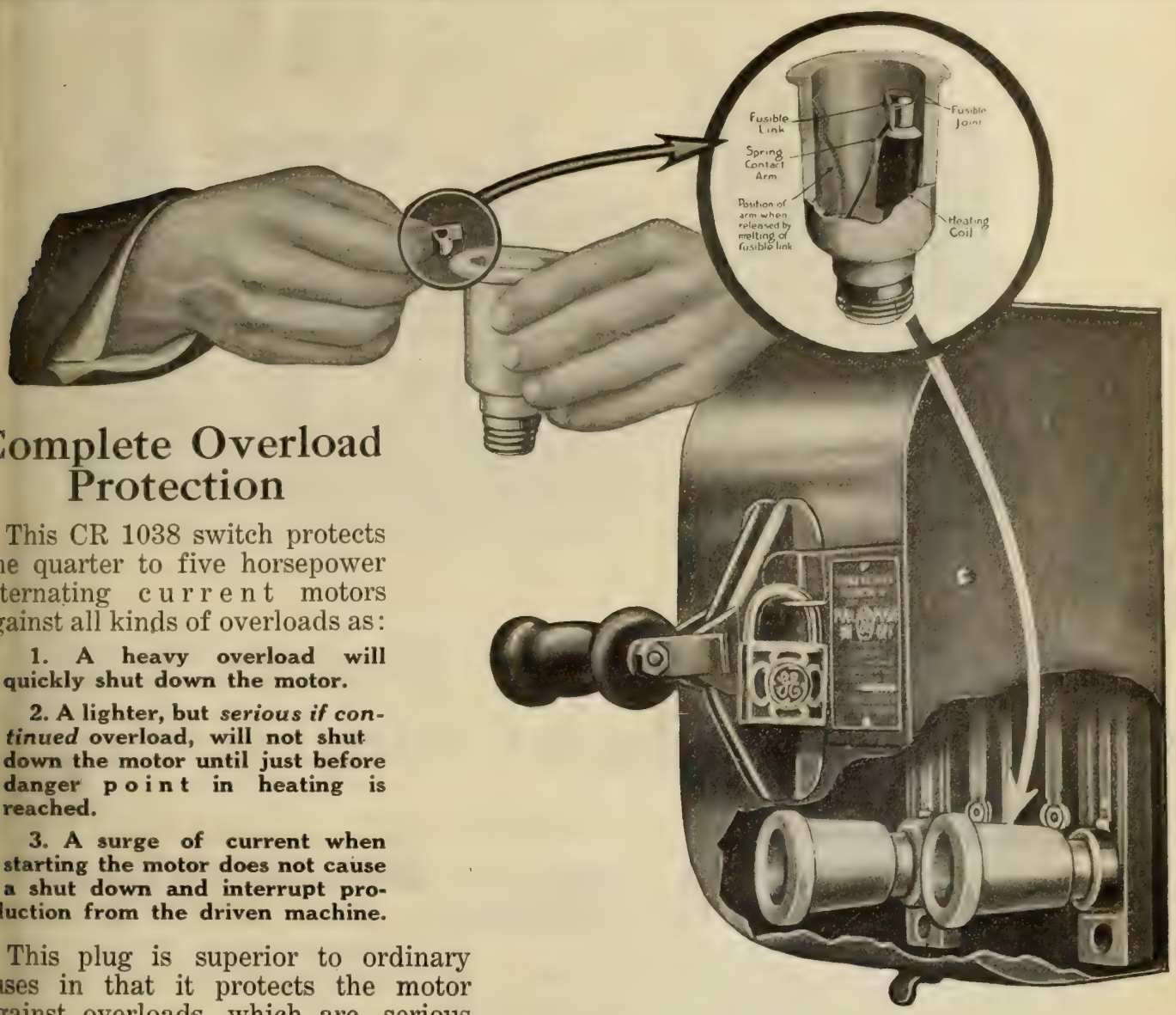
Write our nearest sales branch for more information

Canadian General Electric Co., Limited

Head Office - TORONTO

BRANCH OFFICES: Montreal, Quebec, Halifax, Sydney, St. John, Ottawa, Hamilton, London, Windsor, Cobalt, Sou Porcupine, Winnipeg, Calgary, Edmonton, Nelson, Vancouver and Victoria.

Important motor driven productive machinery must be kept going. Interruptions are practically eliminated where motors are automatically protected against only the overloads that injure.



Complete Overload Protection

This CR 1038 switch protects ne quarter to five horsepower lternating current motors gainst all kinds of overloads as:

1. A heavy overload will quickly shut down the motor.

2. A lighter, but *serious if continued* overload, will not shut down the motor until just before danger point in heating is reached.

3. A surge of current when starting the motor does not cause a shut down and interrupt production from the driven machine.

This plug is superior to ordinary uses in that it protects the motor gainst overloads, which are serious ecause continued, while the former rotected only against peak overloads.

sk our nearest office for descriptive sheet No. 68327A

A small spring switch in the porcelain protective plug shown is held shut by slipping a little link over its end. If a current large enough to injure the motor flows through the plug the fusible joint of the link is melted by the heating coil. For the cost of a postage stamp the link can be renewed and plug made operative again.

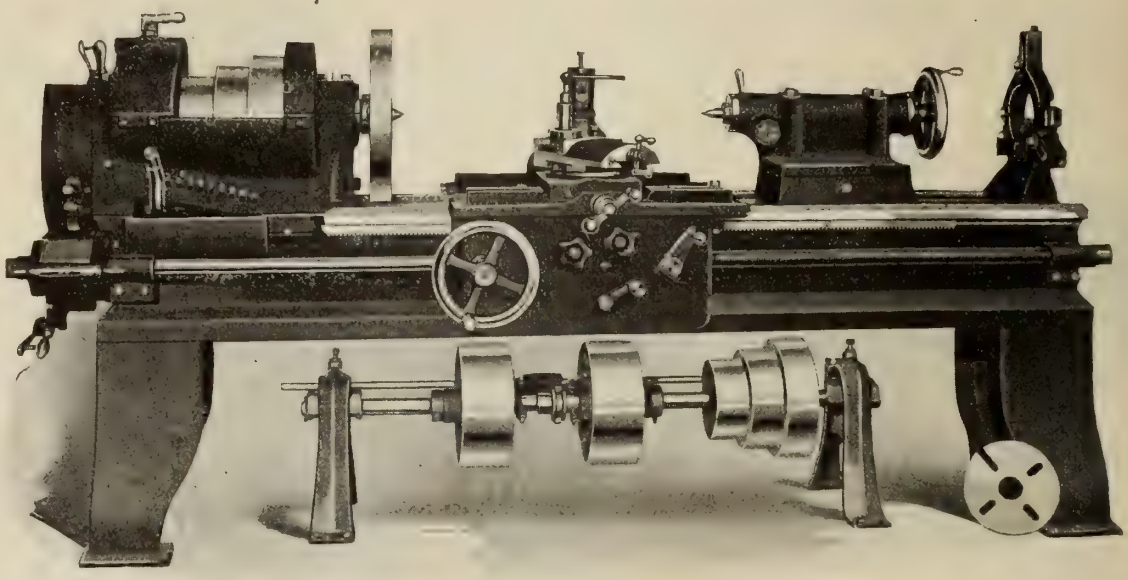
Canadian General Electric Co., Limited

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RANCH OFFICES: Montreal, Quebec, Halifax, Sydney, St. John, Ottawa, Hamilton, London, Windsor, Cobalt, South Porcupine, Winnipeg, Calgary, Edmonton, Nelson, Vancouver and Victoria.

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RAE Machine Too
HAMILTON,



The "RAE" 18-inch Quick Change Double Back Geared Lathe

A Lathe to be accurate must be rigid. Our new type of Webbed Headstock insures great strength and rigidity under all conditions.

It ties together the front and rear bearings of spindle, and in addition, protects the operator.

The bed is of sufficient depth and width and is cross ribbed in design, which ensures rigidity under heavy cuts.

Steel gears are placed wherever necessary. In other words our lathes are honestly built.

May we send you further particulars?

New Type of Webbed Headstock Insures Great Strength and Rigidity Under All Conditions

Works, Limited
CANADA

We also build a 20-inch Semi-Quick Change Double Back Geared Lathe.

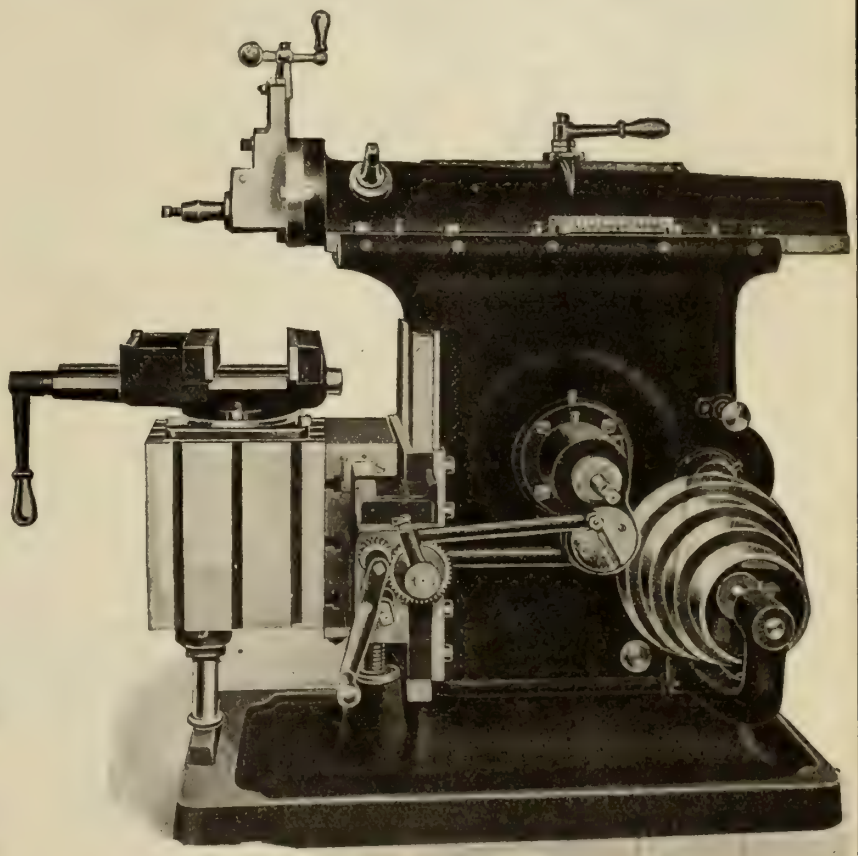
The "Rae" Gap Lathes embody the webbed construction headstock as used so successfully on our engine lathes, with every part accurately finished. Users of "Rae" Lathes will find them rugged in design, accurate in work and economical in upkeep. Once a user of a "Rae" Lathe you become a "Rae" booster. Let us describe to you further the points of interest.

"RAE" Crank Shapers

Every part in our shaper is carefully designed for strength and durability. Weight is placed unsparingly, but only where absolutely necessary.

The ranges of speeds have been carefully graded, each one being both practical and useful.

There are other features we would like to tell you of. Suppose you write us.



Rae Machine Tool Works, Limited
HAMILTON - CANADA

If interested tear out this page and place with letters to be answered.

SMALL TOOLS for Machine Shops

SOME OF OUR LINES

"Little Giant" Taps
"Little Giant" Dies
"Little Giant" Screw Plates
Wilt High Speed Drills
Wilt Carbon Drills
Wilt High Speed Reamers
Wilt Carbon Reamers
High Speed Cutters
Carbon Cutters
Standard Drill Sleeves
Use-Em-Up Drill Sleeves
Union Drill Chucks
Jacobs Drill Chucks
Files
Hack Saw Blades
Confined Drills and Countersinks
Micrometers
Gauges

J. A. M. Taylor Tool Co.
TORONTO

RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL

Representing Machine Tools of Quality

THE lines shown in this collective advertisement are exclusively represented in Canada by the Rudel-Belnap Machinery Co., Montreal and Toronto.

All are products of highest quality and are universally recognized as leaders. We shall appreciate a careful study of the following pages.

We invite your enquiries

Rudel-Belnap Machinery Company
Limited

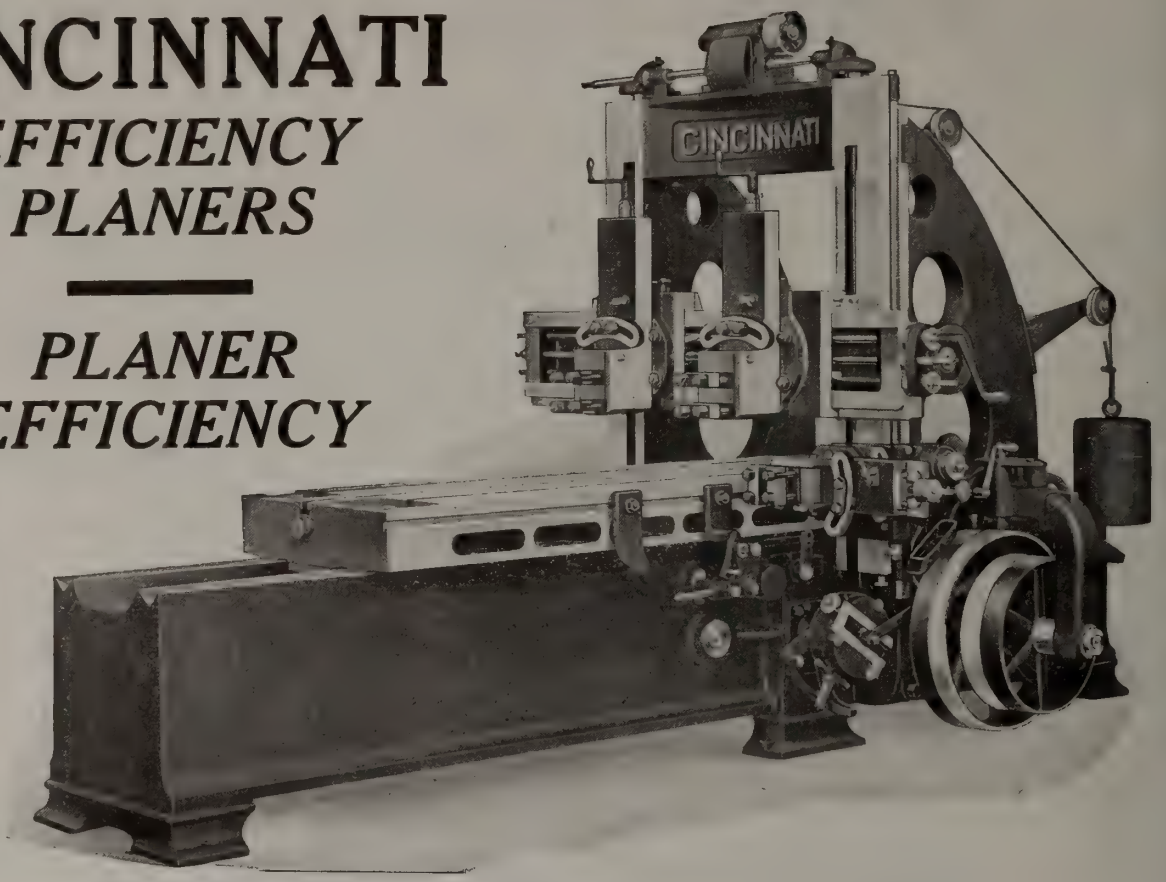
TORONTO **MONTREAL**

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RUDEL-BELNAP MACHINERY Co LIMITED
TORONTO MONTREAL

CINCINNATI
EFFICIENCY PLANERS

PLANER EFFICIENCY



36-inch Cincinnati Tu-Speed Planer. Made in sizes up to 56 inches with two speeds. Larger sizes up to 134 inches, single speed or any type motor drive.

2 Speeds—without stopping
in Cincinnati Tu-Speed Planers

PLANERS THAT INCREASE YOUR OUTPUT AT BED-ROCK COST

RIGID CONSTRUCTION—These solidly built Cincinnati Planers give accuracy and speed to any planing operation.

VARIABLE CUTTING SPEEDS—10 cutting speeds and 10 return speeds are provided by Cincinnati motor-driven planers, all obtainable while the machine is in operation.

EASE OF MANIPULATION—Men who know machines appreciate the simplicity of control in Cincinnati Planers. It means easier work—more work.

The more difficult the work --- the more you need "Cincinnati"

CINCINNATI PLANER CO., Cincinnati, Ohio, U.S.A.

CANADIAN AGENTS: RUDEL-BELNAP MACHINERY CO., TORONTO AND MONTREAL

RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL

RAPID PRODUCTION

is made possible by convenient positions of control backed up by tremendous power and rigidity, carefully balanced simple mechanism in

CINCINNATI BORING-MILLS

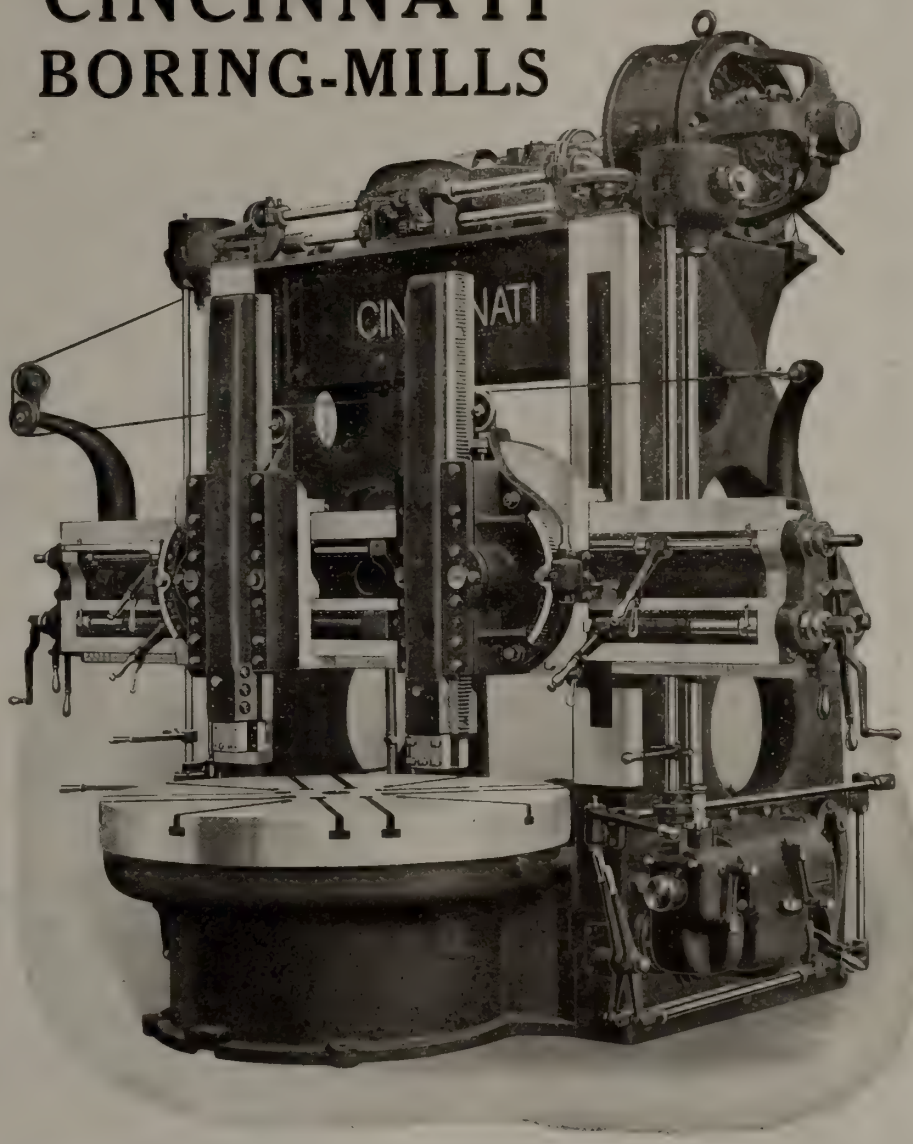
"Real Hustlers"

No matter how heavy or light the job may be they hustle it through in a manner that amazes the man used to old-fashioned boring mills.

Convenient and adaptable; can be quickly changed from one job to another; handles a wide range of work.

Everything necessary to big returns in boring and turning is embodied in the "Cincinnati" design.

Get our bulletin and check up point for point. Built in sizes from 42 inches to 20 ft.



Cincinnati Boring Mills, massive in construction and simple in mechanism, provide tremendous power for handling heavy boring rapidly and economically.

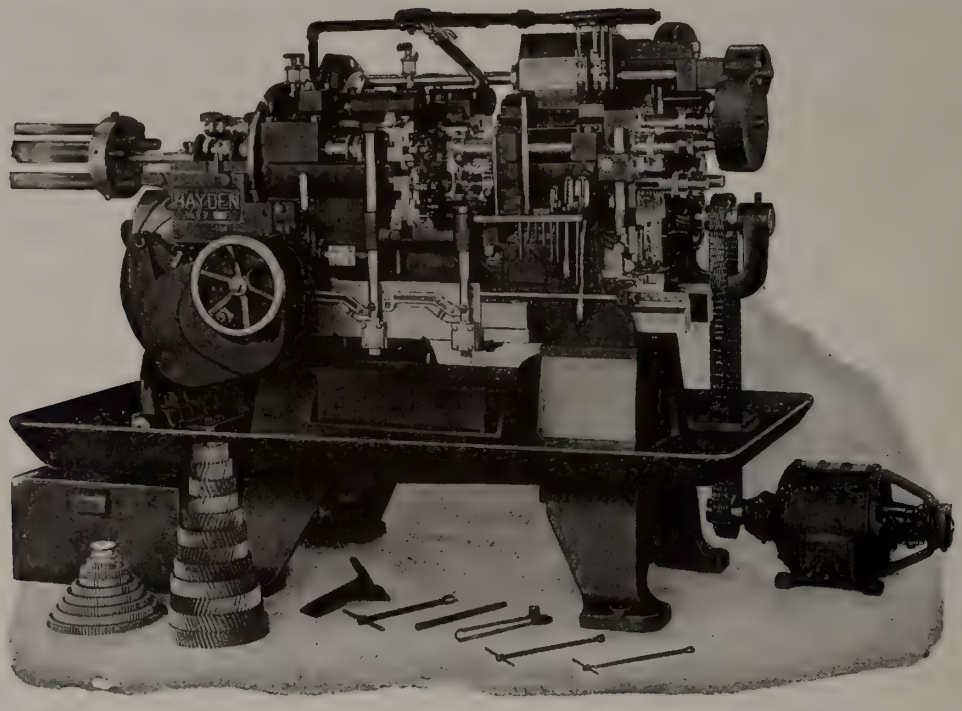
The more difficult the work --- the more you need "Cincinnati"

CINCINNATI PLANER CO., Cincinnati, Ohio, U.S.A.

CANADIAN AGENTS: RUDEL-BELNAP MACHINERY CO., TORONTO AND MONTREAL

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RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL



CINCINNATI

5 Spindle Automatic Screw Machine

MANY DISTINCT FEATURES

16 Spindle Speeds
20 Time Changes
Low Threading Speed
Four Cross Slides
Five Longitudinal Slides

And There Are Forty More, but space does not permit us to mention them all here.

This is the machine you have been wishing for—the machine you need to cut down production costs.

In designing it we considered every requirement you could wish for in a machine for individual needs. This accounts for so many distinct features of superior worth found in the Cincinnati Five-Spindle Full Automatic—Capacity ¾ in. by 3 in. **Our Latest Catalog is waiting to give you full particulars.** Just say the word and you'll get it by return mail.

Cincinnati Automatic Machine Company
Cincinnati, Ohio

Canadian Agents: **Rudel-Belnap Machinery Co., Toronto and Montreal**

RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL

Maintained Accuracy

ACME retains the alignment of the spindle with the vees because the headstock is a solid casting with the bed. The gears have a longer life and the whole machine absorbs less power because the only gears running are those doing the actual work.

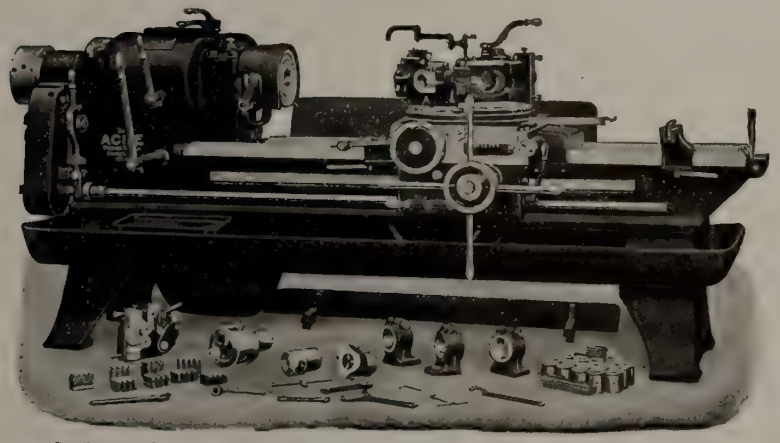
THE CINCINNATI ACME FLAT TURRET LATHE IS A PRODUCTION MACHINE

It will save you money in time and labor —but it will still be saving you money after a lot of high speed manufacturing.

It handles bar work up to 3¼ in. and chuck work up to 16 in. diameter.

We publish a valuable bulletin describing this machine and its work.

May we send a copy to you?



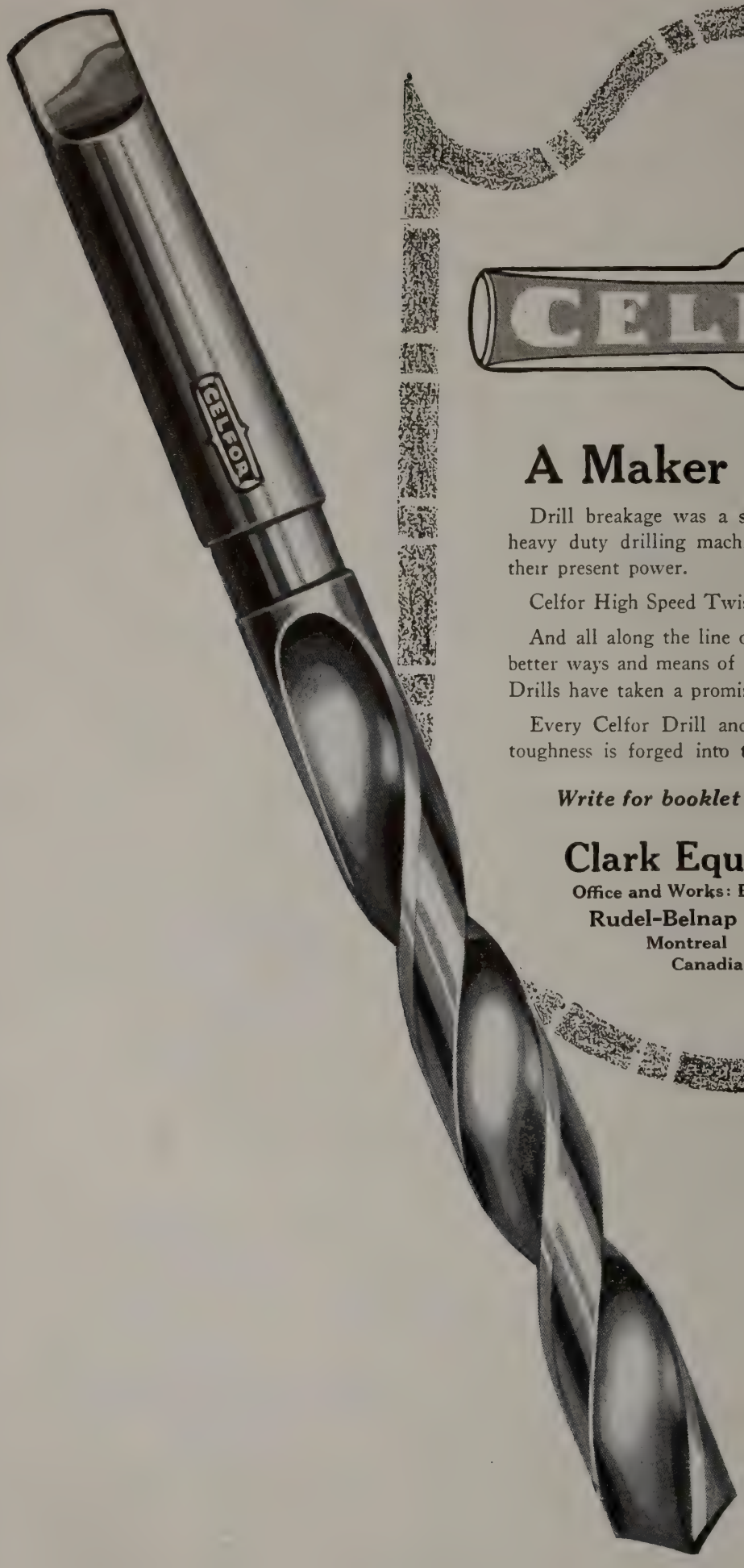
3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

The Acme Machine Tool Co.

Cincinnati, Ohio

Canadian Agents: Rudel-Belnap Machinery Co., Montreal and Toronto

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CELFOR

A Maker of History

Drill breakage was a serious problem long before heavy duty drilling machines had been developed to their present power.

Celfor High Speed Twist Drills solved the problem

And all along the line of new requirements, and of better ways and means of meeting them, Celfor Twist Drills have taken a prominent part.

Every Celfor Drill and Reamer is shock tested—toughness is forged into their very life.

Write for booklet and catalog No. 17

Clark Equipment Co.

Office and Works: Buchanan, Michigan

Rudel-Belnap Machinery Co.

Montreal - Toronto

Canadian Agents

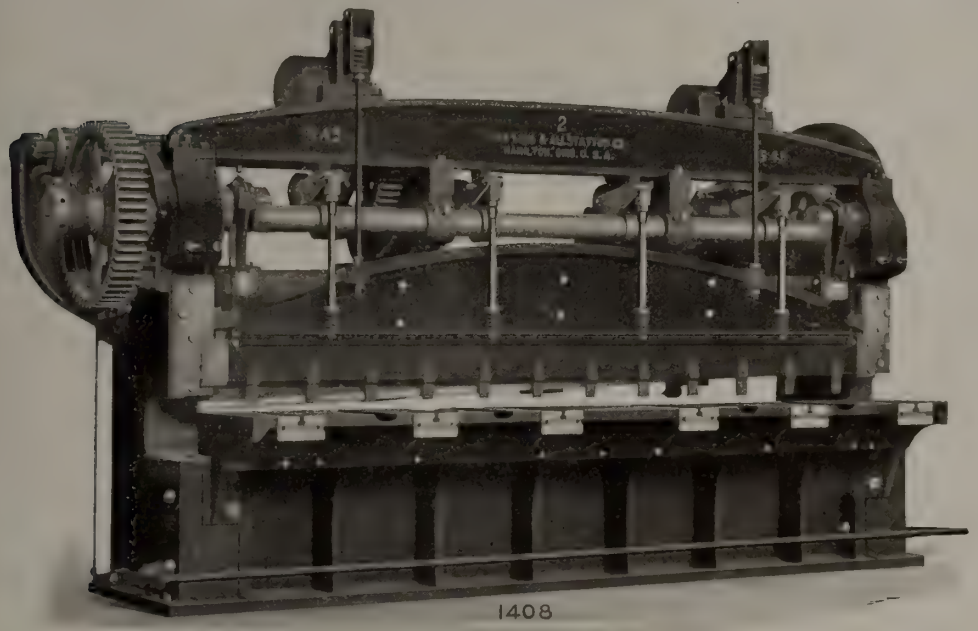
RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL

"The Quality Line"

of

PUNCHING and SHEARING MACHINERY

means a big saving to your plant in time and labor



Size No. 2, Gate Shear

(144 inches wide between the housings, 5-inch throat, motor-driven)

The L & A Quality Line includes Alligator Shears, Angle Iron Shears, Bar Iron Shears, Billet Shears, Squaring Shears, Beam Punching Machinery, Boiler Punches, Disc Punches, Horizontal Punches, Multiple Punches, Structural Punches, etc.

Let us figure on your requirements.

The Long & Allstatter Co.

Established 1856

American Punch & Shear Works

HAMILTON, OHIO, U.S.A.

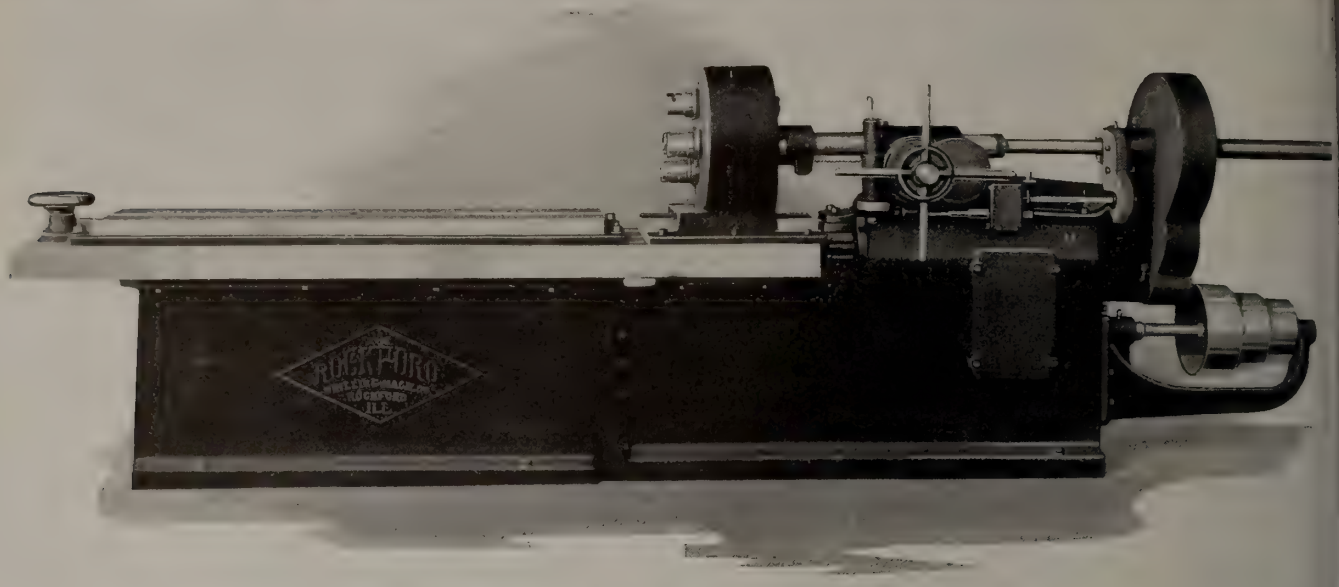
Incorporated 1878

Canadian Agents:
RUDEL-BELNAP MACHINERY CO., LIMITED
Toronto Montreal

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RUDEL-BELNAP MACHINERY CO LIMITE

TORONTO MONTREAL



ROCKFORD

Single End Horizontal Heavy Duty Boring Machine

Here's a single end horizontal Boring Machine that will successfully withstand the gaff of all Heavy Duty Boring.

It's a Rockford and it contains all the well-known Rockford quality of material and design.

This machine is especially designed for crank-case boring and its speed and ease of handling make it popular throughout the Automotive Industry Field.

It is fitted with a 3-step Cone Drive and Countershaft, and interchangeable Pick-off Gears.

Other special features include a 4 spindle Drive Head and Index or Pivot Plate, forward and reverse feeds, feed back gears and complete tooling equipment.

Full details will gladly be sent upon request.

ROCKFORD DRILLING MACHINE COMPANY

Rockford — Illinois

CANADIAN AGENTS

RUDEL-BELNAP MACHINERY CO., MONTREAL and TORONTO

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France. Italy and Colonies, Monti & Oscuro, Milano, Italy. Scandinavia, Rylander & Asplund, Stockholm, Sweden, Spain and Portugal. Casamitjana, Hermanos, Barcelona, Spain. Australia, Selon Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

SPRACO



PNEUMATIC PAINTING EQUIPMENT

Does the work of 3 to 12 Skilled Painters

Figure It Out---You Are the One Who Profits

The following is a fair average figure on the performance of

Spraco Painting Equipment

received from concerns using it:—
One painter with a hand brush will use in a day's work 2½ gallons of paint covering 1,000 sq. ft.
With the Spraco Paint Gun, one painter in a days' work uses **20 gallons** of paint, covering **8,000 sq. ft.**
It does not take much figuring to show you that the average job will more than pay for the Spraco Painting Equipment.

Send for Bulletin CM 40

Spray Engineering Co.

Boston, Mass., U.S.A.

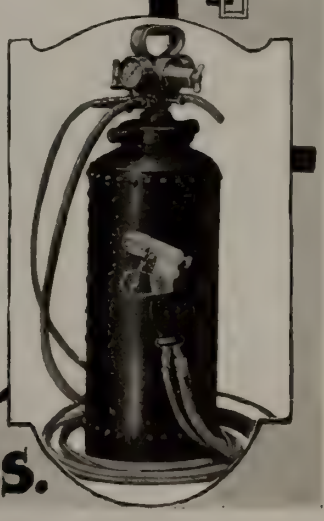
Engineers for
Spray Cooling Systems, Irrigation Systems, Aerating Reservoirs, Air Conditioning, Gas Washing.

Manufacturers of
Air Washers, Spray Nozzles Painting Equipment, Flow Meters, Park Sprinklers.

Canadian Representatives:

RUDEL - BELNAP MACHINERY CO.

MONTREAL AND TORONTO, CAN.



SPRAY ENGINEERING CO.

93 Federal St. Boston, Mass.

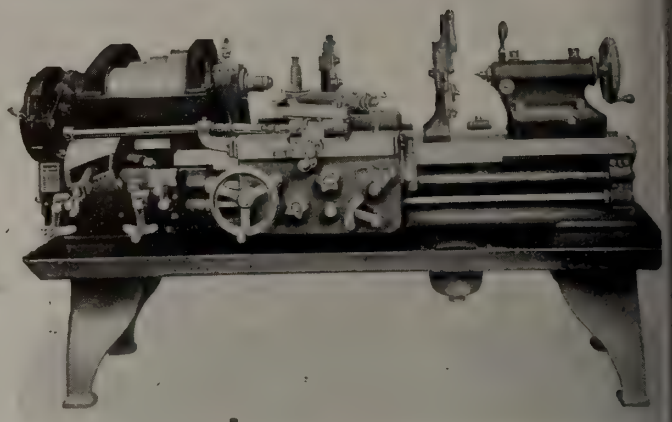
If interested tear out this page and place with letters to be answered.

RUDEL-BELNAP MACHINERY CO. LIMITED
TORONTO MONTREAL

"AMERICAN"
High Duty Tool Room Lathe

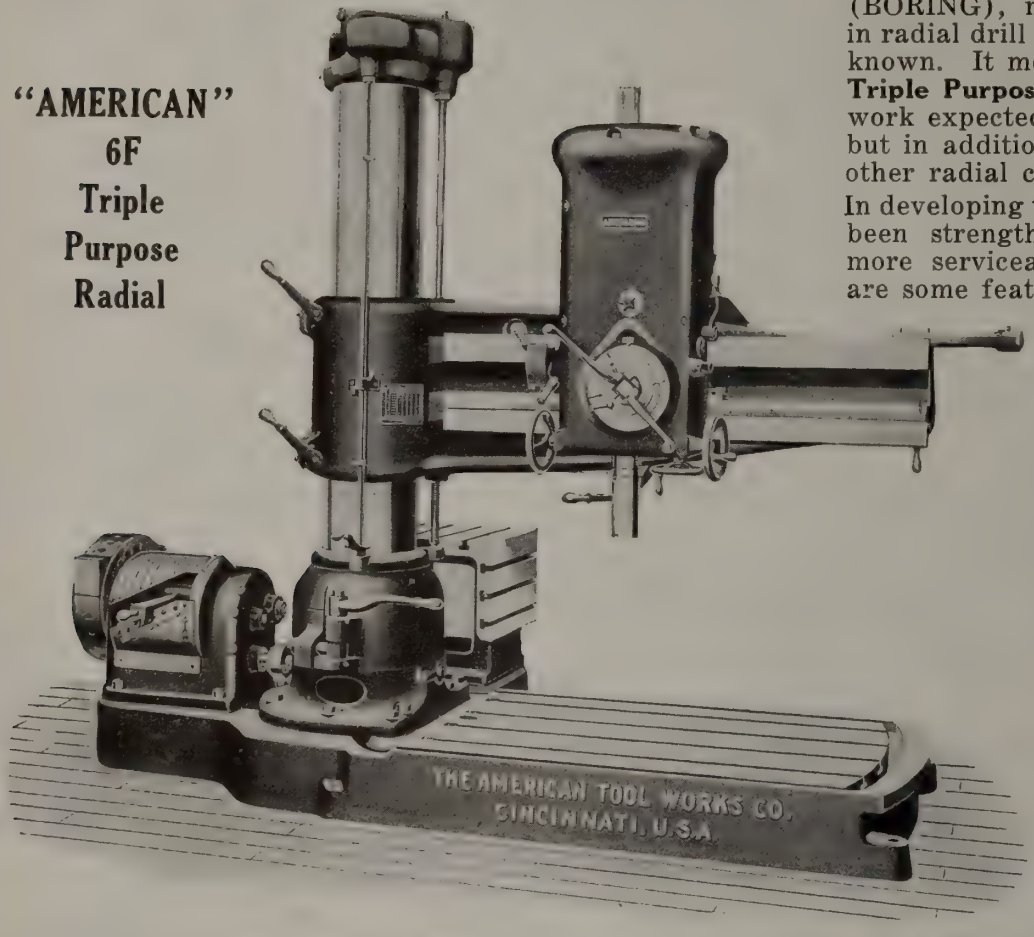
The "AMERICAN" Tool Room Lathe is of very recent design and embodies a number of original features which are of distinct advantage to modern manufacture.

We guarantee the workmanship on these machines to be the very best that intelligent effort, combined with long experience, skilled workmen and a complete jig and tool system can produce, and likewise positively guarantee every piece of metal that enters into the construction of our tools.



May we send complete descriptive matter?

"AMERICAN" 6F Triple Purpose Radial



AMERICAN

The addition of the third functio (BORING), marks the greatest advanc in radial drill design that industry has eve known. It means that the **"AMERICAN Triple Purpose Radial** will handle all th work expected of an ordinary radial dril but in addition handle such work that n other radial can.

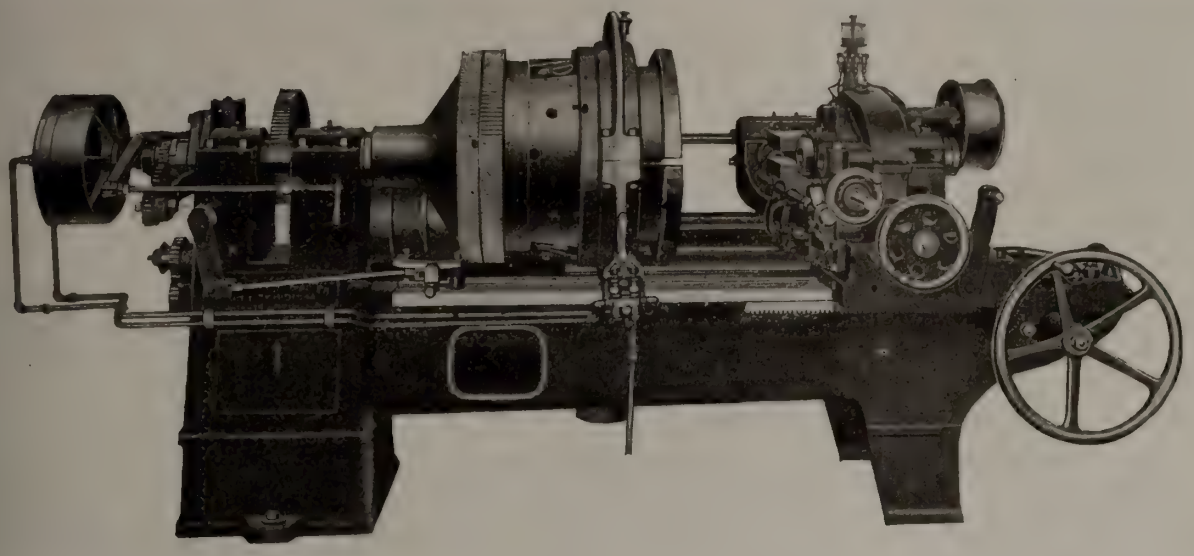
In developing this new radial every part ha been strengthened, improved and mad more serviceable and productive. Ther are some features, however, which are o such striking superiorit that we shall call particu lar attention to them b enumeration.

1. Power—20 H.P. delivered t speed box.
2. Quadruple geared head—3 speeds.
3. Internal gear drive.
4. Improved tapping attach ment—runs in oil.
5. Simplicity and convenience
6. Material.
7. Centralized lubrication.
8. Counterweight constructio —Danger eliminated.
9. Feeding mechanism—8 feed on one dial.
10. Improved arm constructio —spring greatly reduced
11. Elevating mechanism—foo proof.
12. Speed box—improved.

THE AMERICAN TOOL WORKS CO.
LATHES, PLANERS, SHAPERS, RADIAL DRILLS
Cincinnati, Ohio, U.S.A.

RUDEL-BELNAP MACHINERY CO. LIMITED

TORONTO MONTREAL



Smalley-General Flange Thread Miller

Lowers Costs!

This is a tool that cuts labor costs and places production on a better paying basis. Accurate, simple and speedy, and operated with efficiency by unskilled, medium-priced help. Mills flange threads with fewer rejects than any other machine.

Reduce your labor costs with the Smalley-General Flange Thread Miller No. 1.

Read This Time Study

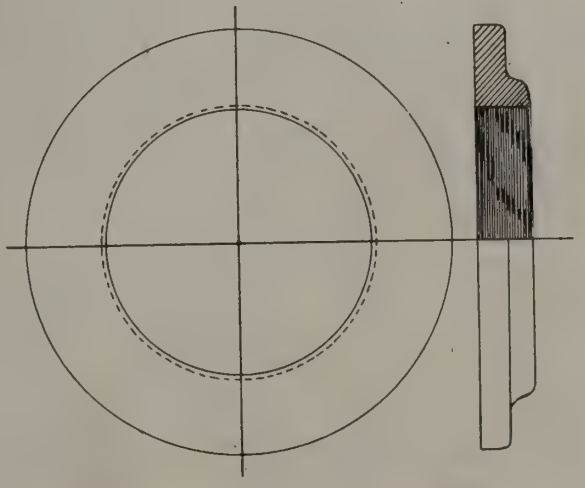
Machine—Smalley-General Flange Thread Miller No. 1. Air-operated collet chuck.

Piece Milled and Faced—Standard cast iron 125 lb. pressure 8" flange. Facing 13½" O.D. x 8⅜" L.D.

Thread—8⅜" diameter, 1¾" long, 8 pitch Briggs tapered.

Time Study—	Min.	Sec.
Chucking from floor	..	15
Facing ⅛" feed	1	40
Adjusting hob	..	10
Milling	2	30
Removing from chuck	..	10

Time complete operation, floor to floor—4 min. 45 sec. Milling Feed—10½" per minute. Limits, .003. Entire flange finished in one chucking. Face and threads in perfect alignment.



SMALLEY-GENERAL CO., Inc., BAY CITY, MICH.

Canadian Agents: Rudel-Belnap Co., Ltd., Montreal and Toronto

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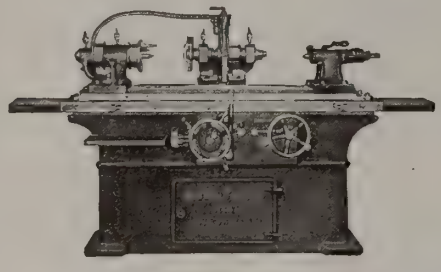
RUDEL-BELNAP MACHINERY Co. LIMITED
TORONTO MONTREAL

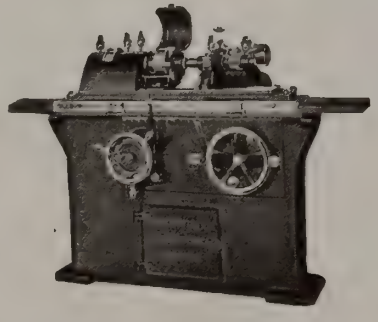
Canadian Agents For

MODERN
Grinding Machines

—Plain Grinders
—Universal Grinders
—Internal Grinders
—Chaser Grinders







For speed in production, accuracy, dependability and durability, Modern Grinders have no equal. We can point with pride to the records in shops which have but one or two as well as those whose batteries run up to over 500. Wherever installed they prove their superiority.

Modern Plain Grinders have many distinctive features. Among them rigidity; controls all on front; positive drive of headstock through internal helical gears; full self-contained; ready for single pulley or motor drive; all revolving shafts, pulleys and gears completely guarded.

These are but a few of the points of Modern superiority. You want just such tools as you get in Modern. You'll be greatly impressed with their accomplishments and the unfailing satisfaction they give.

Find out what they can do for you.

Modern Tool Co.

MAIN OFFICE AND WORKS **ERIE, PA.** STATE AND PEACH STS.

Export Dept., 2 Rector Street, New York City

Canadian Agents:

Rudel-Belnap Machinery Co., Limited
TORONTO AND MONTREAL

RUDEL-BELNAP MACHINERY Co. LIMITED
TORONTO MONTREAL

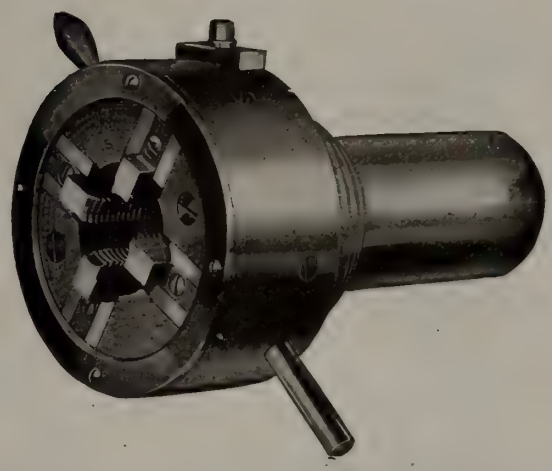
Canadian Agents For

MODERN
Small Tools

—Self-Opening Die Heads
—Solid Die Heads
—"Magic" Chucks
—Collapsible Taps

Modern Small Tools have made a wonderful record—few shops in the States where you'd fail to find one or more. They speed production and lower costs wherever installed.

Modern Self-Opening Die Heads are so efficient that they have been adopted as standard equipment on about 90% of the highest grade turret machines made in America. They're made in 18 sizes, each having a wide range of diameters which may be cut with a single head.



Magic Chuck and Collet Equipment



The Magic Chuck is a great tool for making Q-U-I-C-K changes of small tools—at least 30 times as fast as the ordinary way and practically converts a single spindle machine into a multiple with as many holes as you have tools to use.

Find out about these time-savers and money-makers. Send for complete technical bulletins and get posted.

Modern Tool Co.

MAIN OFFICES AND WORKS ERIE, PA. STATE AND PEACH STS.

Export Dept., 2 Rector Street, New York City

Canadian Agents:
Rudel-Belnap Machinery Co., Limited
TORONTO AND MONTREAL

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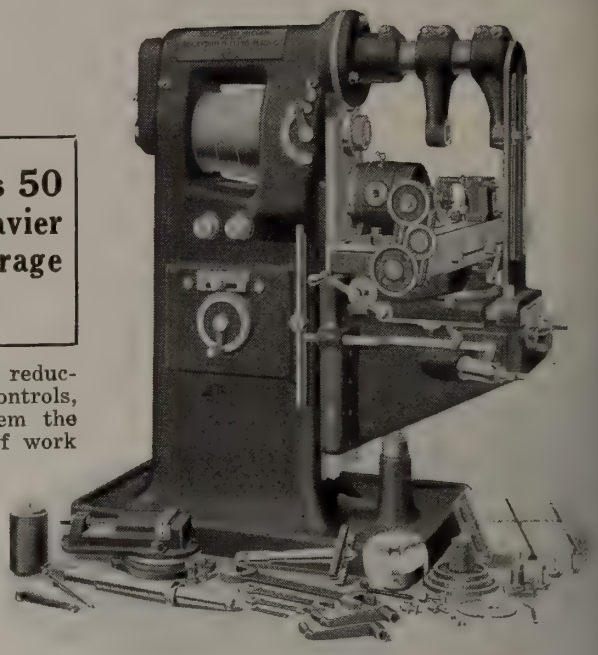
RUDEL-BELNAP MACHINERY CO LIMITED
TORONTO MONTREAL

ROCKFORD MILLER

Takes Cuts 50 Per cent. Heavier than the Average Machine

For heavy duty and a wide range of work the Rockford Universal Miller is the machine to suit your requirements. It is a machine of great adaptability with a capacity for unusual big cuts.

Records show that a battery of "Rockfords" are capable of reducing production costs fifty per cent. Their convenient controls, absolute rigidity and other distinctive features make them the most profitable machines to operate on almost any line of work you may do in your shop.



The Rockford Universal Miller will put your manufacturing operations on a better paying basis—that's certain. Why not at least investigate?

ROCKFORD MILLING MACHINE COMPANY, ROCKFORD, ILL.

Canada: Rudel-Belnap Machinery Co., Toronto, Ont.

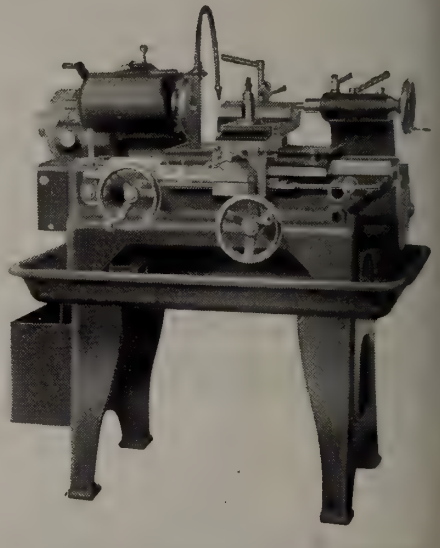
FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris. France. Italy and Colonies, Monti & Oscuro, Milano, Italy. Scandinavia, Rylander & Asplund, Stockholm, Sweden, Spain and Portugal. Casamitjana Hermanos, Barcelona, Spain. Australia, Selson Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

"SUNDSTRAND" NINE INCH MANUFACTURING LATHE

Simplicity in construction, sturdy build and convenient operating features have made the Sundstrand manufacturing lathe the preferred tool in many shops for rapid duplication of parts.

The Sundstrand Lathe has, among its exclusive features, a set of extra ways on the bed, which permit the carriage to travel to the extreme end of the bed, to the front of the tail stock. With separate vees, it is possible to run the tailstock directly back of the carriage, thus permitting small work to be done with greater operating convenience than on the ordinary lathe.

Swing over bed, 9 in.; over plain rest, 7 in.; distance between centers, 12 in.; hole through spindle, 1 11-32 in.; diameter of drive pulley, 8½ in.; speed 350 R.P.M.; spindle speeds, 9; feeds, 4; floor space only 45 in. x 24 in.



ROCKFORD TOOL COMPANY

HARRISON AVE. and ELEVENTH ST.
ROCKFORD, ILL.

Selson Engineering Co., Ltd., London, England (France). Rylander & Asplund, Stockholm, Sweden. M. Mett Engineering Co., Petrograd, Russia. Casamitjana Hermanos, Barcelona, Spain. A. A. Jones & Shipman, Ltd., Leicester, England.

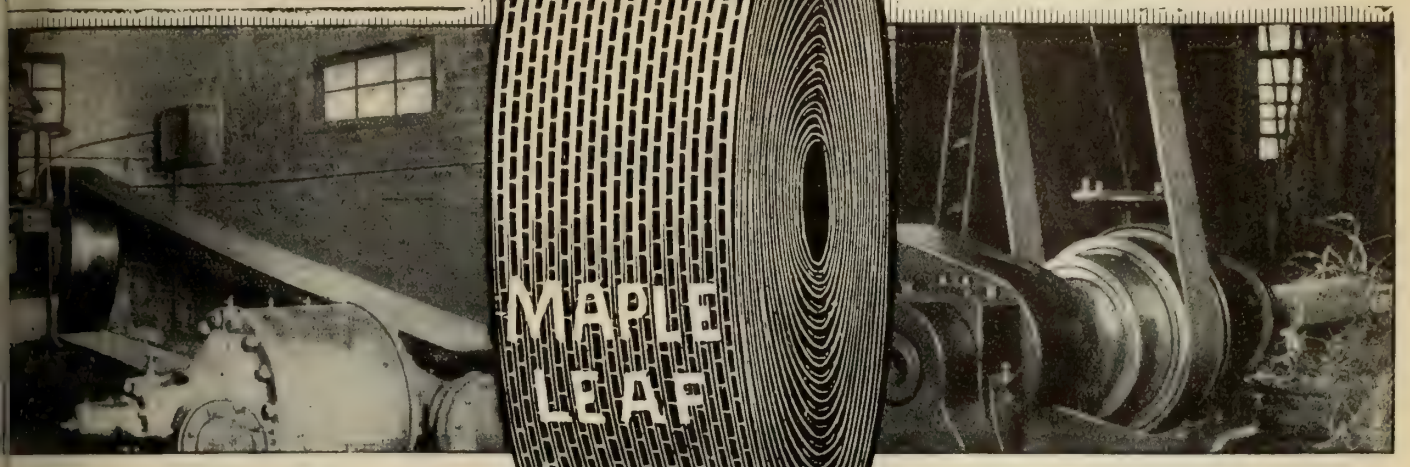
Rudel-Belnap Machinery Co., Toronto, Ont.

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TRANSMISSION SECTION

MAPLE LEAF BRAND

STITCHED COTTON DUCK



Maple Leaf Brand Belting sets a standard in economy, strength and durability.

Maple Leaf Brand Belting grips the pulley positively and is absolutely true running.

BELTING

For transmission of power or conveying purposes Maple Leaf Brand Belting is as efficient as any belting you can buy. It costs less than leather, rubber or balata. Figured on a basis of "service per dollar" it is the best belting buy on the market. Satisfied users throughout Canada will verify these statements.

A recent test at a Canadian university proved that Maple Leaf Brand Belting will stand a breaking strain 50% greater than leather and 25% greater than rubber.

We will gladly send samples and price list on request.



Maple Leaf Belt Dressing

BEST FOR ALL KINDS OF BELTS

Maple Leaf Belt Dressing does not contain resin, mineral or animal oils or other ingredients harmful to belts.

All belts should have an occasional application of a reliable dressing in order that the best results be obtained. We recommend Maple Leaf Belt Dressing as the safe and sane treatment.

Dominion Belting Co., Ltd.

HAMILTON, CANADA

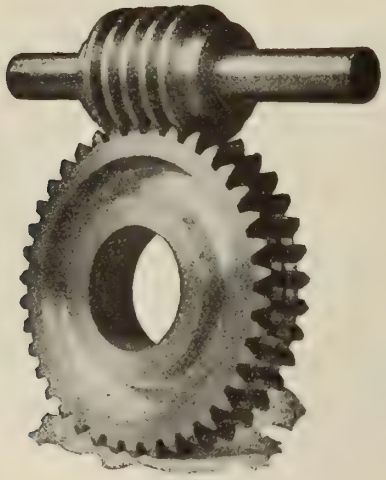
Quebec Branch--51 Duluth Building, Montreal

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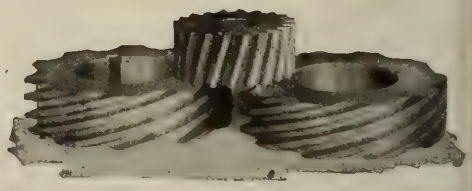
TRANSMISSION SECTION



GOOD



WORM GEARS



HELICAL OR SPIRAL



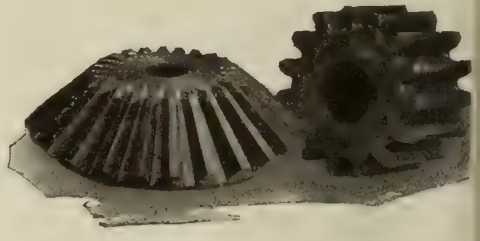
SPUR GEARS

Capacities:

Spur Gear up to.....91 inch Dia.
Worm Wheels up to.....54 inch Dia.
Bevel Gears up to.....62 inch Dia.
Hellical or Herringbone Gears to.....54 inch Dia.
Racks up to.....16 ft. Leng.



DOUBLE HELICAL



RAWHIDE PINIONS

HAMILTON GEA

Van Horne Str

TRANSMISSION SECTION



GEARS

Whatever your Gear requirement we can serve you well —Years of specialized experience are at your service.

Write or wire for quotations

OMPANY, LIMITED

RONTO, Ontario

TRANSMISSOIN SECTION

DUNLOP
"Gibraltar RedSpecial"
BELTING

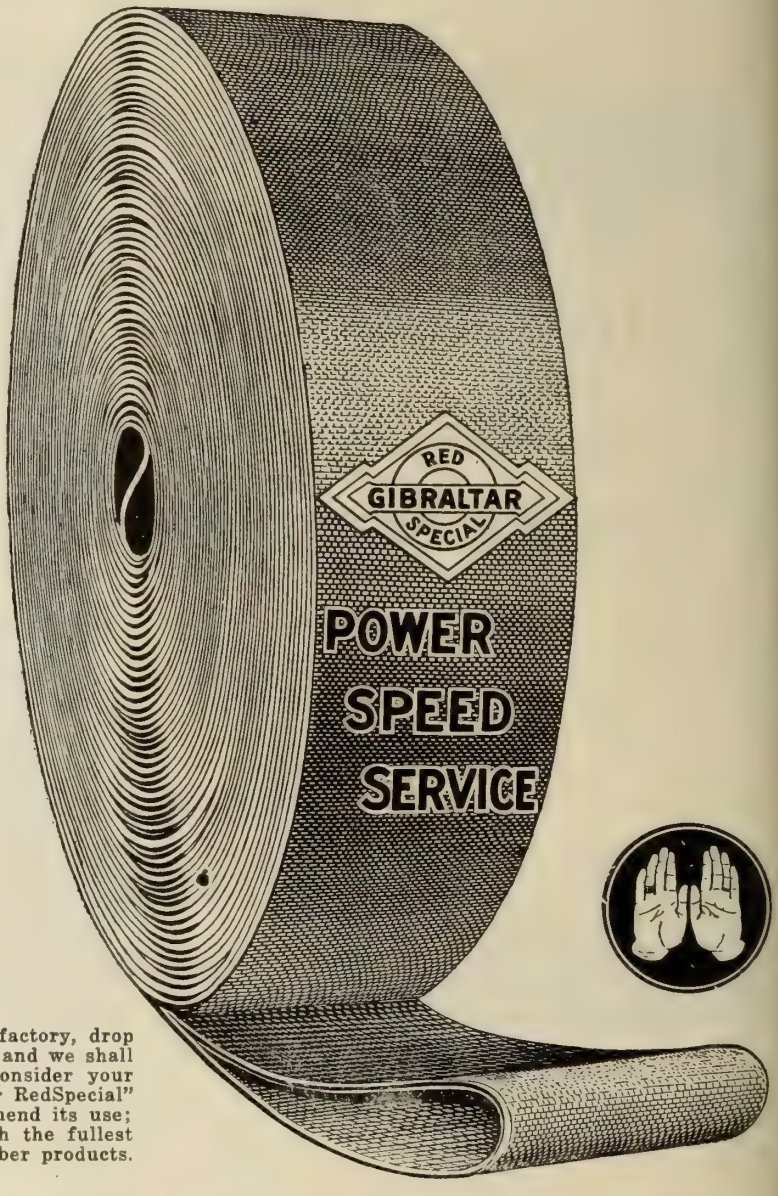
Lessening the Worries of Factory Chiefs

Trimming down Factory Overhead and keeping plants running without interruption from Belt trouble—thus lessening the worries of factory chiefs —is the specific purpose for which

DUNLOP "Gibraltar RedSpecial" BELTING

was specially designed. We believe "Gibraltar RedSpecial" is the one Belt that will unfailingly solve your Belt problems. Its superiority is of no haphazard origin, but is the result of twenty-five years' careful workmanship and adequate experimentation.

Its construction embodies none but the highest grade rubber, compounded to indefinitely retain its pliability. The duck used is specially woven, of tremendous tensile strength. The result is observed in the wonderful tenacity, the enduring flexibility and the absolute uniformity throughout for which "Gibraltar RedSpecial" is deservedly famous. The rich quality of the rubber insures against drying out or rotting, waterproofs the duck, holds the plies securely together and minimizes internal chafing.



The Dunlop Unreserved Guarantee

If you have a difficult drive anywhere in your factory, drop a line to our Head Office, or to our nearest branch, and we shall send a man experienced in belt engineering to consider your requirements. If it is an instance where "Gibraltar RedSpecial" Belting may be suitably employed we shall recommend its use; and we will stand behind our recommendation with the fullest guarantee ever issued by a firm manufacturing rubber products.

Dunlop Tire & Rubber Goods Co., Limited

Head Office and Factories - - - - - - TORONTO

BRANCHES IN THE LEADING CITIES

Makers of Tires for all purposes, Mechanical Rubber Products of all kinds, and General Rubber Specialties

D3

TRANSMISSION SECTION



UNION DRAWN

BRIGHT COLD FINISHED STEEL

SHAFTING

We manufacture Bright, Cold-Finished Steel in Rounds, Flats, Squares, Hexagons and Special Shapes for Pump Rods, Piston Rods, Roller-bearing Rods, etc.

Cold Drawn or Turned and Polished Alloy Steel.

- 3½% Nickel Steel.
- 1% Nickel Steel.
- Chromium Steel.
- Chrome Nickel Steel.
- Chrome Vanadium Steel.

For use in manufacturing parts where greater strength and toughness are required than ordinary Cold Drawn Steel.

Besides maximum strength and accurate size you get absolute straightness and highly polished surface in UNION DRAWN, BRIGHT, COLD-FINISHED STEEL PRODUCTS.

Large stock constantly on hand to meet demands for prompt delivery.

Union Drawn Steel Company, Limited

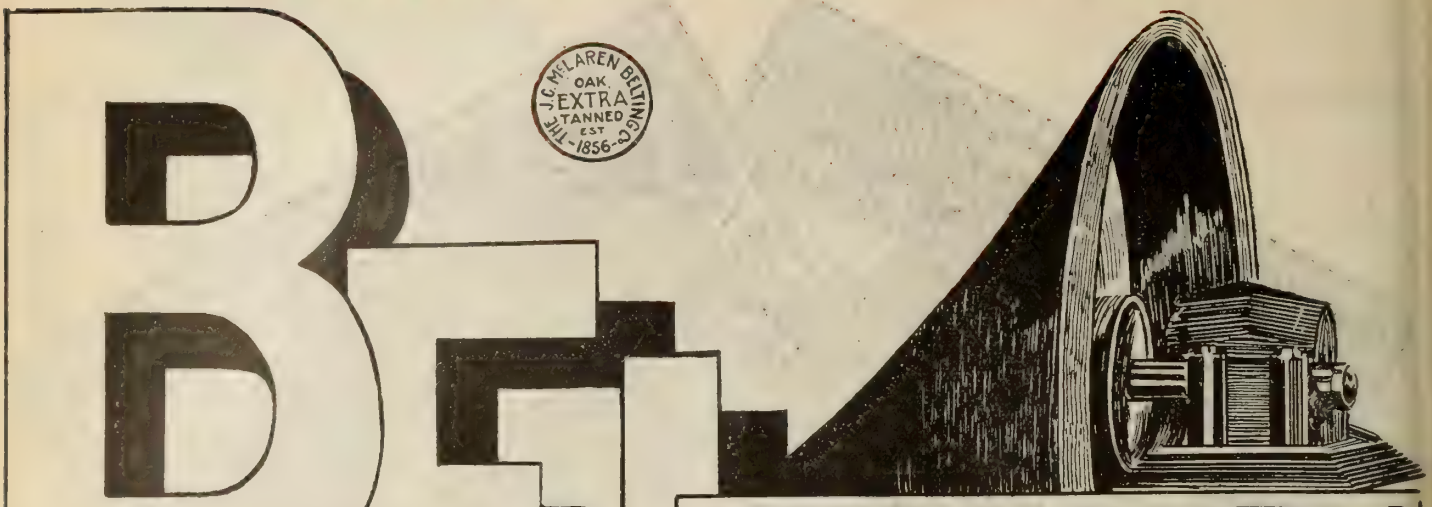
Hamilton **Ontario** **Canada**



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TRANSMISSION SECTION

BELTS



J. C. McLAREN BELTING OAK EXTRA TANNED EST 1856

J.C.McLAREN

Be Sure of the QUALITY of Your Belting

Quality in the belting you use determines to a great extent the output of your plant. The better the belting the better the output.

J. C. McLaren's products represent a **quality** in belting that is unsurpassed.

They are flexible, gripping, tough—they will carry all the power that any belting can possibly carry, yet wear long and always give good service.

The cost records of scores of plants bear witness to the fact of J. C. McLaren's belting economy and efficiency.



Sixty-one years of successful experience!
Put your belting problems in our hands.

J. C. McLaren Belting Co., Ltd.

MONTREAL TORONTO WINNIPEG

TRANSMISSION SECTION

LEVIATHAN AND ANACONDA
ELEVATING TRANSMITTING CONVEYING
BELTING

MONTREAL
TORONTO
WINNIPEG
W. W. HICKS
EDMONTON
AND CALGARY
GORMAN, CLANCEY
& GRINDLEY

MAIN BELTING COMPANY OF CANADA, LIMITED.
LEVIATHAN AND ANACONDA
MONTREAL. TORONTO.
10 ST. PETER STREET,
MONTREAL.

Jan. 8, 1920.

Gentlemen:-

You will be interested to know that we will shortly have off the press our new 150-page reference work on Power Transmission, Conveying and Elevating.

This book is, throughout, the production of technical experts of broad practical experience. No time or expense has been spared to make it the most complete and useful reference work of the kind ever issued in Canada.

It is profusely illustrated with reproductions from actual photographs and original drawings, and contains a number of carefully prepared rules and tables for the information and guidance of belting users. Contents are conveniently arranged, and a comprehensive index is included.

The volume is printed on fine paper and is substantially bound, de luxe, loose-leaf style. Our aim has been to make this a valuable and permanent addition to any manufacturer's office library.

I will be pleased to forward you a complimentary copy, carrier charges prepaid, upon receipt of your request on your firm's stationery. The edition is limited.

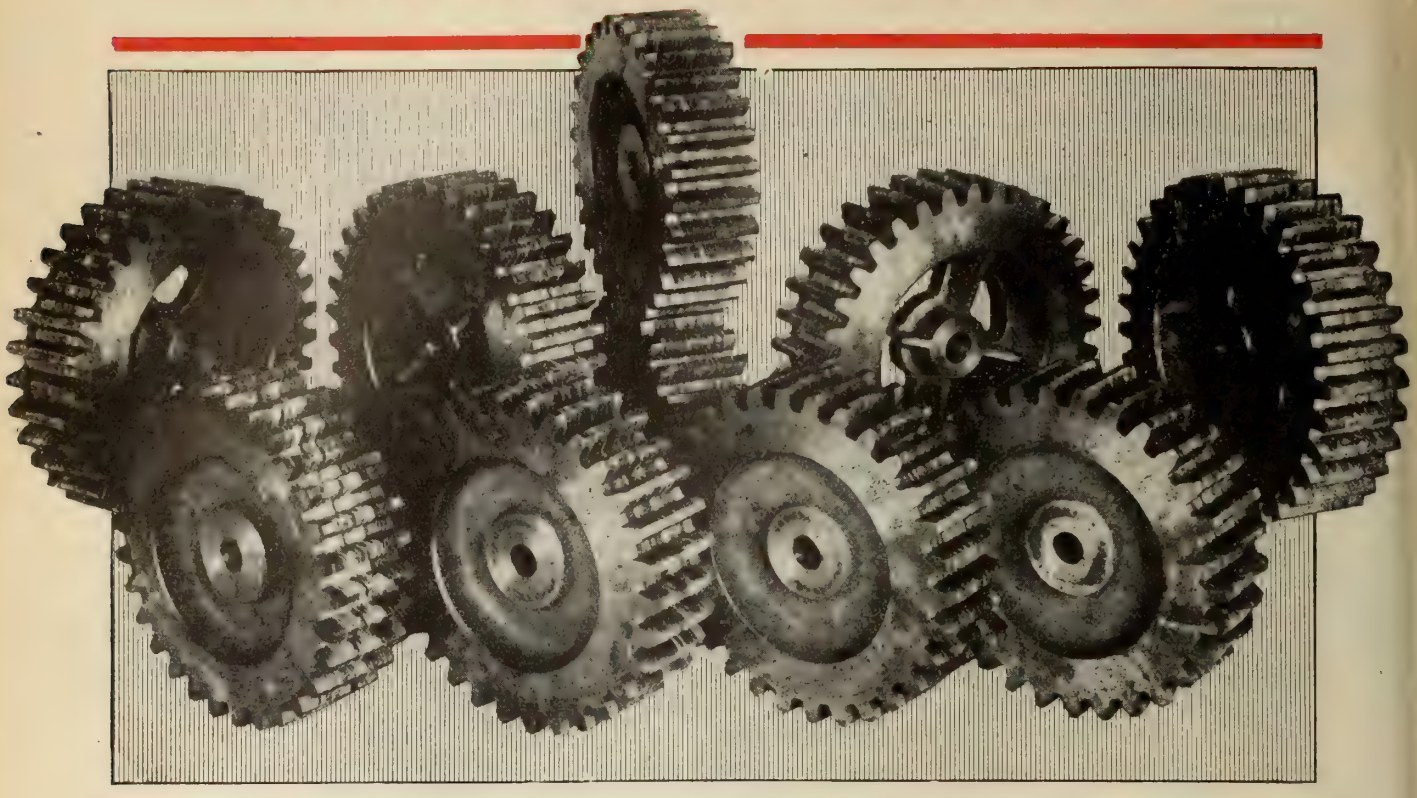
Very sincerely yours,
MAIN BELTING COMPANY OF CANADA, LIMITED.
D. E. Parker
Managing Director.

A REAL GUARANTEE

Our responsibility for each LEVIATHAN and ANACONDA Belt extends beyond payment until the belt has earned in actual service its full cost as compared with the service of any other belt of any kind, under the same or similar conditions, barring accidents.

We regard this as the only guarantee that is fair to the buyer.

TRANSMISSION SECTION



All Kinds of

GEARS

Rawhide and Silent Micarta
Pinions for a noiseless drive
Let us tell you about them.

Besides giving you an accurately cut product, we are prepared to give you the very best of service.

"Hurry Orders and Break Down Jobs" receive special attention.

Try a catalog—it makes good reading and is just full of gear data.

Philadelphia GEAR Works

Vine and 11th Streets

PHILADELPHIA, P.A., U.S.A.

TRANSMISSION SECTION

Mechanical Rubber Goods

For nearly forty years we have been manufacturing mechanical rubber goods, and are supplying many of the largest mills, plants, railroads, and leading concerns in all kinds of industry. We are large manufacturers of Rubber Belting, Rod and Sheet Packings, Hose for all purposes, Pump Valves, Gaskets, Tubings, etc.



Rubber Belting

For the transmission of power and conveying of materials, made in any size and ply and in various grades to take care of operating conditions of all description.



Daniel's P.P.P. Rod Packing

The original and only genuine self-setting rod packing. In construction, P.P.P. consists of two sliding wedges and compressible cushion, which allows the packing to adjust itself to the rod, according to the pressure exerted, thereby overcoming friction to a greater extent than by the use of other packing. Unequalled for the packing against steam, water, air, ammonia and other fluids. Holds your rods fluid tight and wears for a remarkably long length of time.

Send for copy of "The Story of Some Friction Tests."



Sheet Packing

High grade sheet packing in both red and black. Our EBONITE, black sheet packing is recognized as the leading high grade sheet packing now on the market. Most serviceable for high pressure, superheated steam, hot water, ammonia, oils and acids.

Our **HERCULES** is a very efficient red sheet packing and ranks with the best of other makes.



Hose For All Purposes

One complete department of our plant is devoted to the turning out of rubber hose for the various uses, such as—Steam, Water, Air, Suction, Fire Protection, Chemical, Acids, etc.

LARGE STOCKS OF OUR MECHANICAL RUBBER GOODS, INSURING PROMPT SHIPMENTS, CARRIED BY OUR CANADIAN AGENTS.

QUAKER CITY RUBBER COMPANY

Philadelphia, Pa., U.S.A.

General Canadian Agents:

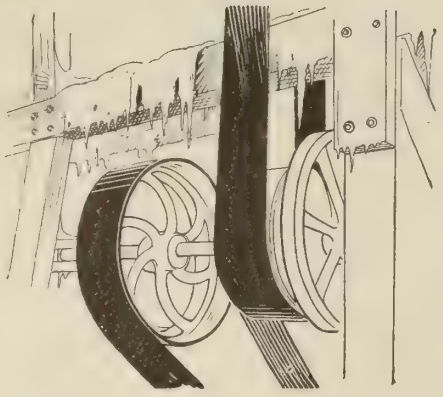
INTERNATIONAL MACHINERY & SUPPLY CO., LIMITED

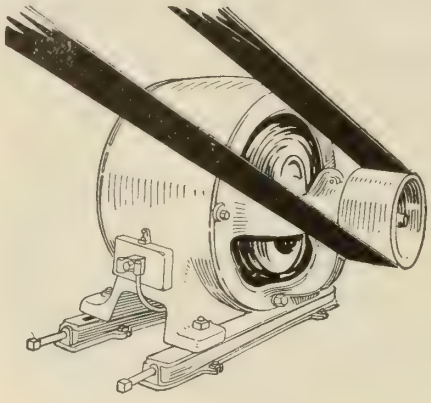
371-373-375 ST. JAMES STREET, MONTREAL

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TRANSMISSION SECTION

BELTING





You Already Know—

the good qualities possessed by a first class Balata belt.

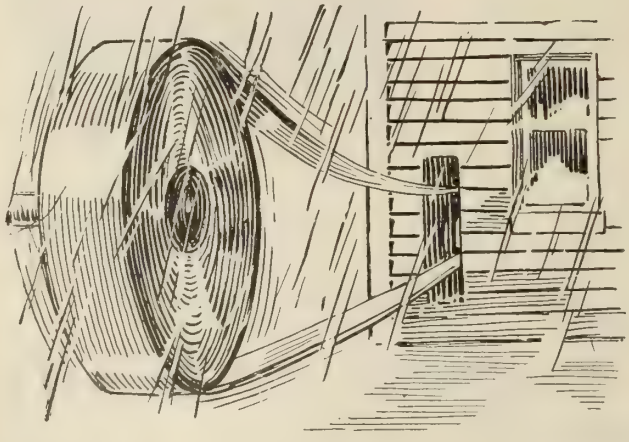
THE PRICE has, however, advanced on this material, making the first cost very high.

FORTUNATELY we placed large orders previous to the recent advances and

We Are Prepared

to give our customers the benefit of prices which were in effect previous to the late advances.

We have a good stock of



Lanco Balata Belting

and would like to have your orders.

Do not forget the long-wearing qualities and the really waterproof conditions of Lanco Balata.

FEDERAL ENGINEERING CO., LIMITED

172 John St., Toronto

TRANSMISSION SECTION

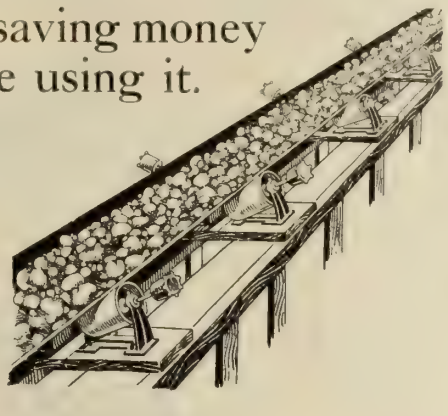
BELTING

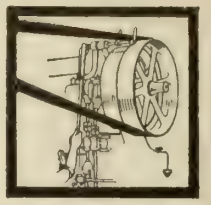
--*for*

Transmission

SCANDINAVIA BELTING — TORONTO

Cuts to right show where recommended. This belt is saving money for the firms who are using it.

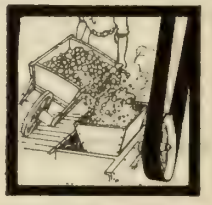




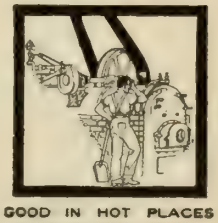
GOOD ON BELT SHIFTERS



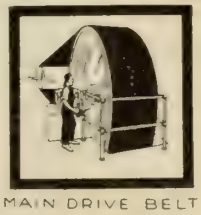
GOOD IN OILY PLACES



GOOD IN DUSTY PLACES



GOOD IN HOT PLACES



MAIN DRIVE BELT

--for Conveying

Our regular belt for abrasive materials.



an Economical Belt for Conveying

Broken
Stone
Ore
Coal
Coke
etc.

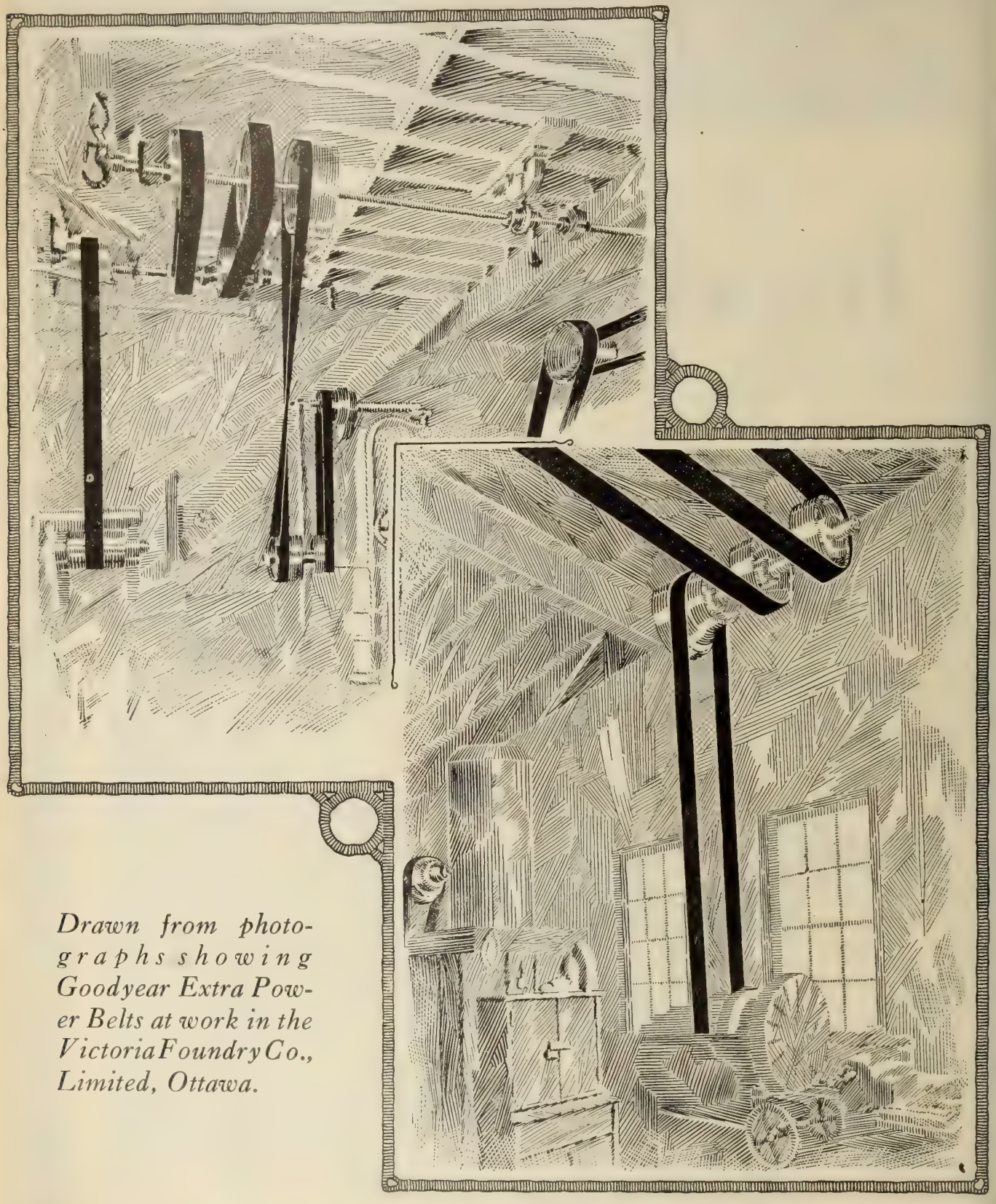
For materials that are non-abrasive, use our Special Conveyor. This is especially adapted for handling clay, pulp, sawdust, sand, etc., and is cheaper.

Write us about your requirements.

FEDERAL ENGINEERING CO., LIMITED

172 John St., Toronto

TRANSMISSION SECTION



Drawn from photographs showing Goodyear Extra Power Belts at work in the Victoria Foundry Co., Limited, Ottawa.

GOODYEAR
MADE IN CANADA

TRANSMISSION SECTION

Reduce Belt Replacement

Changing belts costs money.

Belts which wear out quickly must be replaced frequently.

This costs money for belting.

Costs money for idle machinery.

Costs money for idle hands.

Costs money because piece-workers become dissatisfied.

Goodyear Extra Power Belting reduces belting costs.

It wears long, and so makes the belting itself cost less.

It keeps machinery and men busy, and enables everyone to produce at greatest efficiency.

This has been the experience of every one of the more than a thousand Canadian plants which use Goodyear Extra Power Belting.

For example, here is what the Victoria Foundry Company, of Ottawa, say about their Extra Power:

VICTORIA FOUNDRY COMPANY, LIMITED, OTTAWA

Gentlemen:

We have certainly had great satisfaction from your "Extra Power" Belting.

We have used it on all kinds of machines. It has been in service a surprising length of time—and is still in service.

For instance—

16 months on the cone of a 30-inch Lodge & Shipley lathe.

18 months on the cone of a 24-inch lathe.

24 months on a 30-inch drill press.

12 months on main drive of a 36-inch planer.

And all still in service. Not a replacement so far. We are mighty pleased.

Yours very truly,

THE VICTORIA FOUNDRY COMPANY, LIMITED.

Men trained by Goodyear to solve belting problems are always available to confer with you. No obligation. Just wire, phone or write the nearest branch.

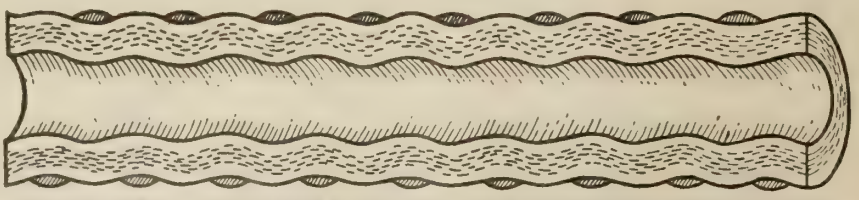
The Goodyear Tire & Rubber Co. of Canada, Limited

Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton London, Winnipeg, Regina, Calgary, Edmonton, Vancouver

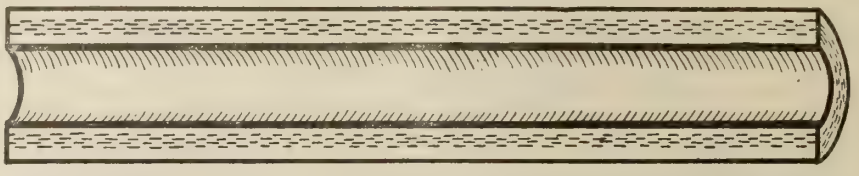
EXTRA POWER BELTING

If interested tear out this page and place with letters to be answered.

TRANSMISSION SECTION



SECTION OF STEAM HOSE SHOWING THE EFFECTS OF WIRE-WINDING UNDER PRESSURE.



SECTION OF GOODYEAR STEAM HOSE UNDER THE SAME PRESSURE.

Goodyear has made Wire-Winding on Steam Hose Unnecessary

THAT the expansion of steam in steam hose had to be controlled by wire-winding has been long taken for granted by industry. Of course, the wire became bent and the hose choked up; it became too hot to handle; it was inconvenient to cut into shorter lengths; the wire cut through the cover. But it had always been so. And wire-winding seemed essential to protect hose from rough usage and from pressure bursts.

The illustration shows what wire-winding does to steam hose. Under the heat and pressure of use, the hose expands faster than the wire. Bulges and blisters form. The tube cracks and the fabric is weakened.

Goodyear has made wire-winding on steam hose unnecessary. Goodyear has developed a hose fabric strong enough to control steam under high pressure—tough enough to insure long service *without special winding or covering.* Add an inner tube of special compound to resist heat and a tough cover—there you have the story of very long service and very low final cost.

The high quality of Goodyear Steam Hose—the unusual construction, developed solely to meet the severe conditions under which steam hose is used—are but samples of what you will find in all Goodyear Industrial Hose.

Goodyear has scientifically developed a hose for every industrial use. Samples of this hose, and the advice of a trained technical man, are yours for the asking—without obligation. Phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver. Service stocks in other cities.

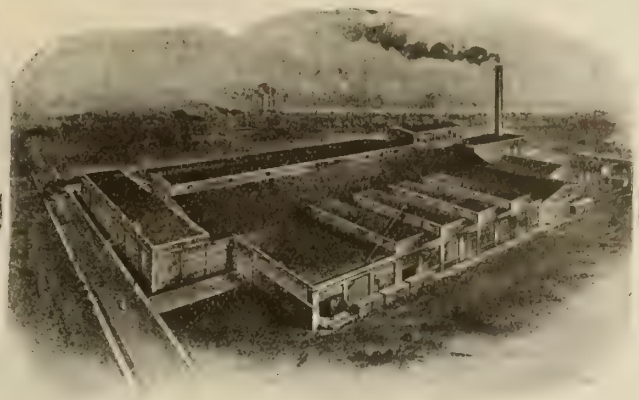
GOODYEAR

MADE IN CANADA

INDUSTRIAL HOSE

TRANSMISSION SECTION

SHAFTING



Cold Drawn, Turned and Polished Steel Shafting

Rounds
Squares



Hexagons and Flats

Finished Machine Keys Ready to Drive.
Free Cutting Screw Stock and Piston Rods.

The Canadian Drawn Steel Co., Limited

Hamilton
Canada

Flawless Products

Quickest Service

CANADIAN

H. J. WADDIE, *President and Manager* R. K. HOPE, *Vice-President* S. D. BIGGAR, *Treasurer* C. R. BROWN, *Secretary*

TRANSMISSION SECTION

WHEN THINKING OF BELTING KEEP IN MIND THAT

The back of the Ox



is the part where the fibre of the hide is tightest and unaffected by the action of breathing, therefore the most suitable to produce a dead straight and practically stretchless belt.

Tullis
LEATHER BELTING
COLUMBIA BRAND

is made entirely from this portion of the hide.

SEND FOR OUR ILLUSTRATED CATALOGUE

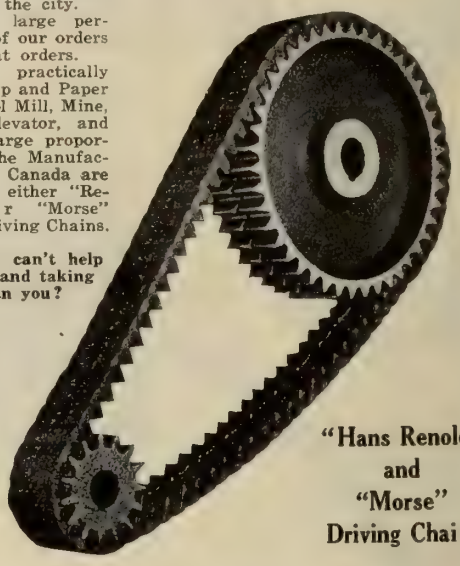
JOHN TULLIS & SON, LTD.
BELTING SPECIALISTS
ST. ANN'S WORKS, GLASGOW, SCOTLAND
Established 1834

Canadian Agents:
UNIVERSAL SUPPLIES Limited
Room 25, 204 St. James Street
MONTREAL

It's Interesting

WHEN a large Hydro-Electric Plant installs a 5000 H.P. "Morse" Silent Chain Drive.
WHEN one of the largest Canadian Manufacturing Plants install over 27 "Renold" Silent Chain Drives totalling over 4000 H.P.
WHEN a large Canadian city installs a 500 H.P. "Renold" Silent Chain for driving Generators to provide light for the city.
WHEN a large percentage of our orders are repeat orders.
WHEN practically every Pulp and Paper Mill, Steel Mill, Mine, Grain Elevator, and a very large proportion of the Manufacturers in Canada are Users of either "Renold" or "Morse" Silent Driving Chains.

Well, you can't help sitting up and taking notice. Can you?



"Hans Renold" and "Morse" Driving Chains

Sole Canadian Agents:
JONES & GLASSCO (Reg'd.)
Engineers.
MONTREAL, St. Nicholas Building. TORONTO, Bank of Hamilton Building

PLEWES Limited
WINNIPEG
For All
Machinists' Supplies

CLUTCHES
Combined Jaw and Friction. Friction only.
Gas Engine Clutches. Jaw Clutches.
Write for interesting printed matter.
The Positive Clutch & Pulley Works, Ltd., Canada
MONTREAL Factory: Aurora, Ont. TORONTO

If that old machine is not earning you money, then it's losing money, see!

Sell it to the firm who can use it, and both of you will make money.

ADVERTISE IT IN THE CLASSIFIED SECTION OF
CANADIAN MACHINERY

TRANSMISSION SECTION

The Drive of Efficiency

MORSE CHAINS

The Drive of Durability

Positive as Gears



Flexible as a Belt

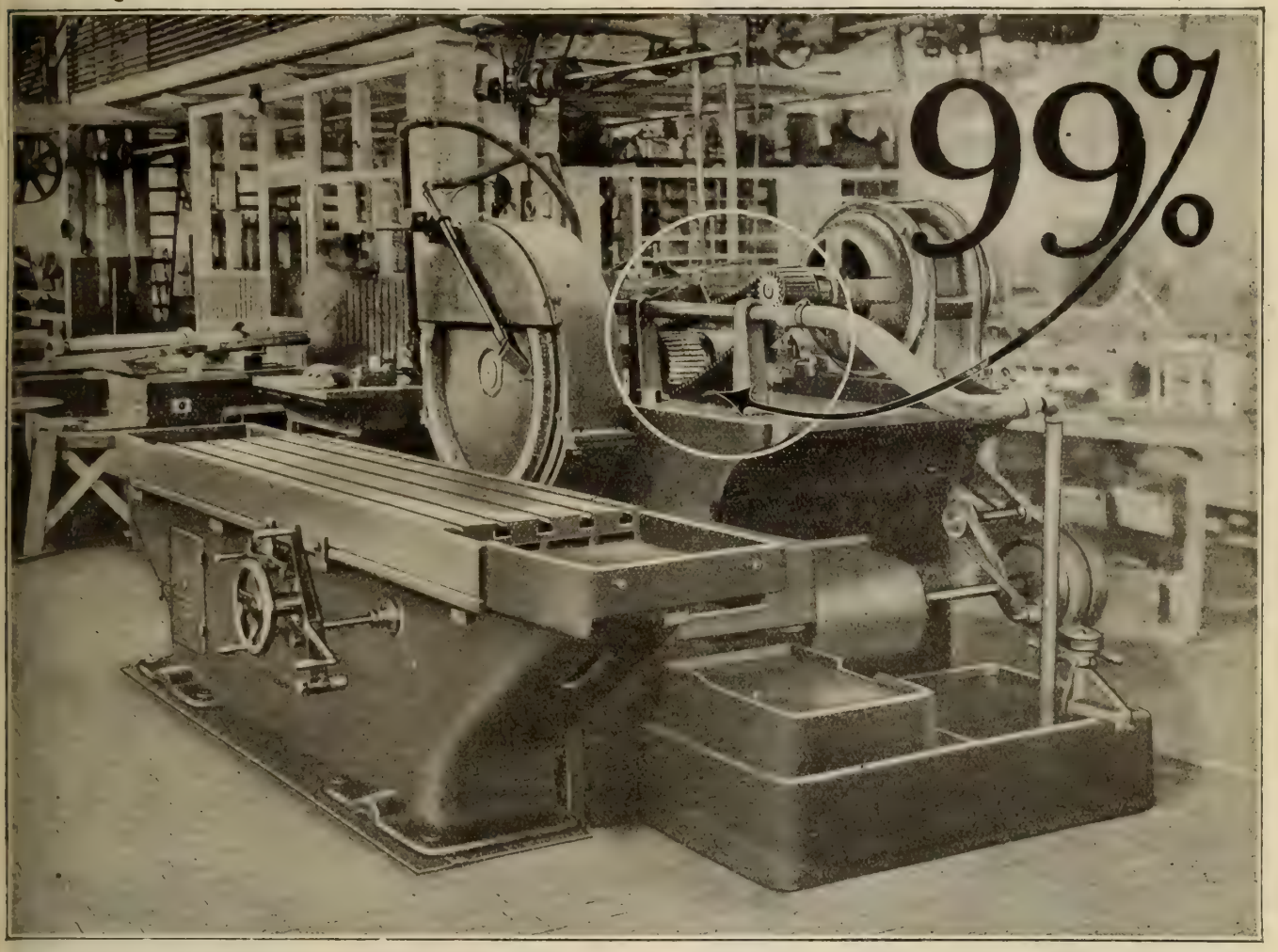
Longer Life

About 2½ Million Horse Power in World-Wide Service

Morse Steel Belts will rid you of belt slippage (power loss), give more power to your machines and ensure durability in your transmission.

The Morse Rocker Joint Silent Chain Drive has made good right from the first and held itself supreme through years of hard service.

Bring your transmission problems to Morse engineers. They are men of wide experience. Let them help you plan your drives.



Heavy Duty Face Grinder Drive.

MORSE CHAIN CO., Largest Manufacturers of silent chains in the world **ITHACA, N. Y.**

MORSE ENGINEERING SERVICE — Address Nearest Office

BOSTON, MASS. .....141 Milk Street
CHICAGO, ILL. .....Merchants Loan and Trust Bldg.
CLEVELAND, OHIO .....Engineers' Bldg.
DETROIT, MICH. .....1003 Woodward Avenue
GREENSBORO, N.C. .....805 Ashboro Street
NEW YORK CITY .....50 Church St., Hudson Terminal Bldg
PITTSBURGH, PA. .....Westinghouse Bldg
SAN FRANCISCO, CAL. .....Mondanock Bldg.

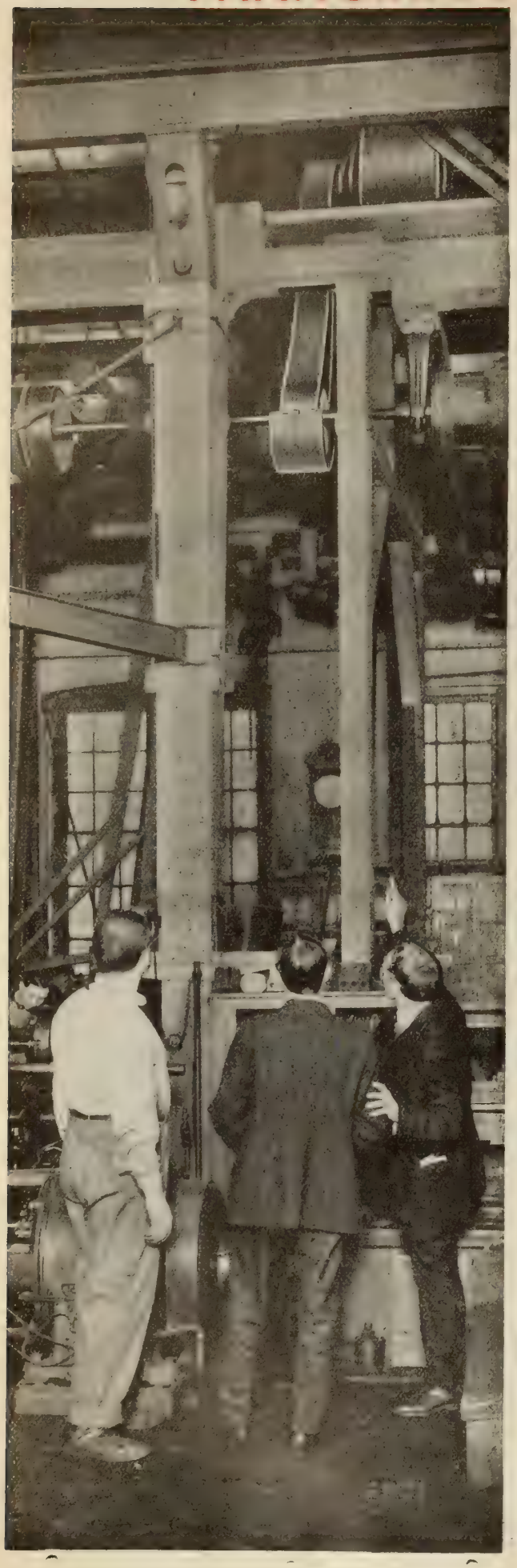
ASSISTANCE WITHOUT OBLIGATION

ATLANTA, GA. .....Earl F. Scott, M.E., 702 Candler Bldg
CANADA.....Jones & Glassco, Regis'd
MONTREAL..St. Nicholas Bldg., Toronto, Bank of Hamilton Bldg
KANSAS CITY, MO....Morse Engineering Co., R. A. Long Bldg
MINNEAPOLIS, MINN.....413 Third St., Strong-Scott Mfg. Co.
ST. LOUIS, MO. .....Morse Engineering Co., Chemical Bldg

LICENSEES FOR EUROPE & EASTERN HEMISPHERE.
The Westinghouse Brake Co., Ltd., 82 York Road, London, N.

If interested tear out this page and place with letters to be answered.

TRANSMISSION SECTION



"That's an Efficient Line Shaft Drive"



ALL the power of the motor is delivered to the line shaft. There is nothing lost in slippage; no need to worry about that drive! It requires less attention than the motor. The motor needs less care, too, for there is just enough flexibility in the

Link-Belt Silent Chain Drive

to protect the motor armature against shock. Positive transmission, without slip or loss, means increased production.

The alignment of the line shaft is not affected at all by the Link-Belt Silent Chain Drive. There is no intense friction on the bearings, to cut and heat them.

The installation of a single Link-Belt Silent Chain Drive, as for instance, a line shaft transmission from an electric motor, often leads to the general adoption of the Link-Belt system throughout the plant.

One advantage of Link-Belt Silent Chain that appeals to power users applying direct motor drives is that the large variety of speeds offered makes it possible to secure on short centers speed ratios that favor the use of high speed motors, thus effecting a considerable saving in the initial cost of the motor installation.

Let us tell you how little it should cost for a drive.

We furnish each drive complete and guarantee its satisfactory operation.



CANADIAN LINK-BELT COMPANY
LIMITED

WELLINGTON AND PETER STREETS, TORONTO

TRANSMISSION SECTION

LOOK FOR THIS BRAND

Highest Grade
Mechanical Rubber Goods
For Every Purpose

THE UNIQUE
GUTTA PERCHA & RUBBER LIMITED
TRADE P.M.S MARK
PAPER MILL SPECIAL
TORONTO — CANADA
TRANSMISSION BELT

BELTING
Power Transmission,
Conveyor and
Elevator

PACKING
Redstone" Pure Red Sheet
Cloth Insertion Sheet
"Sun" Spiral

HOSE
Water, Steam, Air Drill, Pneumatic Tool,
Oil, Gasoline, Suction and Fire Hose,
Underwriter Mill Protection Hose

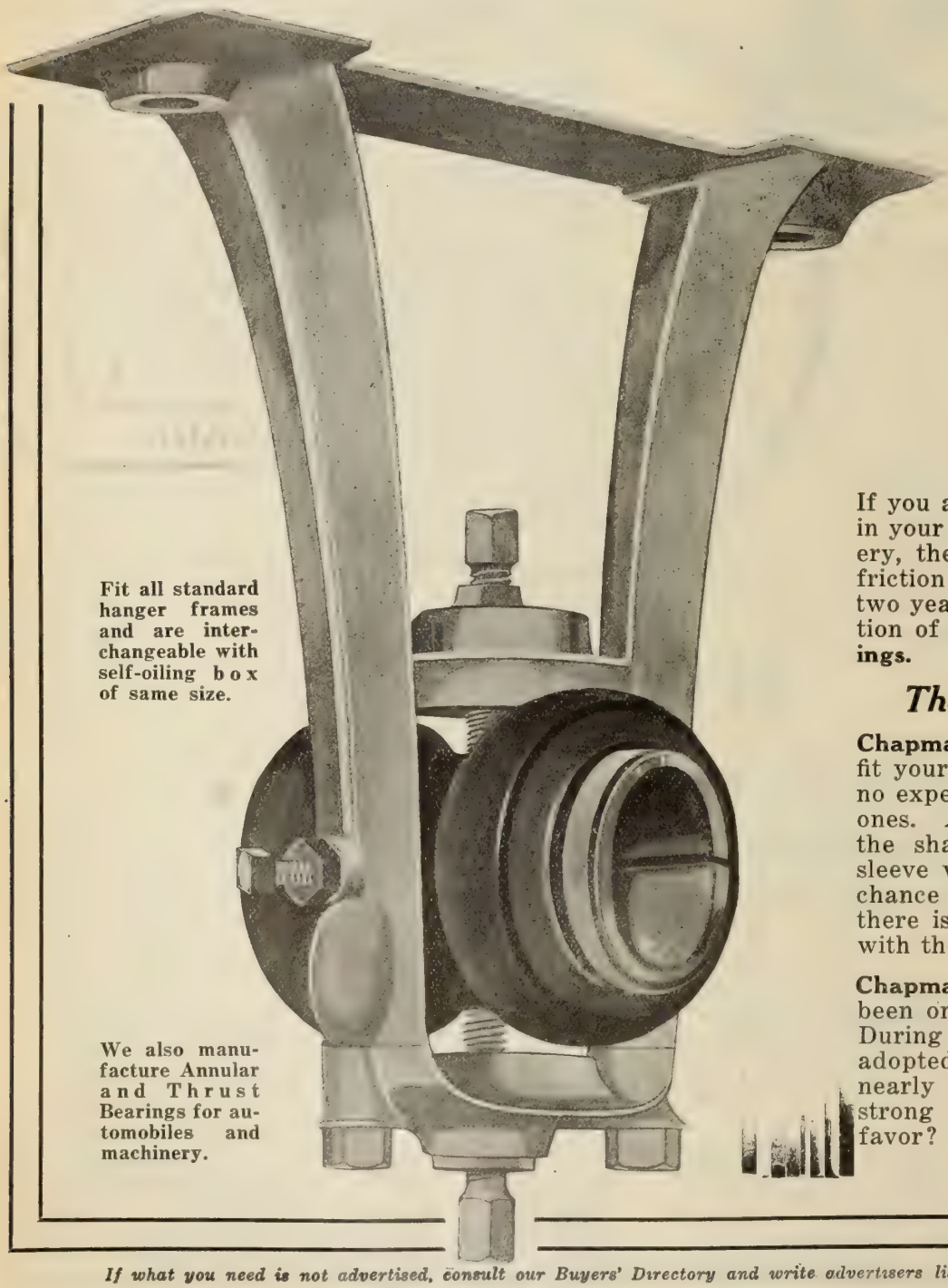
GUTTA PERCHA & RUBBER, LIMITED
HEAD OFFICE AND FACTORY: TORONTO, CANADA

BRANCHES:
Halifax, Montreal, Ottawa, Calgary, Fort William, Lethbridge, Winnipeg, Vancouver, Regina, Victoria, Saskatoon, Edmonton,

If interested tear out this page and place with letters to be answered.

TRANSMISSION SECTION

CHAPMAN DOUBLE BALL BEARINGS



Fit all standard hanger frames and are interchangeable with self-oiling box of same size.

We also manufacture Annular and Thrust Bearings for automobiles and machinery.

You Pay for Them

Whether You Use Them or Not!

If you are using babbitted bearing in your power transmission machinery, the power being lost through friction by these bearings would in two years' time pay for an installation of **Chapman Type Ball Bearings.**

They Fit Any Hanger

Chapman Type Ball Bearings will fit your present hangers. There is no expense or delay of getting new ones. As these bearings lock onto the shaft by the compression of sleeve wedges, there is no possible chance for shaft-cutting or wear, as there is no moving part in contact with the shaft.

Chapman Type Ball Bearings have been on the market for 16 years. During this time they have been adopted as standard equipment by nearly 4,000 plants. Isn't this a strong recommendation in their favor?

TRANSMISSION SECTION

TRANCO TRUCK

The Universal Elevating Truck

Operates With Sterling Head and Handle At Any Angle When Lifting and Lowering the Load

The "Tranco" Truck can be operated with the steering head and handle at any angle. Other trucks can be steered at any angle, but when the load is lifted or lowered, the handle must be in front. Not so with the "Tranco" Truck. Due to its chain lifting mechanism, the load can be lowered or raised with the steering head and handle in any position. No matter how cramped the quarters, the "Tranco" Truck will do its work—you can't corner a "Tranco." This feature is found only in the "Tranco" Truck.

MADE IN CANADA

The TRANCO Method

By placing the load on inexpensive platforms and conveying the platforms when loaded by means of the TRANCO Trucks to their destination, handling is reduced to a minimum. The operation is quick and methodical, one man with a TRANCO can do the work of five men using old-time trucks and old-time methods. Spoilage and breakage is almost negligible, too, where Tranco Trucks are used.

Better write for our illustrated Tranco Truck booklet.

CHAPMAN DOUBLE BALL BEARING CO.

339 Sorauren Ave., Toronto, Ont.

408 Shaughnessy Bldg., Montreal



Full Line of Steel Balls Carried in Stock

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TRANSMISSION SECTION

Service

Quality

BERNARD

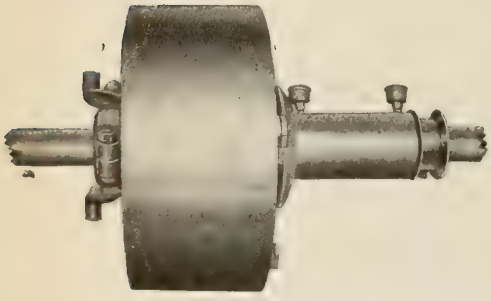


TRANSMISSION APPLIANCES

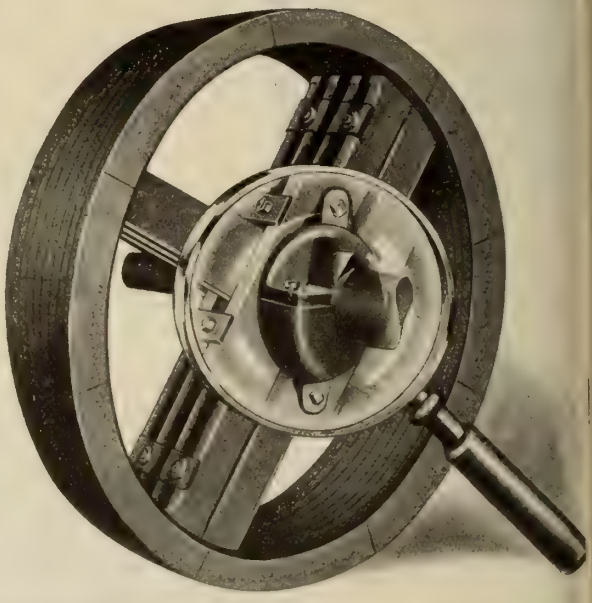
have achieved an enviable reputation in the Industrial World. Their excellent performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.

We stand back of our products and will give Dealers every assistance.

Put them to the Test.



BERNARD CLUTCH



BERNARD SAFETY COLLAR

Safety

The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances

Offices and Works: FORTIERVILLE, Que., Canada

Satisfaction

Corporation Town of Pembroke Ontario

Excellent Sites Available

Terminal Point on Ottawa Div of G.T.R.

Good Water Supply

On Main Line of C.N.R. Trans Continental

On Main Line of C.P.R

Abundant Hydro Power at Very Low Rates

On Ottawa River Great Shipping Facilities

Don't decide definitely on that new site before you investigate Pembroke.

It's an excellent location for almost any class of industry—from steel and iron to textiles.

Industries at present include large iron and steel plates, extensive saw mills, shook mills, wood-working plants, electrical goods, office furniture, textiles, etc.

Easily accessible to the great Western Canada markets,

being on main line of two transcontinental railways. Also terminal point on Ottawa division Grand Trunk Railway.

Power cheap and plentiful

4,000 Hydro-Electric horsepower developed, 2,000 of which is immediately available for manufacturing purposes at $15.00 to $18.00 per H.P.

Plenty of Skilled Labor — both Male and Female

Excellent Sites Available —or water front if necessary

Say the word and we'll send you the fullest particulars at once.

ADDRESS INQUIRIES TO THE MAYOR
PEMBROKE, ONT.

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TRANSMISSION SECTION

The Connecting Link between Power and Production

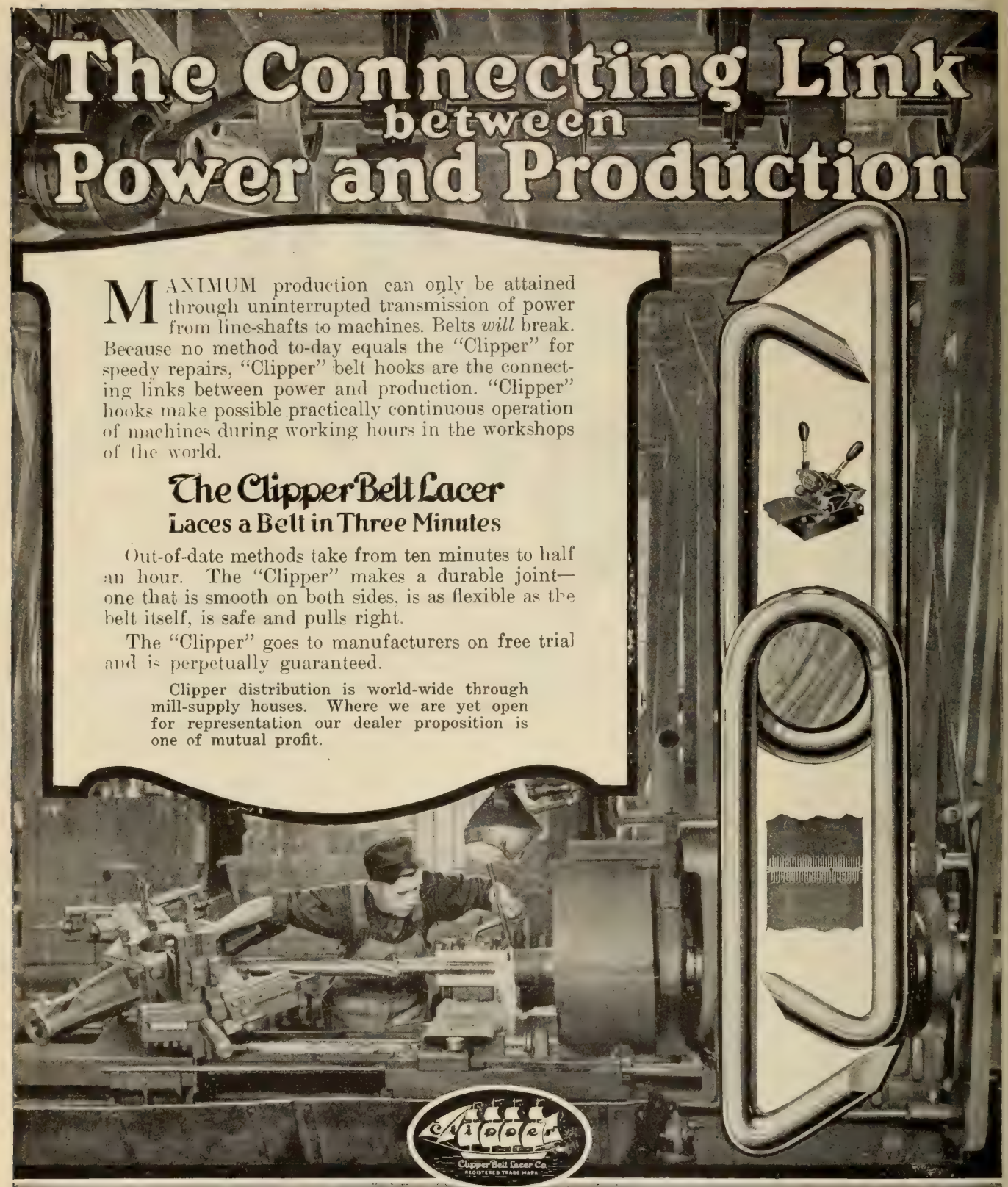
MAXIMUM production can only be attained through uninterrupted transmission of power from line-shafts to machines. Belts *will* break. Because no method to-day equals the "Clipper" for speedy repairs, "Clipper" belt hooks are the connecting links between power and production. "Clipper" hooks make possible practically continuous operation of machines during working hours in the workshops of the world.

The Clipper Belt Lacer
Laces a Belt in Three Minutes

Out-of-date methods take from ten minutes to half an hour. The "Clipper" makes a durable joint—one that is smooth on both sides, is as flexible as the belt itself, is safe and pulls right.

The "Clipper" goes to manufacturers on free trial and is perpetually guaranteed.

Clipper distribution is world-wide through mill-supply houses. Where we are yet open for representation our dealer proposition is one of mutual profit.



Clipper Belt Lacer Company

GRAND RAPIDS, MICHIGAN, U. S. A.

LONDON, ENGLAND—NO. 10 NORFOLK STREET

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

SPECIAL HIGH GRADE

FORGING BILLETS

Marine Steel (Lloyd's Specification)

Chrome Steel
Chrome Vanadium
Nickel Steel
Chrome Nickel

SPECIAL ALLOY STEEL

FOR

PUNCHES

And Other Special Steels for Various Purposes.

PROMPT SHIPMENT.
WRITE FOR PRICES.

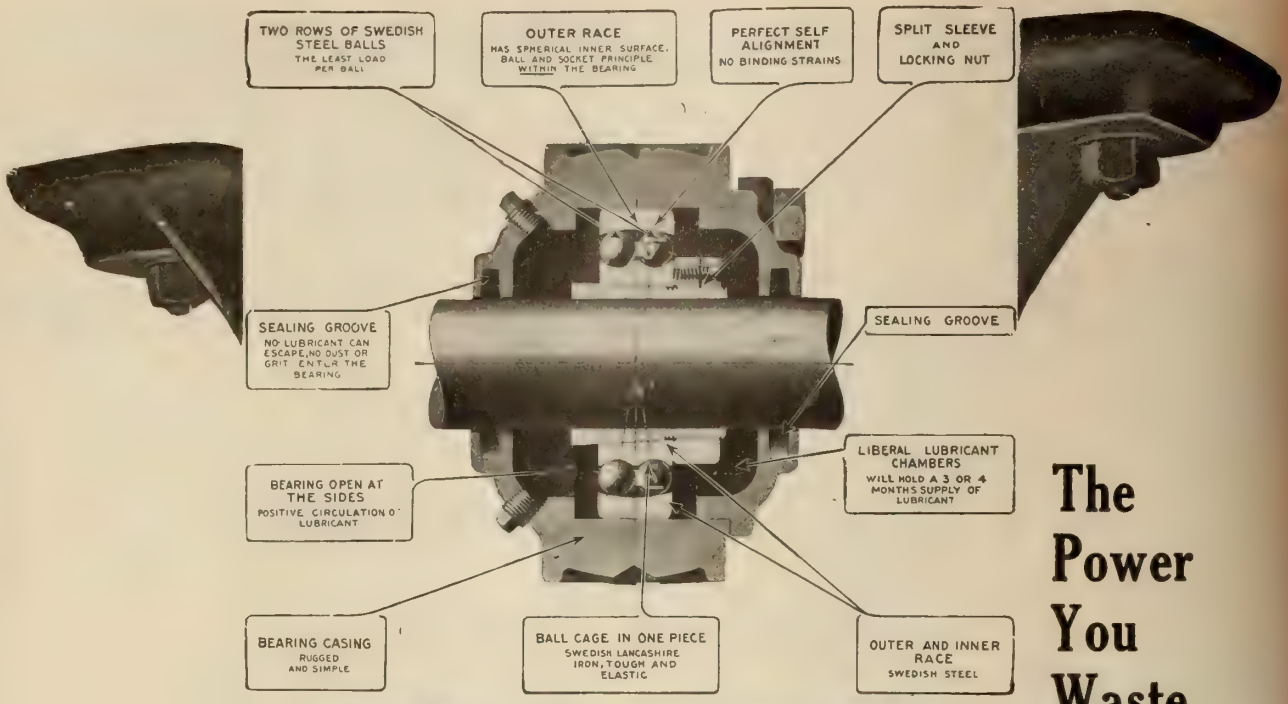
The ANDREWS STEEL CO.

NEWPORT, KY., U.S.A.

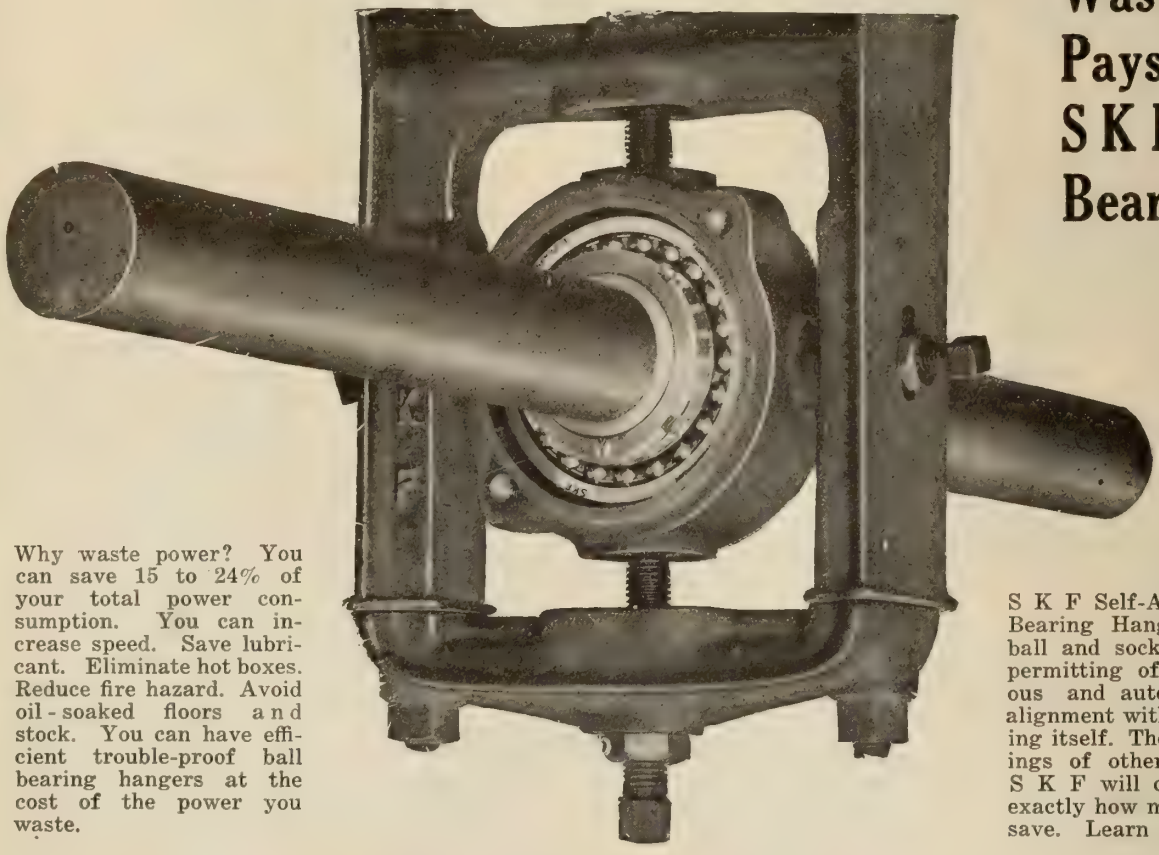
Cable Address: "ASCO" NEWPORT

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TRANSMISSION SECTION



The Power You Waste Pays for S K F Bearings



Why waste power? You can save 15 to 24% of your total power consumption. You can increase speed. Save lubricant. Eliminate hot boxes. Reduce fire hazard. Avoid oil-soaked floors and stock. You can have efficient trouble-proof ball bearing hangers at the cost of the power you waste.

S K F Self-Aligning Ball Bearing Hangers on the ball and socket principle, permitting of instantaneous and automatic self-alignment within the bearing itself. The actual savings of others who use S K F will convince you exactly how much you can save. Learn the facts.

If you are having transmission troubles and wasting power needlessly—if you want to have a cleaner, better-looking shop—use S K F.

We will gladly send you complete literature and letters from some of the big S K F users. Ask us to send you the "EVIDENCE."

CANADIAN SKF COMPANY, LIMITED

412 ST. JAMES ST., MONTREAL

83 KING ST. WEST, TORONTO

STEEL CASTINGS



This is a sample cut from a Dominion Steel Casting machined and bent cold. It illustrates the superiority of Dominion Cast Steel for machinery parts.

Representative Physical Test.

Tensile Strength	74200
Elastic Limit	38400
Elongation in 2"	31.2%
Reduction in Area	51.5%

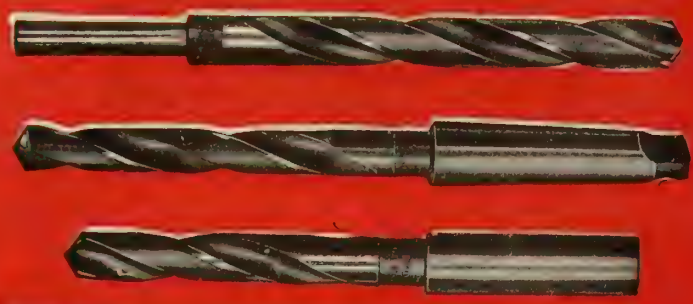
Modern methods in a modern plant are responsible for the enviable reputation *Dominion Castings* bear for strength and durability.

Manganese, special alloy and regular analysis produced in *Electric* and Acid Open Hearth furnaces with all heats subject to careful *chemical* and *physical* tests assure you of a product suited to your needs.

Send us your enquiries.

Dominion Foundries and Steel Limited

HAMILTON - ONTARIO

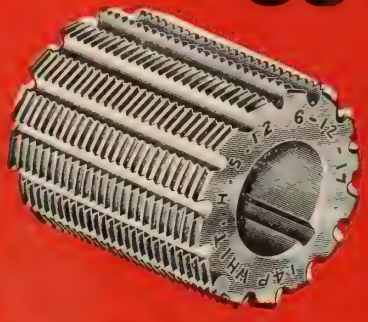




BUTTERFIELD

TWIST DRILLS, GEAR AND MILLING CUTTERS

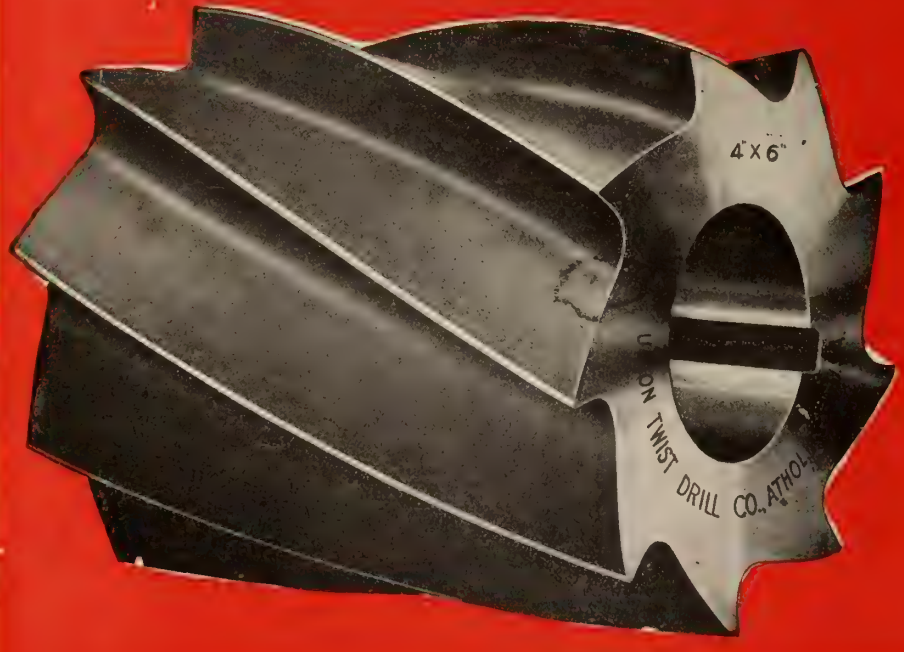
(Carbon and High Speed Steel)



Their ability to serve accurately and long equals that of Butterfield Taps, Dies and Reamers — the sincere praise of a thousand users wouldn't be a better recommendation.

They are the happy result of a great combination of specially trained men and the finest special machinery.

OUR COMPLETE LINE OF DRILLS AND CUTTERS ARE FULLY DESCRIBED IN OUR CATALOG A. Be sure to send for a copy.

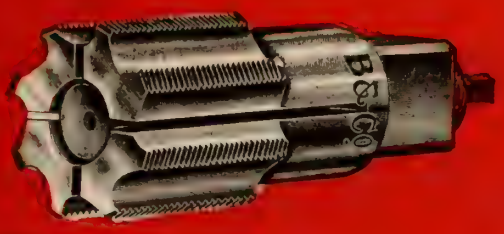


Butterfield & Co.,
Inc., Rock Island, P.Q.
Toronto Office: 220 King St. West



Butterfield

Taps, Dies and Reamers











The Deciding Factor in Tool Economy is Quality

Every process in the manufacture of Butterfield Tools is performed by experts, whose entire aim is to produce the highest quality—and the rigid inspection prevents any possibility of inferior tools reaching the shipping room.

By the service afforded—by the ability to cut cleanly and accurately and to duplicate the work over a long period of use—Butterfield quality gives the maximum returns on your investment.

Butterfield Tools reflect splendidly our 35 years' continuous concentration on improvement in high speed tools. You can't go wrong with a Butterfield.

Send for Catalog No. 17. It's just out.

Butterfield & Co., Inc., Rock Island, P.Q.

Toronto Office: 220 King St. W.

If interested tear out this page and place with letters to be answered.

Announcement

BAINES & PECKOVER
Steel Merchants

dissolved on December 31st, 1919

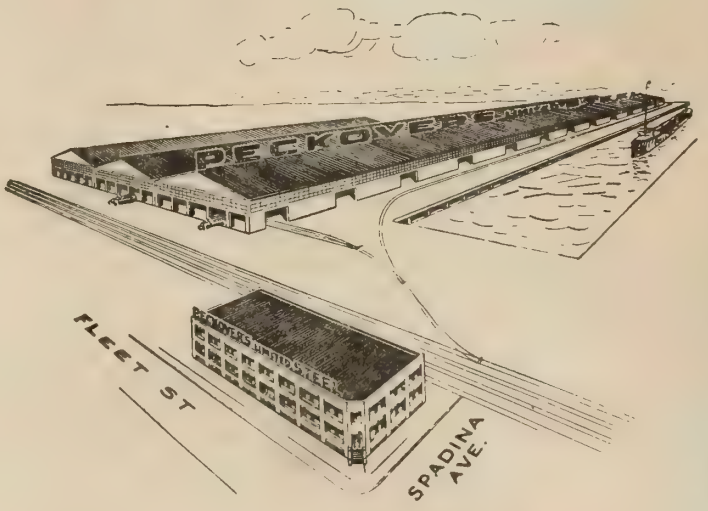
Peckover's
LIMITED
STEEL MERCHANTS

FOOT MARKET STREET
TORONTO

Opens on January 2nd, 1920
with a full line of stock

BOILER TUBES

Structural Steel
Fabricating
Reinforcing Steel
Contractors' Ironwork
Threaded Work
U M Plates
Sheared Plates
Chequered Plates



Merchant Bars
Welding Steel
Free Cutting Steel
High Carbon Steel
Nickel Steel
Tool Steel
Spring Steel
Hoops, Bands, Box Strapping
Shafting
Stripsteel
Black Sheets
Galv. Sheets
Auto Sheets
Bolts, Nuts, Washers, etc.

Proposed Warehouse, Office and Dock

Agents in Canada for: "FERALUN" Slip Proof Treads
"TRIUMPH-SUPERB" High Speed Steel

SERVICE - SALES

High-Grade Machine Tools

MODERN manufacturing conditions demand efficient methods in the factory.

Equally important is the careful selection of the equipment for the factory.

High-grade machine tools of established prestige are the backbone of efficient production.

Equally high-grade representation of these is just as essential and must be coupled with an honest desire to render such service as will most benefit the interests of the user.

The F. F. BARBER MACHINERY COMPANY has been incorporated to fill this need.

We will handle only a restricted number of the highest grade machine tools which have been carefully selected as representing in our judgment the last word in their respective fields.

The personnel of our sales staff will be drawn from men experienced in shop and engineering practice who can in a concise way serve or advise our customers.

Our whole aim will be to so conduct our business through efficient service and fair dealing as to thoroughly maintain the established prestige of the lines we represent.

HIGH GRADE MACHINE TOOLS PLUS SERVICE

F. F. Barber Machinery Co.
Limited

Telephone
Adel. 6749

Foy Bldg.
TORONTO

HIGH GRADE MACHINE TOOLS PLUS SERVICE



EVERY skilled workman looks with pride upon his best tools. Skilled mechanics of today ask for tools made of "RedCut"

Each passing year sees RedCut more firmly entrenched in the hearts of the men in the shops.

RedCut is true to its name—superior in service—the best for all machine work.

"RedCut Superior"

The Nationally Known---First Quality

HIGH SPEED STEEL

The Best for All Machine Work

VANADIUM-ALLOYS STEEL CO.

GENERAL SALES OFFICES: PITTSBURGH, PA WORKS: LATROBE, PA.

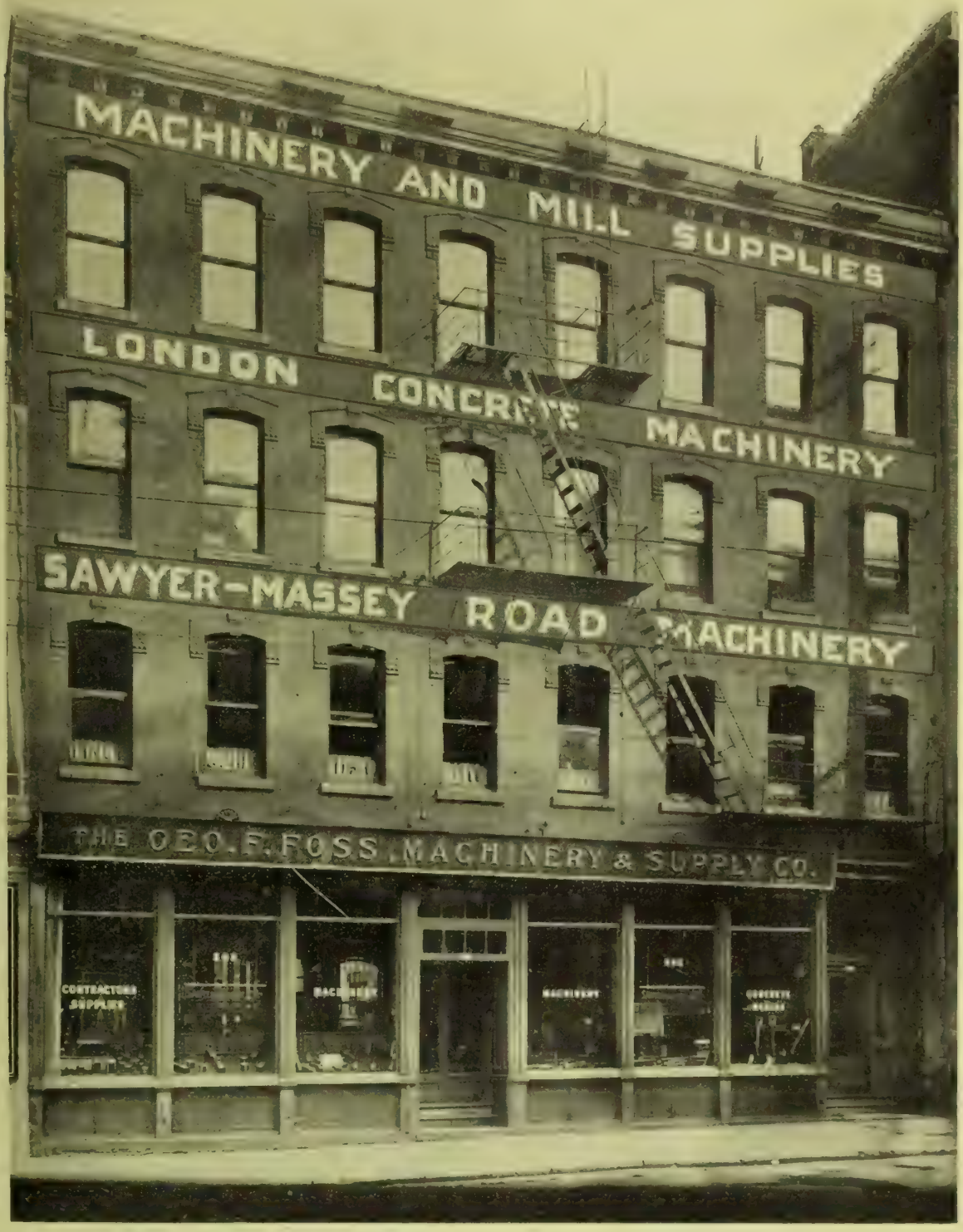
BRANCHES:
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DETROIT, NEW YORK, PHILADELPHIA,
PITTSBURGH, TORONTO

Write for Booklet



The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED

305 St. James Street - Montreal, Quebec

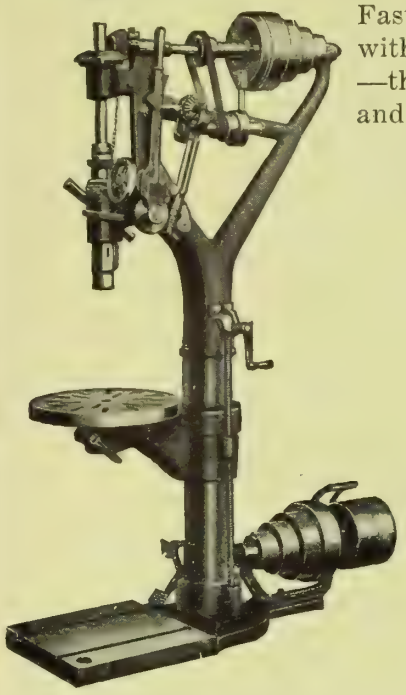


MACHINE TOOL EQUIPMENT
FACTORY AND MILL SUPPLIES
ROAD MAKING MACHINERY
CONCRETE MIXERS, ETC., ETC.

The GEO. F. FOSS MACHINERY & SUPPLY Co
LIMITED

305 St. James Street - Montreal, Quebec

Silver Drills

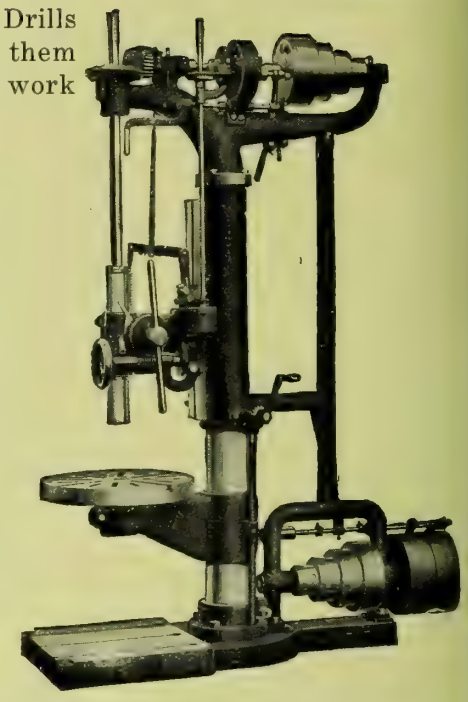


Fast, Strong, Accurate and Dependable Drills with an experience of 64 years behind them —they can be depended on to finish the work and do it right.

The 20" is made in four distinct styles with round or square base and can be furnished singly or in gangs of 2, 3 or 4 spindles.

The 25" has eight spindle speeds and six positive geared feeds.

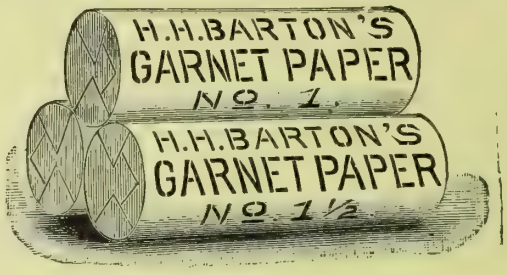
Send for full description and quotations.



The Silver Mfg. Co.

290 Broadway

Salem Ohio



H. H. BARTON & SON CO.

Manufacturers of

"BEST"

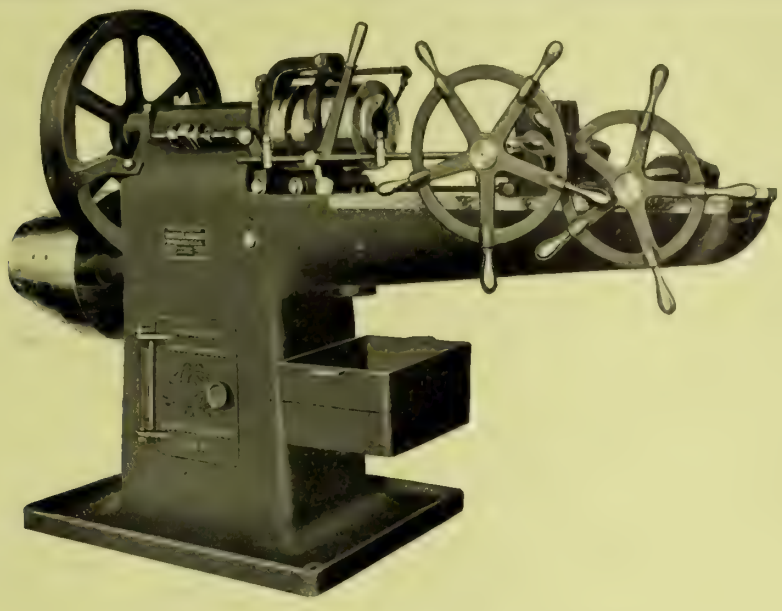
AMERICAN FLINT PAPER

Emery Paper, Emery Cloth, French Emery Paper, Polishing Paper, Garnet and Sand Cloth

FACTORY
Barton's Siding, Holmesburg Junction
Penna.

STORE
109 South Third St., Philadelphia
Penna.

The GEO. F. FOSS MACHINERY & SUPPLY Co
LIMITED
305 St. James Street - Montreal, Quebec



The 1½-inch Single Bolt Cutter

Capacity to thread bolts and tap nuts from ⅜ to 1½ inches inclusive. It will also thread pipe of the same size.

Carriage has large bearing surface gibbed to take up wear, and equipped with vise having hardened steel reversible jaws, also gibbed, and may be set off centre either way. Traverse of carriage 15 inches.

Gears and pinions are cut from the solid. Guards cover rims and teeth completely. Spindle gearing ratio is 5 to 1.

Column and headstock are cast in one piece. Base ribbed to catch oil. Large chip pan placed outside of column can easily be removed for cleaning, and drains into oil well located inside of column.

Cone has four steps for 4 inch belt.

Countershaft equipped with tight and loose pulleys, 14-inch diameter and 4-inch face. Speed 225 R. P. M.

Plunger pump set inside of column is driven from main shaft by an adjustable crank; a large flow of oil is delivered directly on the chasers. System is equipped with safety valve, thus relieving pump when nozzle is closed.

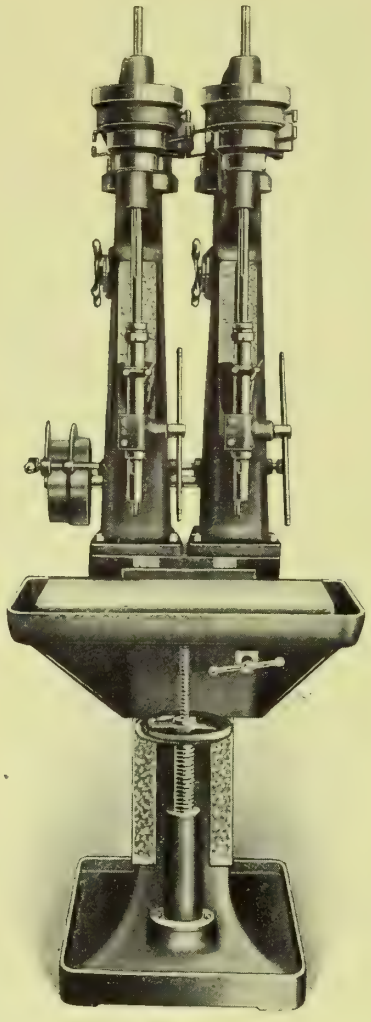
Floor space 6 ft. 4 in. x 2 ft. 1⅝ in.

Crated weight 1,800 pounds. Export boxed weight 2,200 pounds.

This machine is also made with motor drive, and can be equipped with power feed or lead screw attachment.

Manufactured by
THE UNIVERSAL MACHINE CO.
BOWLING GREEN, OHIO

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec



The Edlund

Open Type Drilling Machines

Are a combination of every desirable feature that goes to make up the ideal drilling machine. Quick change, high speed, straight, endless belt, large bearing surfaces, frame in one piece, S K F ball bearing throughout and constructed in combinations of from one to six spindles are only a few of these features. Let us tell you them all.

The City Engineering Co., of Dayton, Ohio, have the following to say with regard to our machines:—

"We have been using the Edlund drill for about four months and it has proven very satisfactory. Its accuracy and shifting arrangement we find is far superior to any drill that we know of. We cannot recommend this drill too highly."

Write for Catalog

Edlund Machinery Co., Inc.

Cortland, N. Y., U. S. A.

Eastern Agents: The Geo. F. Foss Machinery and Supply Co., Limited, Montreal, Que.

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

THE LONDON LINE
of Concrete Machinery



London Concrete Mixer
No. 4 or No. 6, portable and made in two sizes, suitable for small jobsb, requiring a capacity up to 60 cu. yards per day.

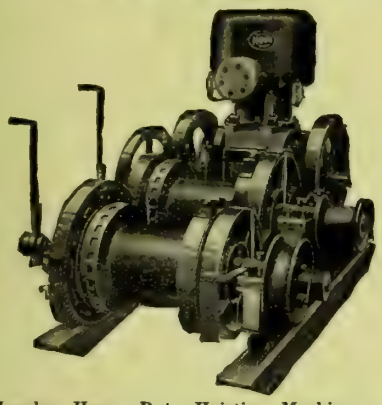
Meets Every Requirement of Concrete Construction

Designed and built by experts in concrete machinery, the London Line comprehends every need of the contracting field, and embraces every modern feature of improvement that promotes rapid output, efficient work, and economical production. The London Concrete Line includes, Concrete Mixers, Contractors' Pumps, Gasoline Hoisting Engines, Concrete Block and Brick Machines, Tile Machines, Concrete Cars.

We are also Canadian Distributors for the Novo Engines, Air Compressors and Outfits.



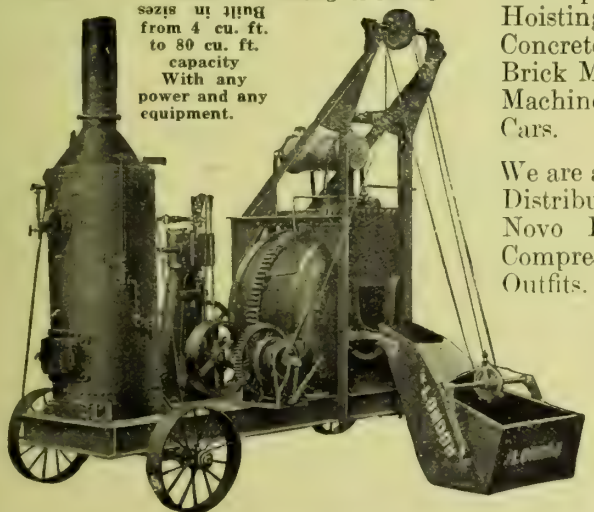
London Concrete Mixers
equipped with Novo Dust Proof Gasoline Engines covered steel house. with



London Heavy Duty Hoisting Machines
Suitable for all kinds of Hoisting or Pulling Built in sizes from 4 cu. ft. to 80 cu. ft. capacity With any power and any equipment.

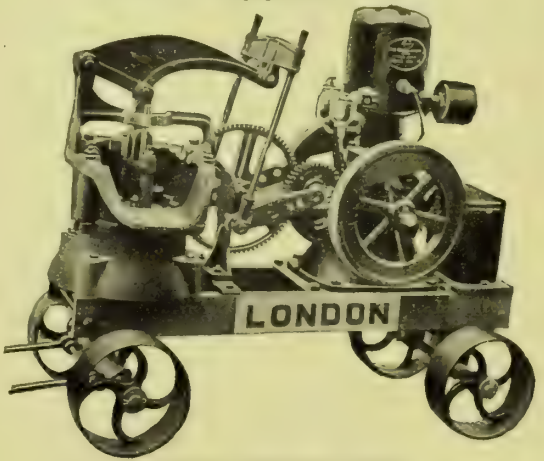


The London Concrete Cart
One of the latest additions to the London Line, but already in extensive use. An essential part of every contractor's equipment.



London Concrete Mixer
A machine with a reputation for thorough and rapid work. Will run for years without repairs.

Catalogues for any of these lines will be mailed on request.



London Diaphragm Pumps
Equipped with 1½ H.P. Novo Gasoline Engine. Suitable for pumping sewers or any kind of work where life is not over 25 ft.

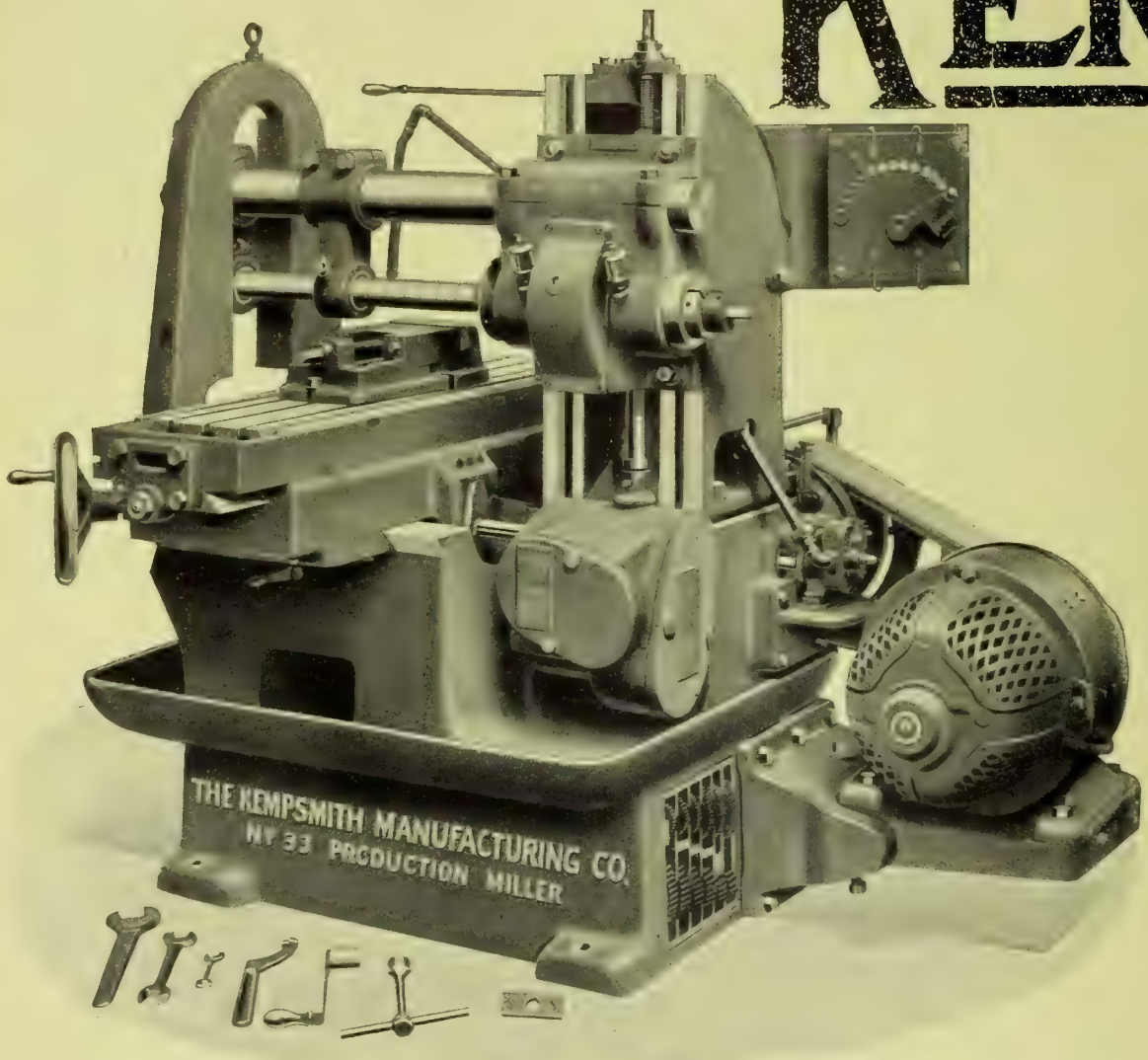
THE LONDON CONCRETE MACHINERY CO., LIMITED, London, Ontario

World's Largest Manufacturers of Concrete Machinery. *Branches or Agencies in all Large Cities throughout the British Empire.*

Montreal Agents: **GEO. F. FOSS MACHINERY & SUPPLY CO., 305 St. James St.**

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

KEMP

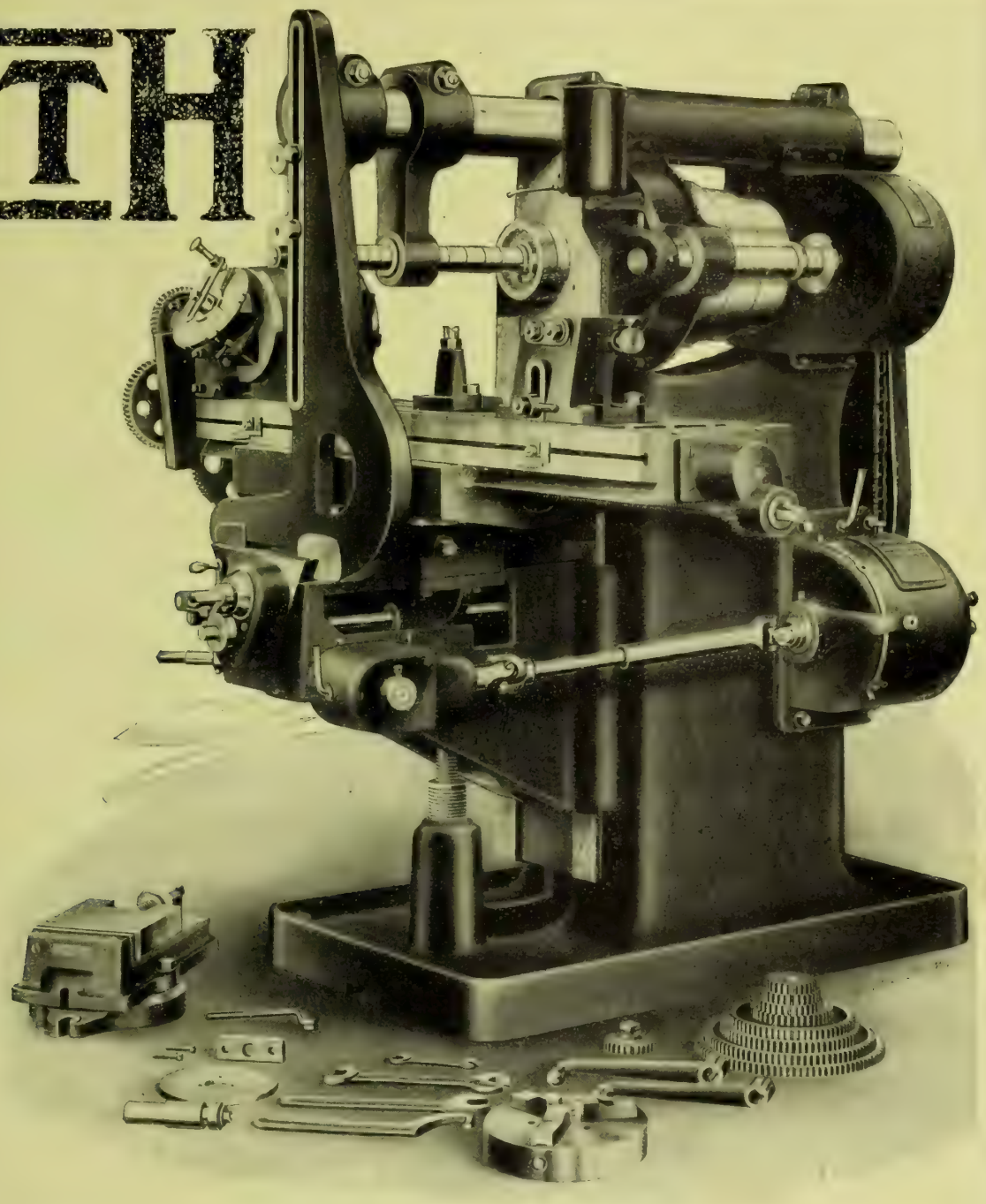


No. 33 Production Miller

Kempsmith Millers are built in three sizes each Plain and Universal Cone Types, two sizes of Production types and one size of All Geared type. Kempsmith Millers dot the globe and are found in use everywhere, where production and perfection are required.

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

SMITH

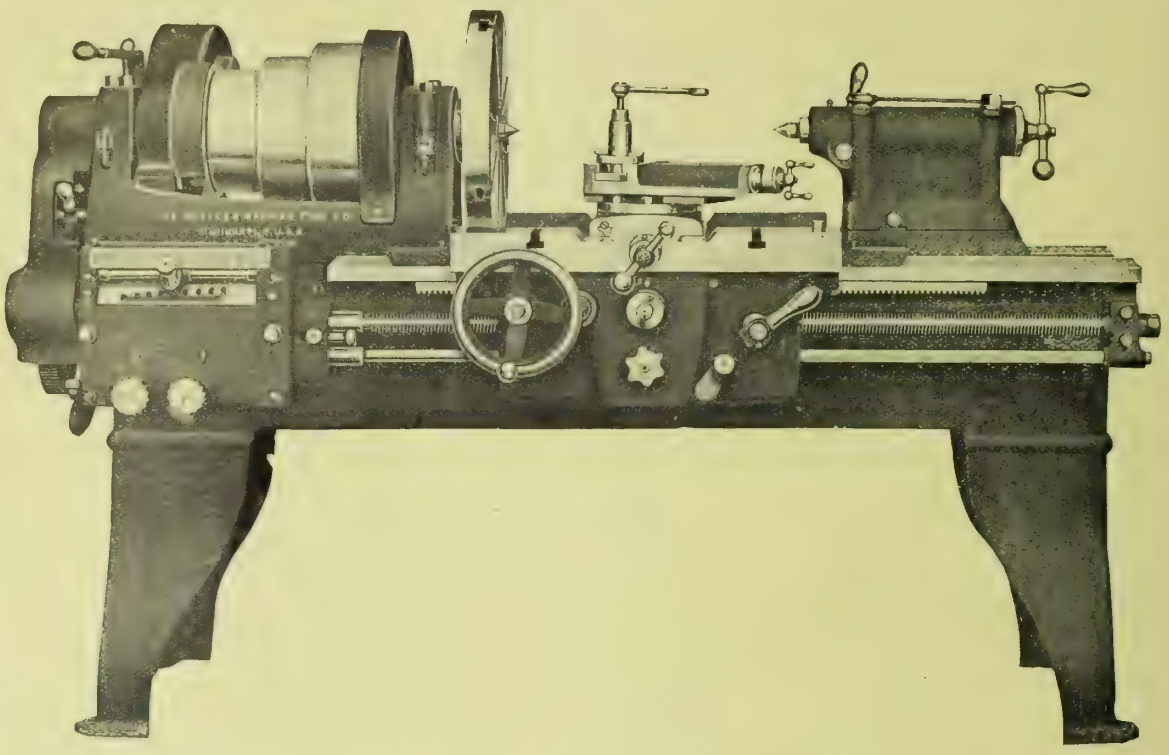


KEMPSMITH No. 3 Universal Milling Machine
Double Back Geared

Kempsmith Mfg. Co., Milwaukee, Wis. U.S.A.

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

A Buddie of the Mueller Radial Drill



A Machine that gives Universal Satisfaction

All we have to say about the Heavy Duty MUELLER Engine Lathe is this: If you need an 18-in. Engine Lathe and fail to get a proposal on the MUELLER, you have missed an opportunity of a lifetime.

The next move is yours.

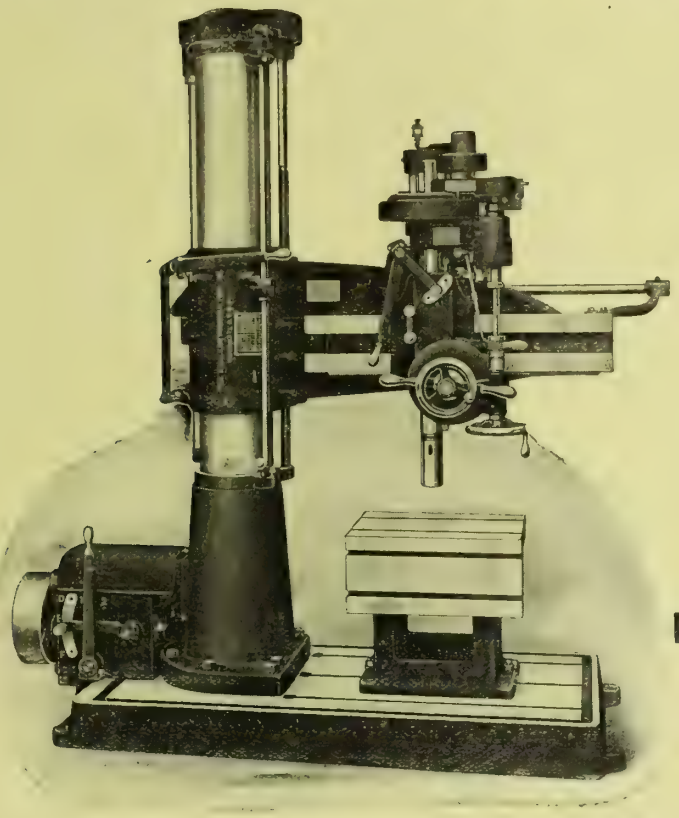
MUELLER Radial Drills and Lathes
sold in Canada exclusively by

The Geo. F. Foss Machinery and Supply Company, Limited
Montreal, Que.

The House of Service

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

IT'S A LEADER



THE Heavy Duty MUELLER Radial Drill is a distinctive outfit. It is different in many ways from the average radial drill, and in consequence the results obtained with our machines are out of the ordinary. For rigidity it has no equal. It has no limit when it comes to pulling capacity, and years of service will not impair its wonderful alignment and durability.

Here is the point: We have just made what may sound to you like a rather strong statement, but, we will stick to it and are ready to prove it to anyone thinking of installing a radial drill.

Is that you, Mr. Reader?

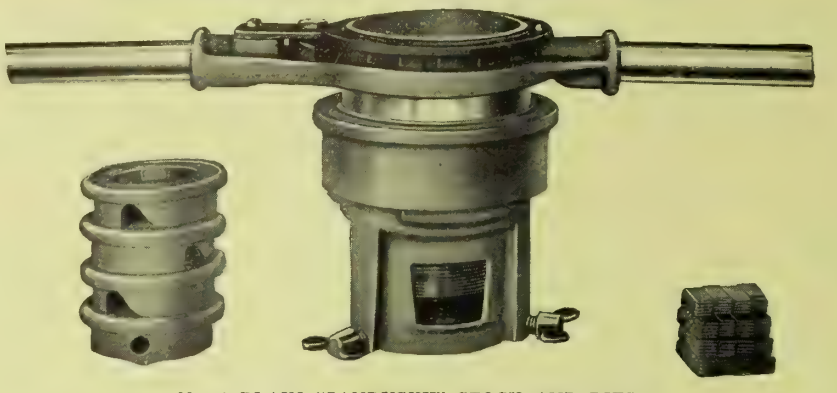
MUELLER Radial Drills have been manufactured in Cincinnati, Ohio, since 1902 by

THE MUELLER MACHINE TOOL COMPANY

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

"SANDUSKY" STOCKS AND DIES

THE BEST PIPE THREADING TOOL



No. 1 PLAIN "SANDUSKY" STOCK AND DIES
Threads 1", 1¼", 1½" and 2" Pipe. List Price, $24.00

The "SANDUSKY" Stock and Die is made only of the very best materials. Dies and Cone Rings are made of superior steel, and other vital parts of a high grade malleable iron. It is the best and simplest pipe threading device made.

It has the exclusive advantage of the "Automatic Throw-out of the Die," "Taper Cone Ring," and the "Guided and Supported Leader Screw," three features patented by us and which can only be found in the "SANDUSKY" Stocks and Dies.

You will note from illustrations that the "SANDUSKY" Stocks and Dies have very many less parts than others, and are unqualified, and most durable pipes threading tools of any type.
These tools are all finished in green enamel, insuring an attractive and durable finish, another exclusive feature.
They are packed each complete with dies, one in a box, and delivered freight paid to New York.
Note: All stocks furnished with either Whitworth or U.S. Standard dies. Please specify kind of thread required on order.



"SANDUSKY"
No. 1A RATCHET STOCK AND DIES

Threads 1", 1¼", 1½" and 2" Pipe.
List Price, $30.00.



"SANDUSKY"
No. 2 GEARED STOCK AND DIES
Thread 2½", 3", 3½" and 4" Pipe.
List Price, Stock and Dies, $100.00.
Stand, $30.00 Extra.



"SANDUSKY"
No. 0 STOCK AND DIES

Threads ¼", ¾", ½" and ¾" Pipe.
List Price, $20.00.
With Ratchet, $25.00

THE MODERN MACHINERY CO.

WILMINGTON, DEL., U.S.A.

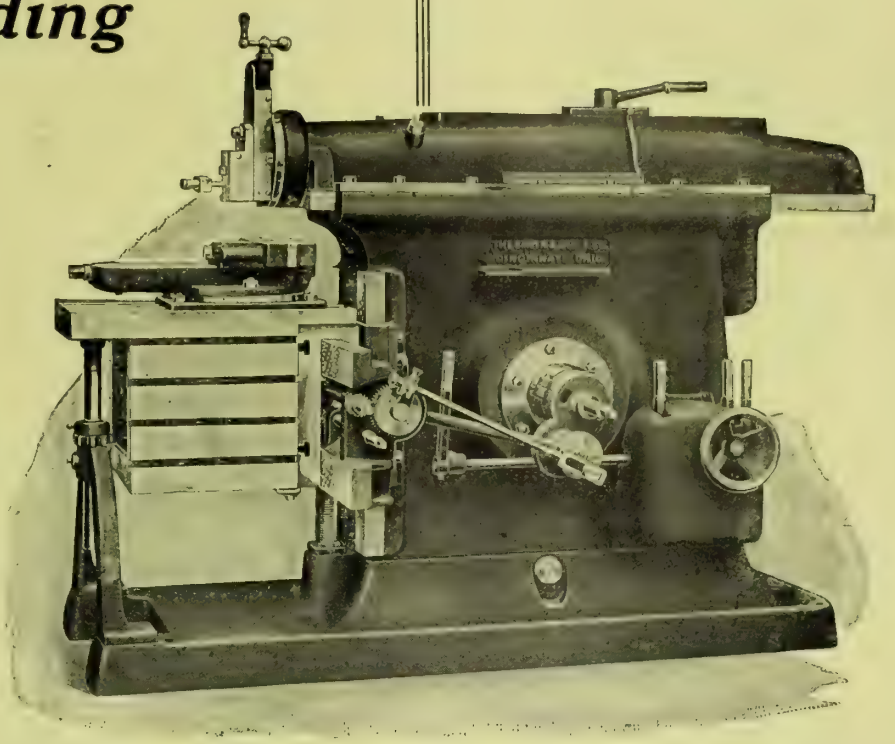
The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

Over 30 Years
of building
Shapers Exclusively

12" to 34" Stroke

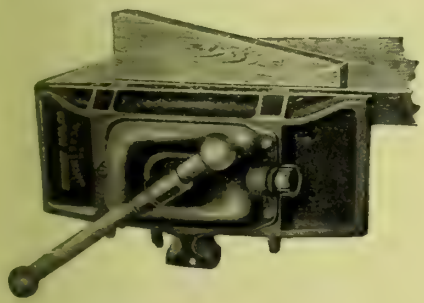
The Shaper Specialists

THE SMITH & MILLS CO.
Cincinnati, Ohio
U.S.A.



The Emmert—Universal Patternmaker's, Machinists' and Tiger Vises

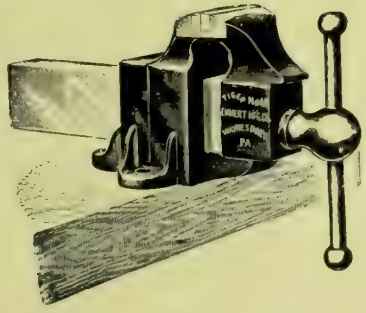
Patternmaker's and Woodworker's Vise



This vise is equipped with seven pairs of jaws, so that it is adapted to grasp any kind of work without regard to irregularity of form.

No.	1	2
Size Jaw	7 x 18½ in.	5 x 14 in.
Opens	14 in.	12 in.
Wgt.	86 lbs.	56 lbs.

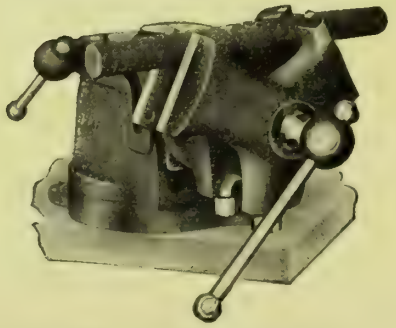
"Tiger"



Rigid—Strong—Full Weight. Guaranteed first-class in every respect.

Styles—Solid jaw, sta. base; solid jaw, swivel base; adj. jaw, sta. base; adj. jaw, swivel base. Sizes: 2½ in. to 7 in.

Toolmaker's and Metalworker's Vise



This Emmert Vise is so constructed as to be used in any conceivable position. It is supplied with one set of grooved jaws to hold all clases of round work, one set of jaws which will hold any class of taper work, one set to hold copper work, and one set to hold any size ring. It is also supplied with a rough jaw for cast iron work, with one smooth jaw for finished work.

Sizes—3 in. and 4 in. jaw.

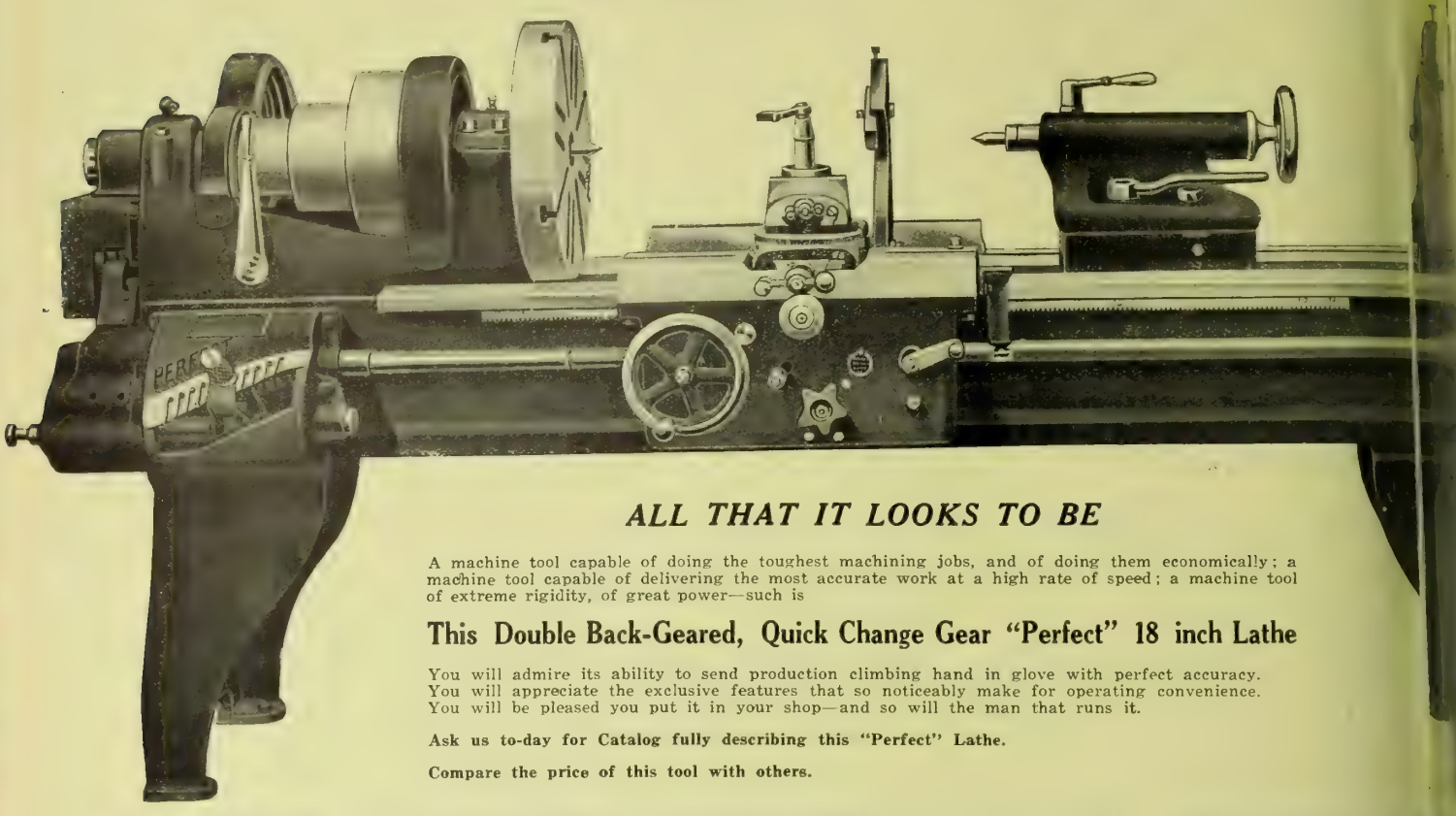
The Geo. F. Foss Machinery and Supply Co.
305 St. James St., Montreal, Canada

The GEO. F. FOSS MACHINERY & SUPPLY Co
LIMITED

305 St. James Street - Montreal, Quebec

THE PERFECT 18-INCH LATHE

"THE TOOL WITH THE APPETITE"



ALL THAT IT LOOKS TO BE

A machine tool capable of doing the toughest machining jobs, and of doing them economically; a machine tool capable of delivering the most accurate work at a high rate of speed; a machine tool of extreme rigidity, of great power—such is

This Double Back-Geared, Quick Change Gear "Perfect" 18 inch Lathe

You will admire its ability to send production climbing hand in glove with perfect accuracy. You will appreciate the exclusive features that so noticeably make for operating convenience. You will be pleased you put it in your shop—and so will the man that runs it.

Ask us to-day for Catalog fully describing this "Perfect" Lathe.

Compare the price of this tool with others.

SCREW CUTTING ENGINE LATHE WITH GA



Accurate, Convenient Design.

Small consumption of Power and Low Price.

A Lathe in a class by itself.

Perfect Machine Co.

GALT, ONT., CANADA

Made by Canadian workman employed by Canadian firm, better and cheaper than any imported tools.

Just the Tool f
Machine Sho
Experimental
Sho
Technical
Scho
Garages, Etc.

Built in 2 si
12" and 14"
swing,
6' and 8' Be

WE GUARANTEE EVERY TOOL WE MAKE.

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED
305 St. James Street - Montreal, Quebec

DOMEKO BABBITTS

For all classes of machinery—not one brand for every purpose—but Bearing Metal specially designed for any requirement. Place your *Babbitt Problems* before us, and learn the value of *Domeko Service.*

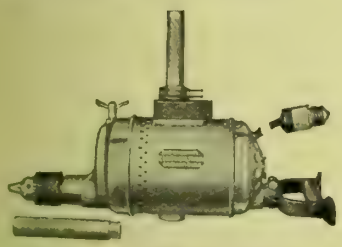


"The King of Heavy Pressure Babbitts." Catalogue on request.

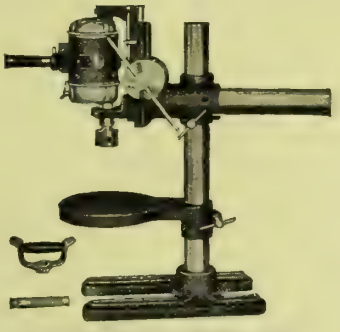
THE DOMINION METAL COMPANY, Limited
SHERBROOKE, QUE., CANADA

The Geo. F. Foss Machinery & Supply Co., 305 St., James St., Montreal, Que. *Montreal Selling Agents*

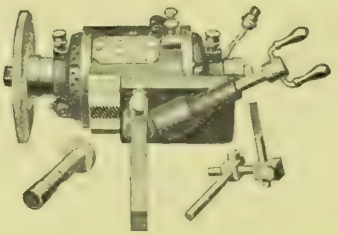
Cut Your Costs "CINCINNATI ELECTRICS" Will Do It



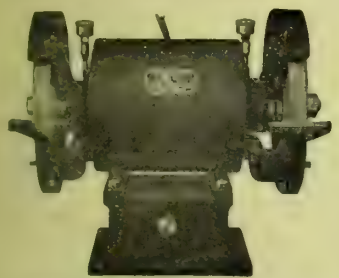
HAND OR BREAST DRILLS
1/4", 3/8", 1/2", 3/4" capacities. Weight from 7 pounds up. Ball and thrust bearings. Gears run in grease. Single and two speeds.



COMBINATION BENCH DRILLING STAND WITH DRILL.
The Motor Drill is detachable and can be used as a separate Tool.

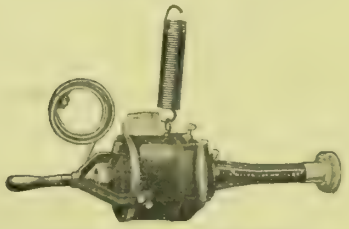


TOOL POST GRINDER
1/4 to 3 H.P. Weight from 16 pounds up. Free hand feed. Bearings adjustable to wear. Horizontal and vertical feeds. Different types for all purposes.



BENCH GRINDER OR BUFFER
Five sizes, 1/4 to 3 H.P. Also Pedestal Floor Grinder, 1 to 3 H.P. Fully enclosed. Dirt and dustproof. Ball bearings.

SPECIAL FEATURES
Air cooled. Ball and Thrust Bearings. All working parts hardened. Overload Allowance. Guaranteed Mechanically and Electrically.



HAND AERIAL GRINDER.
For cleaning castings or surface work of any kind. Made in four sizes, 1/2 to 2 H.P. Weight from 18 pounds up. Guaranteed for hard usage.

CINCINNATI ELECTRIC TOOL CO.
1501-3-5 Freeman Ave., CINCINNATI, Ohio

Carried in Stock by:

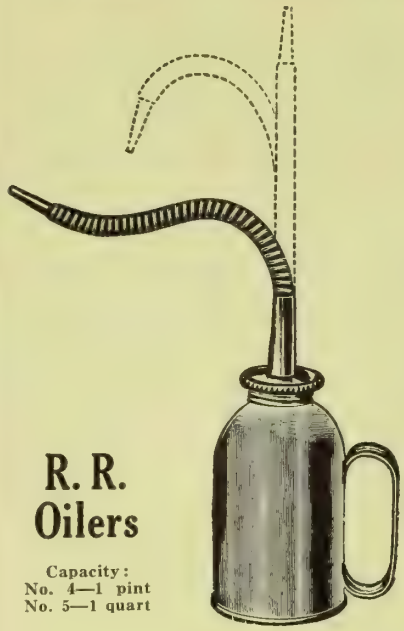
The Geo. F. Foss Machinery & Supply Company 305 St. James St., Montreal, Que.

The GEO. F. FOSS MACHINERY & SUPPLY Co LIMITED

305 St. James Street - Montreal, Quebec

Make Oiling Easy and Economical with ALL-WAY OILERS

"Save 50% of Oil Bill"



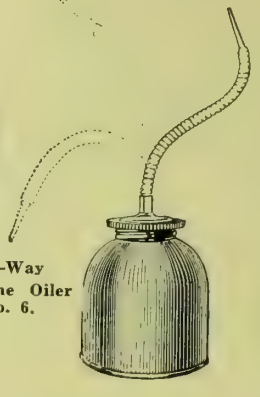
R. R. Oilers

Capacity:
No. 4—1 pint
No. 5—1 quart



THE ALL-WAY OILER

Steel Spring Bottom.
Nos. 1, 2, 3.



All-Way Machine Oiler No. 6.

Special for Tractors, Threshers and Farm Implements.

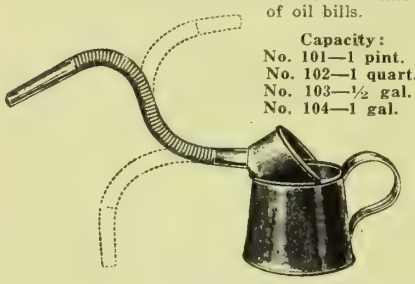


Bend the Spout to Suit the Position

The "All-Way" is an oiler fitted with flexible steel spout, made to bend any angle or position without breaking or interfering with the flowing of the oil. A big saver of time and oil.

It enables you to oil all places that previously could only be reached with force pump cans with specially bent spouts.

Indispensable to those who know. Will last as long as six ordinary oil cans. Saves 50% of oil bills.



Capacity:
No. 101—1 pint.
No. 102—1 quart.
No. 103—½ gal.
No. 104—1 gal.

Combination Filler and Funnel

This filler eliminates the necessity of the use of a separate funnel, as with the flexible spout any part can be readily reached.

Saves much inconvenience and avoids dripping of oil.

Flexible Spout: Grease and Oil Guns

A very handy device for greasing or oiling hard to get at places.

The "All-Way" gun is especially useful and handy in filling lineshaft hanger reservoirs.

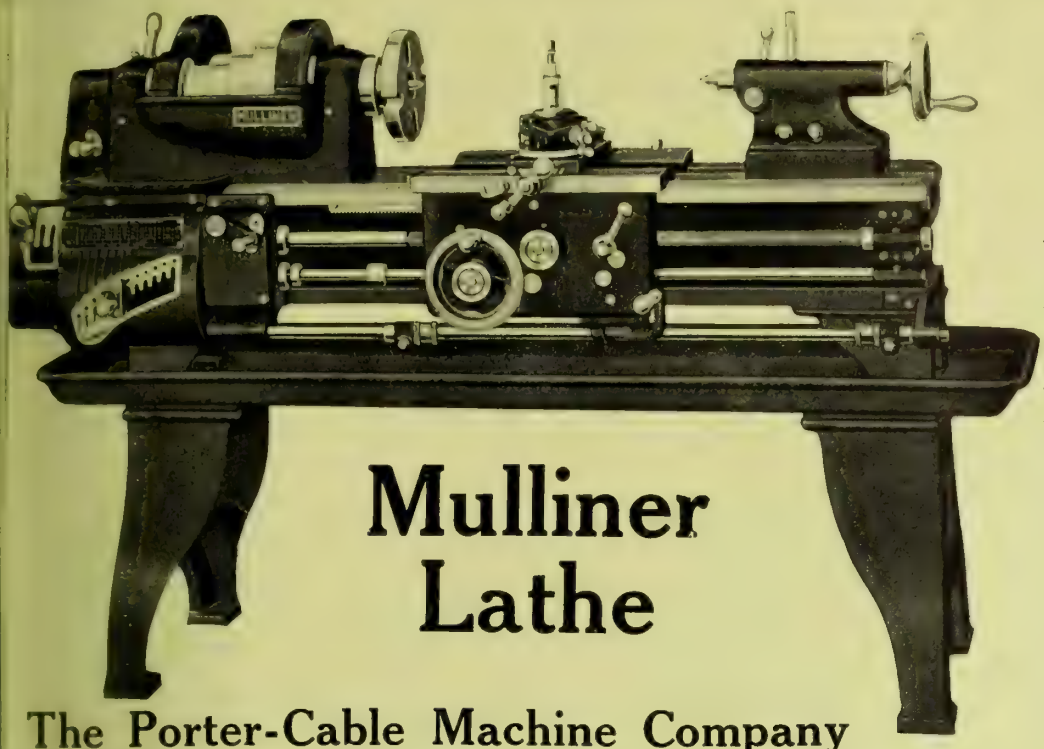
A great saver of time and labor.

THE ALL-WAY OILER MFG. COMPANY
196 KING STREET WEST - TORONTO, ONTARIO

ALL-WAY OILERS

The GEO. F. FOSS MACHINERY & SUPPLY Co.
LIMITED

305 St. James Street - Montreal, Quebec



Mulliner Lathe

The Porter-Cable Machine Company

Syracuse N.Y. U.S.A.

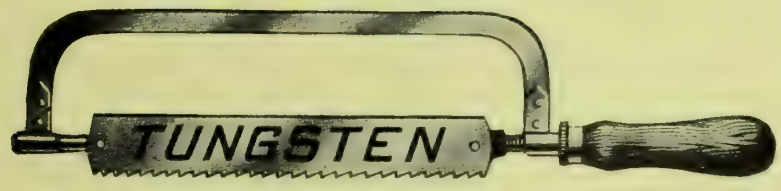
Quick Change

Guaranteed to bore and turn true to within .001" if properly set up, 37 threads and feeds. All attachments. Self-adjusting front and rear journals are adjustable independent of each other. Headstock spindle is of hammered crucible steel ring, self-oiling system.

This is a lathe that will fit into many shop systems. Our catalogue shows all details and other features.

TUNGSTEN

THE WORLD'S

HAND 

POWER

GREATEST

Hack Saw Blades

Geo. F. Foss Machinery & Supply Co. Ltd., 305 St. James St., Montreal, Que.

The GEO. F. FOSS MACHINERY & SUPPLY Co
LIMITED
305 St. James Street - Montreal, Quebec

Sweetland Chucks

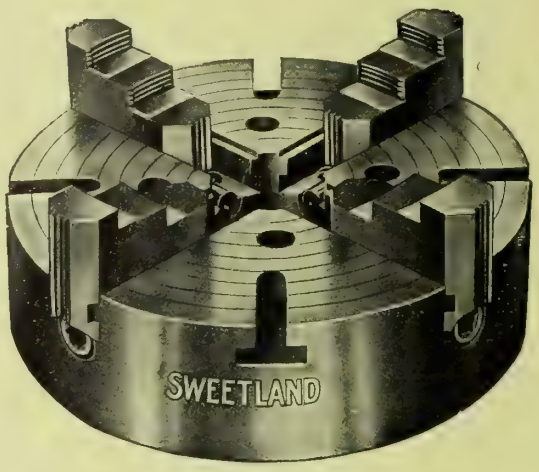
increase production remarkably by conserving the time and energy of men who operate them. Write for this helpful Booklet to-day.

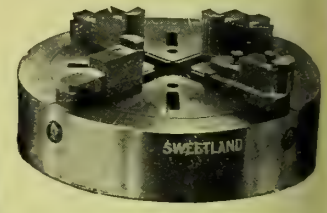
Note particularly the Sweetland Combination Chuck on the left, for all practical mechanics consider it the best Geared Screw Chuck made. Of simplest possible construction, still complete in its interchangeability from independent to universal operation of the jaws, **or vice versa.**



Independent Lathe Chuck

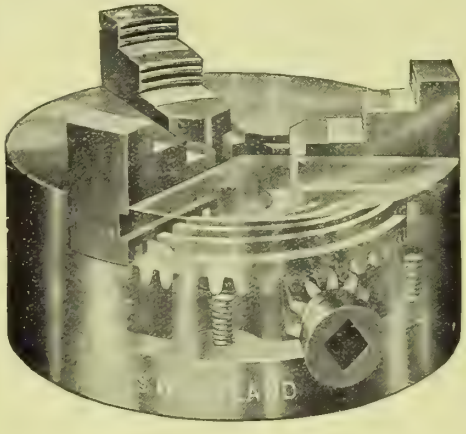
The gripping and bearing surfaces, both of hardened steel, are ground perfectly true. The large screws of special grade steel are flush with the body of this Sweetland Independent Lathe Chuck. The strong jaws are high-grade steel, properly hardened.





Universal Chuck

This Sweetland Chuck has been on the market for over 40 years. Many that long in use are good as ever for accurate chucking work.



Geared Scroll Chuck

Opposite is another Sweetland Chuck, with hardened jaws ground perfectly true on face and bite. Sizes 2½″ to 18″ dia. both with three and four jaws.

When so ordered this Sweetland Scroll Chuck is supplied with Solid Reversible Jaws—two sets in one; or with Non-reversible Inside or Outside Jaws, or with both sets.

Hoggson & Pettis Manufacturing Company

NEW HAVEN, CONN., U.S.A.

BEATTY

DECK MACHINERY FOR SHIPS

Cargo Winches
Hoisting Engines
Clamshell Buckets
Dipper Dredges
Steel Derricks

Our experience and shop capacity enable us to serve you advantageously.

Send us your enquiries for this class of equipment.

Anchor Windlasses
Electric Hoists
Mine Hoists
Hydraulic Dredges
Derrick Irons, etc.



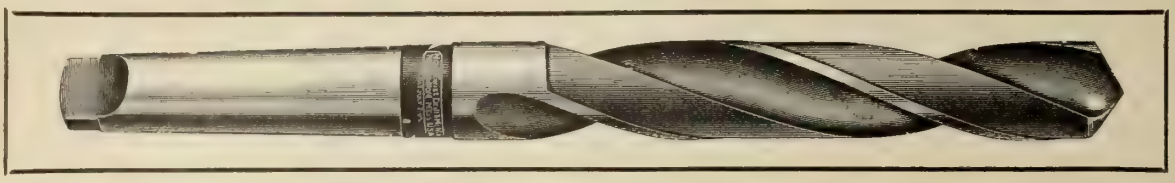
8¼″ x 8″ cargo winches arranged on deck of 1,500-ton ship
These are Horizontal, Single Purchase Machines. We also manufacture Vertical Winches and Double Purchase Winches

M. BEATTY & SONS, Limited, WELLAND, ONTARIO

H. E. PLANT, 1790 St. James St., MONTREAL
KELLY-POWELL, LIMITED, - WINNIPEG
R. HAMILTON & CO., - VANCOUVER
E. LEONARD & SONS, ST. JOHN, N.B.

If interested tear out this page and place with letters to be answered.

"MORSE"



When you buy an article because it is *cheap* you get *just what you pay for* and no more.

Is not the reason you wear good shoes, because you know they will *give better service* and prove the *cheapest in the end?*

Should you not *use the same logic* when buying drills for your company as when buying shoes for yourself?

When men are compelled to use poor tools, does it not *impair their efficiency*, causing them to WASTE VALUABLE TIME and does not this mean DECREASED PRODUCTION?

Would it not be *greater economy* to equip your shop with *High Grade Drills*, which produce good, clean cut holes QUICKLY and ACCURATELY?

"MORSE" Drills always have been and are still characterized by their UNIFORM QUALITY and DEPENDABILITY.

Now to be frank:

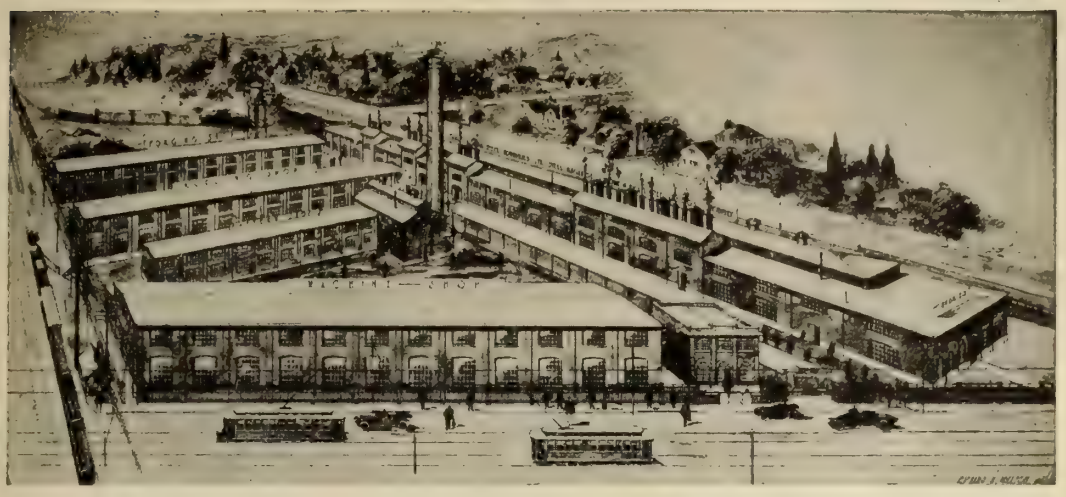
Don't you feel convinced that the honest way to answer these questions would be to *designate* "MORSE" in your next DRILL Requisition.

Morse Twist Drill & Machine Company

NEW BEDFORD, MASS., U.S.A.

Hull Iron and Steel Foundries, Limited

Hull, Quebec



Specify "HISCO" Reg'd. Products

The "HISCO" Plant is the largest of its kind in Canada and equipped with complete modern equipment for machining our products.

This places us in a position to handle orders big and small with unequalled facility.

Steel, Chrome, Manganese and Nickel

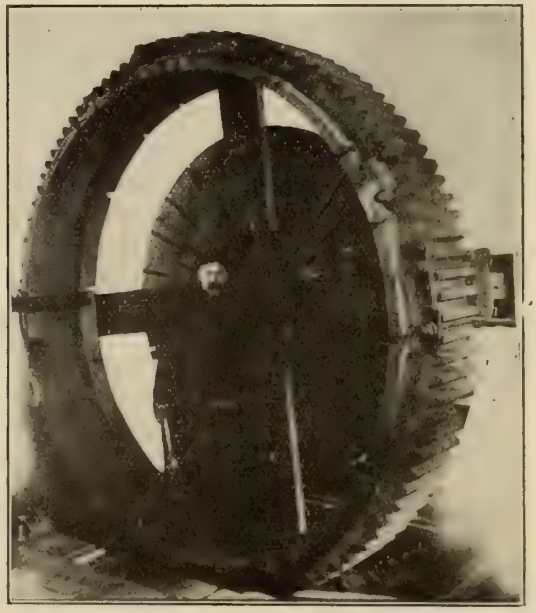
STEEL CASTINGS

Annealed and Unannealed

Cement Mill and Mining Machinery, Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

Machine-Moulded GEARS

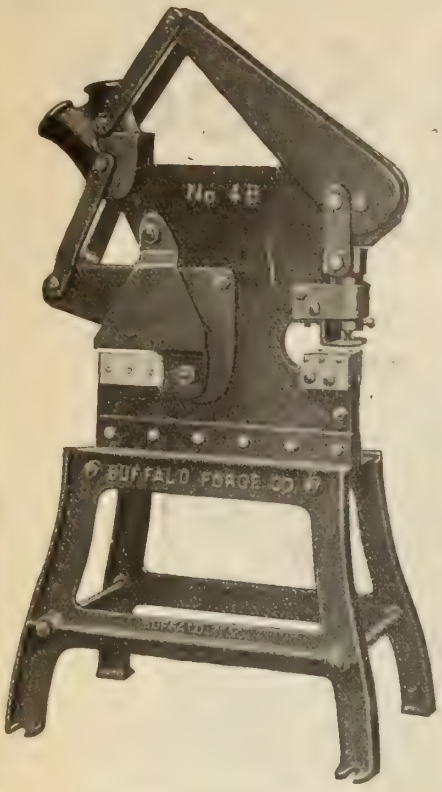
"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.



Write us for Estimates

If interested tear out this page and place with letters to be answered.

CANADIAN



Canadian Steel Shear No. 4

This is one of a series of machines built up of "Armor Plate" steel with tensile strength of 75,000 lbs. per square inch—practically unbreakable and only one-third as heavy as a cast iron machine of the same capacity. Cuts flats up to 3 x 5/8 inches; rounds up 1". Larger sizes on application.

Tools You Can Use

THE requirements for high-grade machine tools is ever becoming more and more critical.

In the modern machine shop where speed and accuracy are so essential *good* tools are indispensable.

CANADIAN

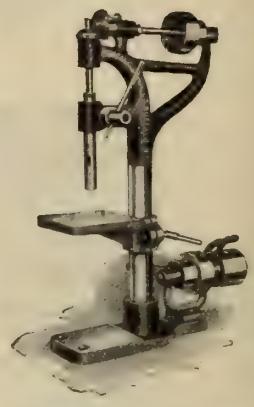
Drills—radial wall, post or floor for both hand and power, shears, bar cutters, and punches are standard equipment in the largest shops in Canada.

Write Dept. 16 for complete catalogue.

Canadian Blower and Forge Co., Ltd.

Kitchener, Ont.

Toronto, Montreal, Calgary, Vancouver, St. John

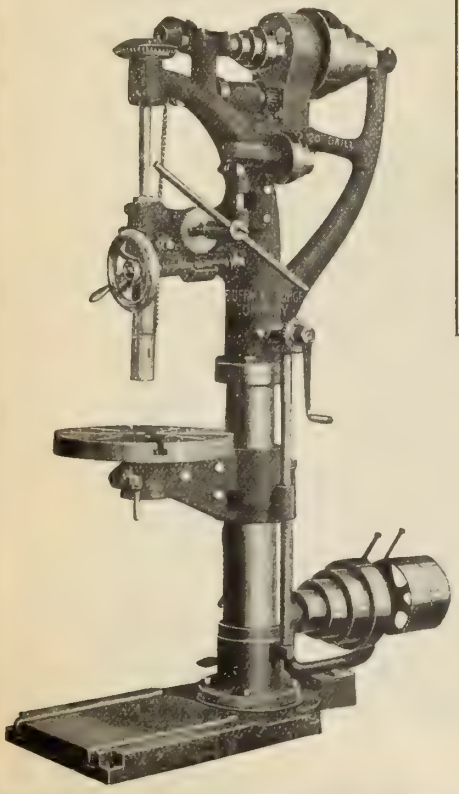


Canadian 10" Power Bench Drill

A strong, powerful little machine, designed for all around work, accurate enough to almost warrant being called a sensitive drill. Holes up to 9/16".

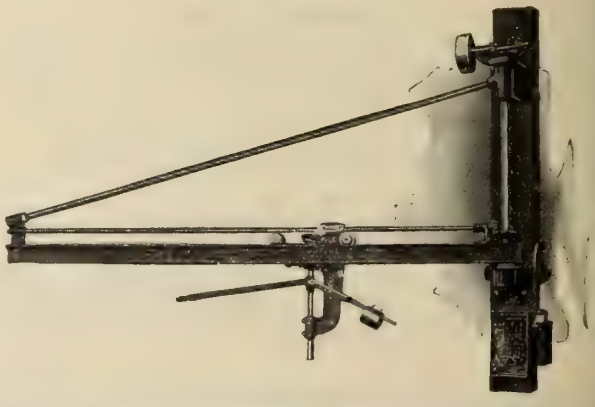
Canadian Radial Wall Drill

A particularly popular machine in ship yards, boiler shops, or structural shops where large surfaces are required to be drilled, reamed, or countersunk. Morse Taper spindle travel 8½". All gears machine cut and accurately fitted.



Canadian 20" Upright Power Drill

This is an exceedingly popular machine because of its excellent design and workmanship, 4 Drills to center of 20" circle; instantly, changed from plain to back gear; has eight speeds and three power feeds.



If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

MacKinnon Steel Co.

Limited

Engineers, Manufacturers and Erectors of Steel Structures



View of Steel Work for Large Railway Shop recently supplied by us.

Structural Steel and Steel Plate Work

OF ALL KINDS

Especially Bridges, Engine Houses, Buildings, Tanks for Air, Water and Oil

Storage yard has a capacity of approximately five thousand tons of shapes and plates and we carry at all times a heavy stock of beams, channels, universal mill plates, sheared plates, etc.

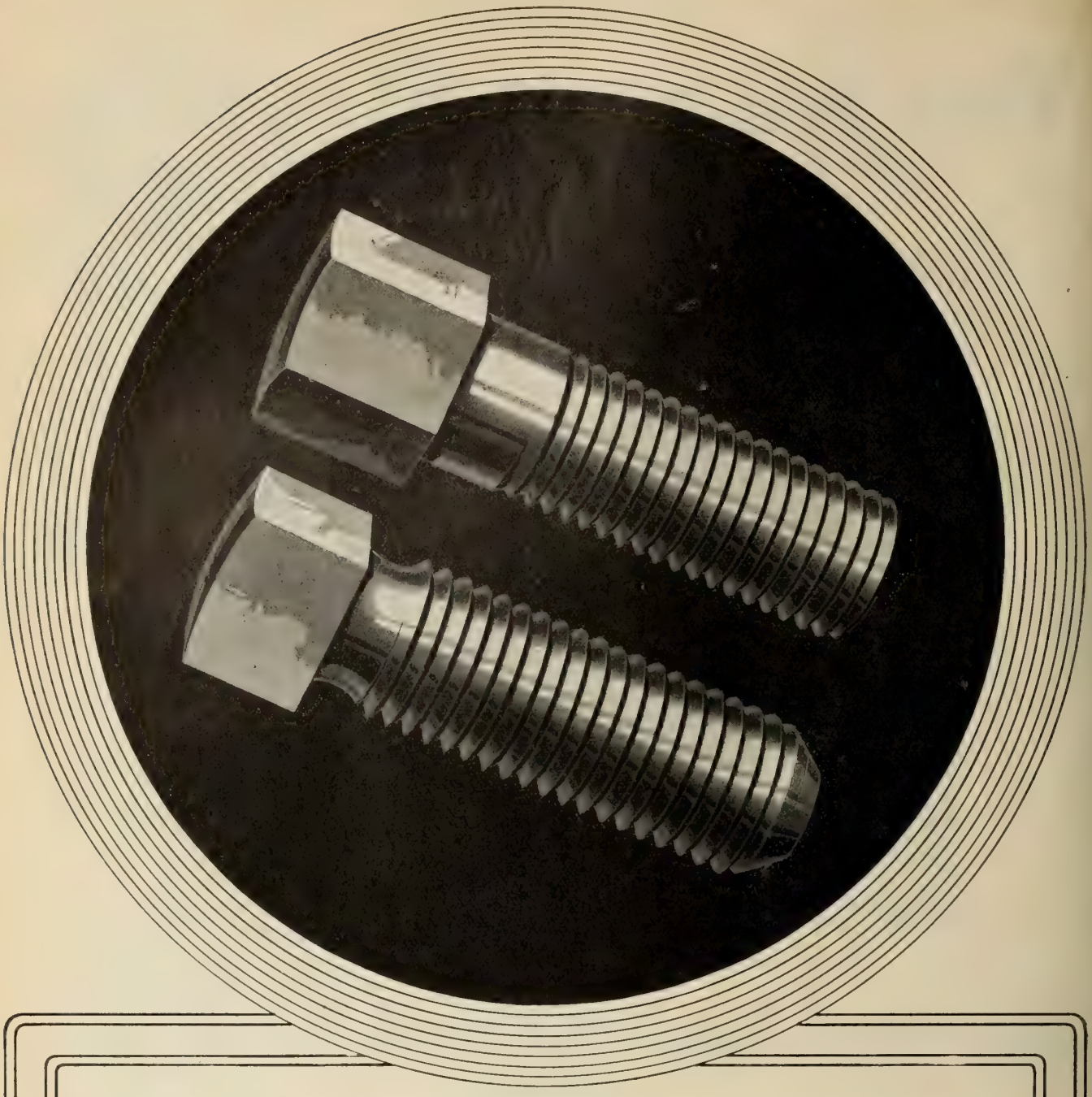
We are prepared to furnish expert erection foremen and crews in any part of Canada or Newfoundland.

Montreal Office: 404 New Birks Building

Halifax Representative: R. R. Power, 9 Prince Street

HEAD OFFICE AND WORKS AT SHERBROOKE, QUEBEC

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SCREWS AND NUTS

READY FOR DELIVERY

NUTS—
Plain .....S.A.E.
Castellated .....S.A.E.
Semi-Finished .....V-U.S.S.

SCREWS—
Cap....V—U.S.S., S.A.E.—
Set .....V—U.S.S.

SPECIALS—Made to customers' specifications up to 2¼" diameter, 10½" long. Quotations on blue prints or samples.

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.

G. T. Ry. and DeCourcelles

ACME AUTOMATICS

276 OF THEM in a large automobile parts plant turn out hundreds of thousands of screw parts daily.

The use of so great a number of Acme Automatics in one shop means more than enormous production.

It means complete confidence in the tried and proven principles of Acme design and Acme construction.

Let us show you what Acme Automatics will do for you.

Capacities $\frac{3}{4}$"-$3\frac{3}{4}$" inclusive.

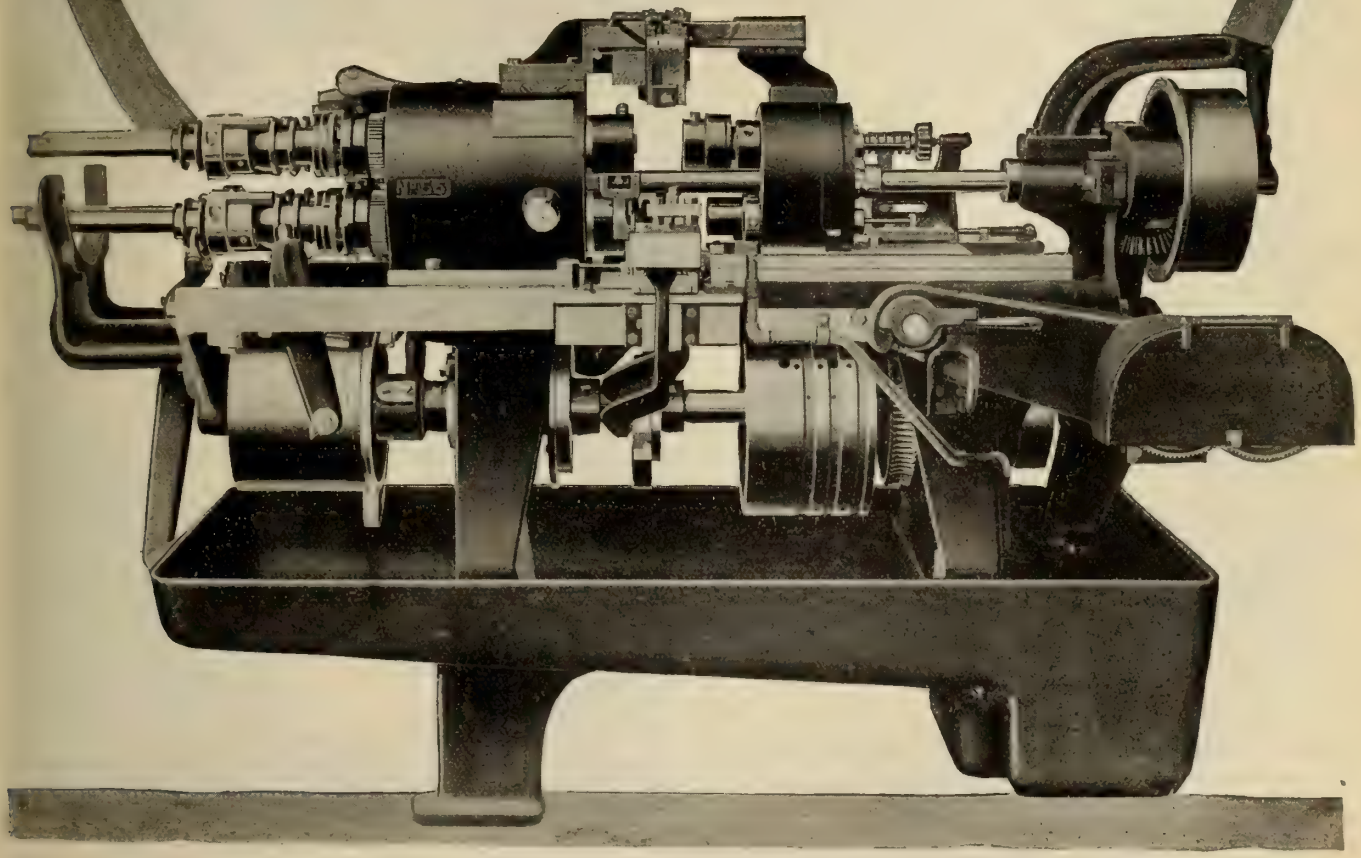
THE
NATIONAL ACME COMPANY
CLEVELAND, OHIO

New England Plant
Windsor, Vt.

Canadian Screw Plant
Montreal, P.Q.

Branch Offices: New York Boston Chicago Detroit Buffalo
Warehouses: New York and Chicago
Representatives in foreign countries

Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont; and Acme Automatics Threading Dies, Collapsing Taps, and Screw Machine Products at Cleveland, Ohio.



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"WACO"

THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
WM. ATKINS & CO., LIMITED
SHEFFIELD - - ENGLAND

ALL SIZES IN STOCK

Refer Safety Problems To Us

Give Your Time to the Development of a Safer Plant

WELDERS! CHIPPERS!



For chippers, grinders, welders and others.

ADJUSTOGLASS GOGGLES with Protexal reinforced lenses will not shatter; will keep your indispensable men on the job; the most popular goggle made; no assorted sizes required.

PROTEXAL SAFETY CLOTHING



Made of rubber, leather and asbestos.

Fire, water and **acid-proofed duck material.**

A garment for every worker —leggings, gloves, aprons, suits.

Every article guaranteed.

The quickest and surest way to get what you want is to ask us for it. Send for catalog D2.

THE STRONG, KENNARD & NUTT COMPANY
SAFETY, FIRST-AID AND WELFARE EQUIPMENT
2044 E. 9th Street -- CLEVELAND, OHIO
If it's for Safety, we sell it.

Swedish Steel & Importing Co., Limited

Montreal
New York
Toronto
Denver

Direct representatives of foremost Swedish mills: makers of

Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.

TRADE MARK SS "DOUBLE ESS"

PROMPT SHIPMENTS from large stock

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Lenses are Easily Replaced in STOCO SAFETY GOGGLES

CELOGLAS
SHATTER-PROOF LENS

Replacing a pair of lenses in Stoco Safety Goggles is only a matter of seconds. You don't even need the pliers shown in the illustration. A pencil will do—or a good stout thumb-nail. If your stock clerk is ruining his chances of salvation while he juggles a tiny screw driver and a microscopic screw, replacing pitted lenses, he'll appreciate this feature.

Price per Hundred

With extra heavy optical glass lenses..... $ 90.00
With Celoglas shatter-proof lenses 115.00

Attractive discounts for quantity orders.

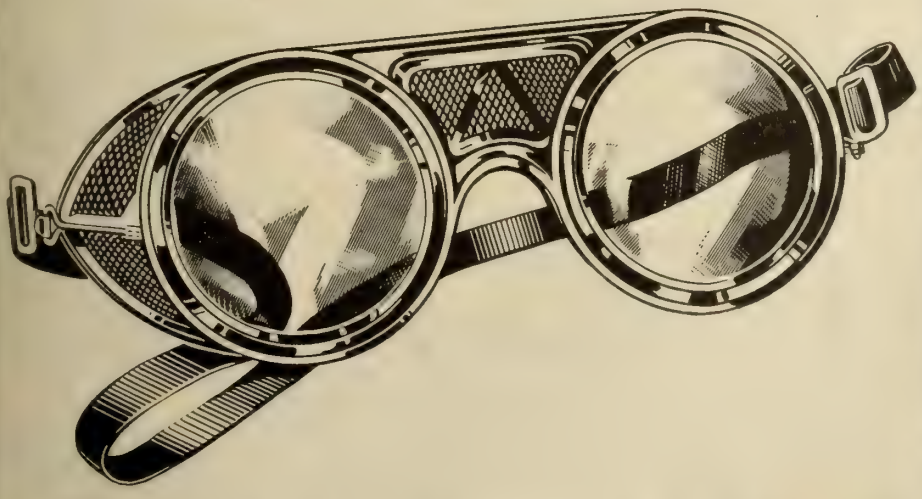
Lenses Only.

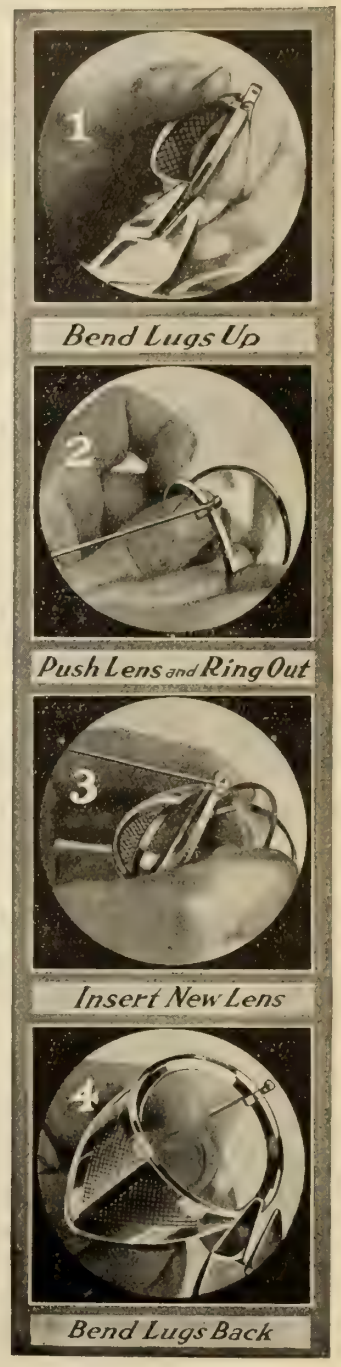
Per Hundred Pairs

Extra heavy optical glass lenses $30.00
Celoglas shatter-proof lenses 55.00

These prices are f.o.b. Geneva, N.Y.

A sample of the Stoco Safety Goggle will be sent without charge to interested responsible people.





STANDARD OPTICAL CO. GENEVA, N.Y.

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Year after Year

They buy

HOYT METALS



"Frost King"

The World's Best All Round Babbitt Metal

"Nickel Genuine"

Specially Made for Gas, Gasoline, Marine Engines, etc.

"Dynamo Genuine"

Scientifically Compounded for Dynamo and Motor Work

Lighten the Babbitt Expense of the Plant

For nearly 40 years we have devoted our efforts exclusively to the perfection of white metal alloys, having delved carefully into the chemical, physical and mechanical properties of each element and its various compounds.

All elements entering into our mixtures are carefully refined and put together in such proportions and in such relation to each other that the best possible alloy is secured for the work for which it is designed.

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HOYT METAL COMPANY

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WINNIPEG
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NEW YORK
ST. LOUIS
CHICAGO
DETROIT

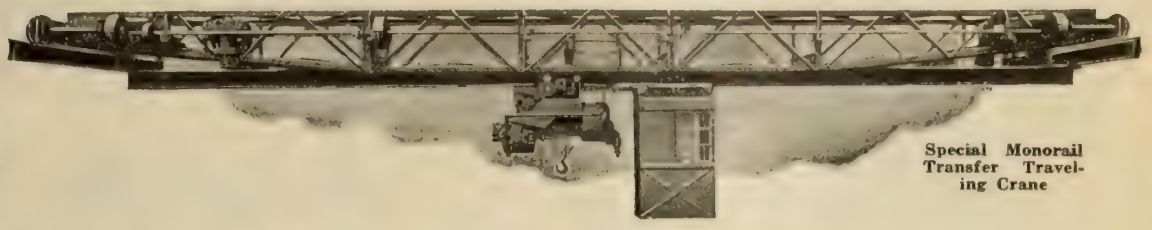
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Type D Electric Hoists
½ to 10 Tons.



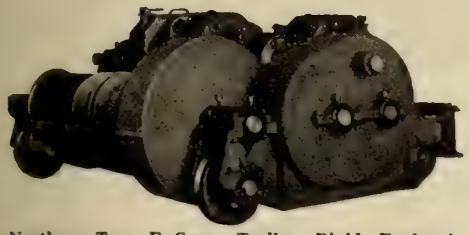
Three Motor Patent
Type E Crane



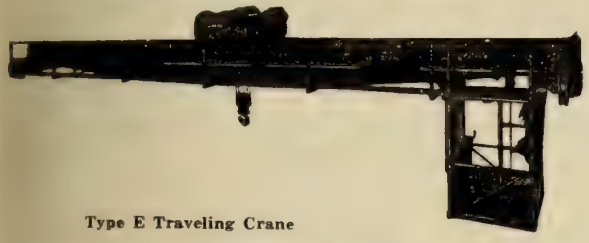
Special Monorail
Transfer Traveling Crane

NORTHERN CRANES

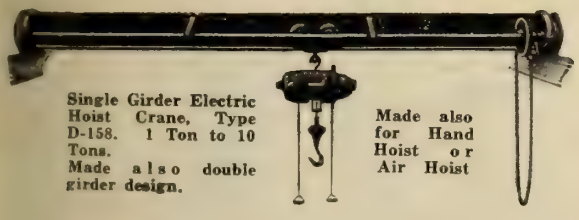
NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada. All gears enclosed and non-overhung.



Type E Traveling Crane



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist



Electric Traveling Gantry Crane with Magnet.

Cranes and Hoists that equal the best

MADE IN CANADA

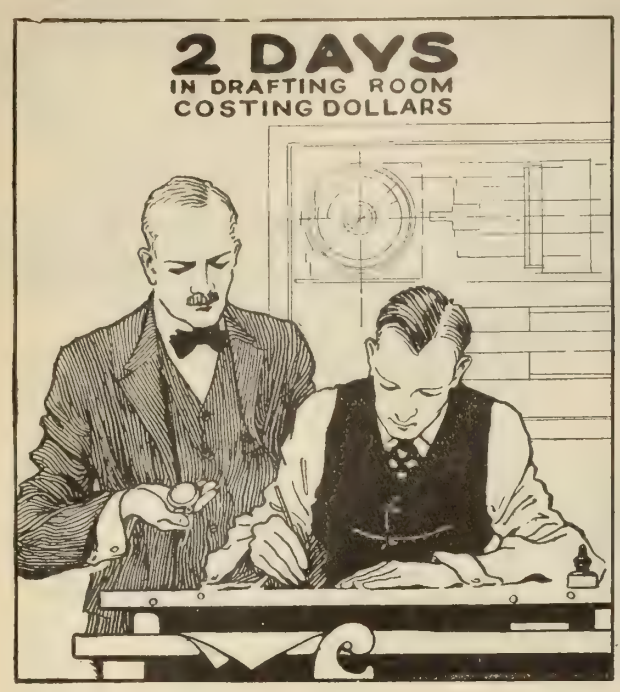
Why purchase imported cranes and hoists when our modern crane plant at Walkerville will take care of your needs?

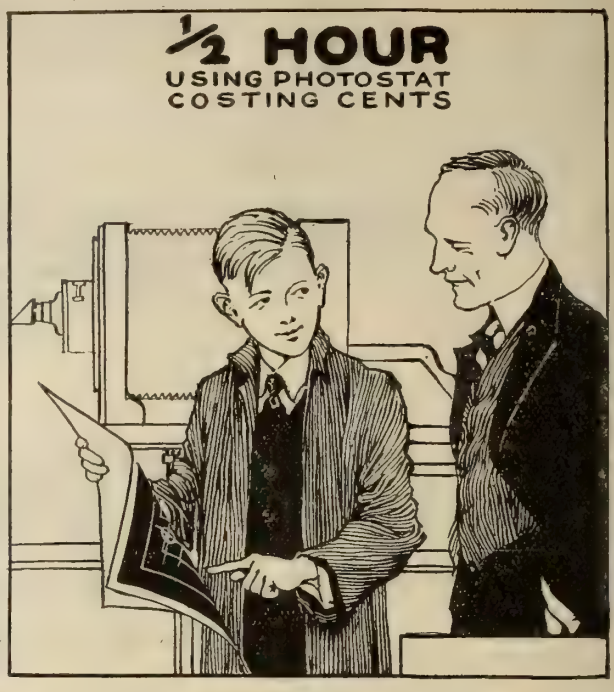
We are an established Canadian firm, and build our cranes to modern designs.

Our line includes electric and hand cranes, electric hoists, air hoists, and foundry equipment. Our catalogues, 28-C and 43-C, tell.

NORTHERN CRANE
Works, Limited
Walkerville, Ont.

If interested tear out this page and place with letters to be answered.





Which? In Your Business?

Your customer sends you a blueprint for that new contract that you have just closed. You must have several copies for the shop. You can't make blueprints from a blueprint and to have a tracing made you must wait anywhere from two hours to two days, or possibly longer if the drafting room isn't able to start work at once. Then there is always the possibility of an error in the tracing when it is finished. It is discouraging, isn't it, when you've quoted that customer an "inside" delivery to get started with him?

And the chief draftsman isn't any more pleased than you, because he probably has to take an expensive man from a creative job and put him on an unproductive copying job.

But wait—there is a way out of your difficulties. It's the

PHOTOSTAT

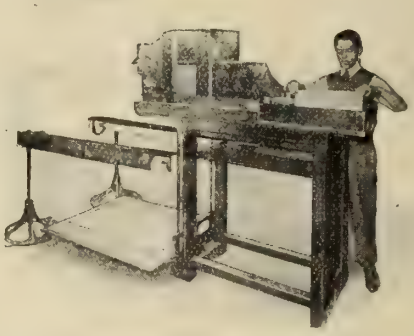
Trade Mark Registered

This machine will give a clear, clean, photographic copy of your blueprint, in a few minutes and without the use of expensive negatives or a dark room. Just think, in this short time it will deliver to you, ready for use, all the facsimile copies you need—and at a cost of only a few cents apiece. Also remember that the PHOTOSTAT

MAKES NO MISTAKES

Ask for our catalog giving complete details

The PHOTOSTAT quickly pays for itself not only because it copies blueprints, but because it copies pencil sketches and drawings, tracings, maps, plans, pages from books, advertising layouts, photographs, small tools and machine parts, production schedules, etc., at **original size, enlarged** or **reduced** within the limitations of the apparatus.



A PHOTOSTAT IN OPERATION

Manufactured by the Eastman Kodak Company Exclusively for

COMMERCIAL CAMERA COMPANY
ROCHESTER, N.Y.

CHICAGO, NEW YORK CITY, PHILADELPHIA, PROVIDENCE, SAN FRANCISCO, WASHINGTON

AGENCIES:

Alfred Herbert, Ltd., Coventry, England
Societe Anonyme Alfred Herbert, Paris, France
Societa Anonima Italiana Alfred Herbert, Milano, Italy
Societe Anonyme Belge Alfred Herbert, Brussels, Belgium
Graham Bros., Stockholm, Sweden.
Dodwell & Co., Ltd., Buenos Aires, Argentine Republic

MADE IN
PREMIER
CANADA
GALVANIZED SHEETS

Dominion Sheet Metal Corporation, Limited
Hamilton - Canada

Galvanized Steel Sheets
have been made in Canada for the last five years. Our present annual capacity is
20,000 Tons
We save you time and money and help keep the exchange rate down.
We are also manufacturers of Galvanized
TONCAN METAL
anti-corrosive sheets.
Best for industrial needs.
Send for Text-Book on Corrosion.

Welding Supplies and Apparatus

Electrolytic Oxygen 99.80% pure

COMPRESSED ACETYLENE
REGULATORS
CUTTING TORCHES
WELDING TORCHES
GOGGLES
FLUX
GENERATORS
CARBIDE
HOSE
WELDING RODS
CARBONITE RODS
PORTABLE TRUCKS

We are also thoroughly equipped to handle everything in the line of welding or cutting work—Oxy-Acetylene—Electric—Thermit.
No job too small—No job too large.
Work guaranteed.

The Carter Welding Company of Toronto, Limited
9 Sheppard Street Toronto, Canada

The Mecca of



The City of St. J

Location:
The city of St. Johns is situated on the Richelieu River in the most densely populated district in Canada—the Province of Quebec—which as regards industries bears the same relation to Canada as New England to the United States. St. Johns is distant about 27 miles from Montreal, and has a population 12,000.

TRANSPORTATION FACILITIES:

By Rail—Unexcelled by any city of its size in Canada. The two main double track arteries of Canadian traffic—the Canadian Pacific and Grand Trunk railways—are the Intercolonial, the D. & H., the G.V., and N.Y., N.H. & H., and the B. & L. All eastern U.S. railways are connected with t Johns, while all the roads are inter-connected the St. Johns yards by a terminal switching co pany at very low rates. There are 50 trains da to Montreal.

By Water—St. Johns is directly connected by with the docks at Montreal, providing unsurpas ocean shipping advantages close at hand. The Richelieu River is a link in the chain of canals fr New York to the St. Lawrence, furnishing the c with a direct water route to the eastern seabo on the Great Lakes.

For more specific information write to the Secretary

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Manufacturers

St. Johns, Quebec

Freight Rates:

Because of its geographical location and transportation facilities, St. Johns is able to command a lower freight rate and cheaper coal and labor than any other centrally located manufacturing plant on the North American continent.

Export Conditions:

Due to the subsidizing of the Canadian Steamship lines by the Government, American manufacturers can lay down their products at a lower price in any part of the British Empire if they are shipped from Canada instead of the U.S. In a great many cases large American manufacturing concerns have found it profitable for trade in the British Empire, to locate their factories and even their assembling shops in Canada.

Labor Conditions:

Skilled and semi-skilled labor is plentiful in St. Johns. The city has long been recognized as the cheapest labor centre in Canada, the workmen are happy and contented, and labor troubles are unknown.

St. Johns has this great advantage over larger manufacturing centres because the workman's cost of living is low—as are also their municipalities and land and building rents.

Public Conveniences:

St. Johns possesses a complete system of electric power distribution, waterworks, sewers, driveways, macadamized streets, concrete walks, public parks and buildings, etc.

St. Johns is a beautiful residential city, and is liberally provided with places of amusement for the entertainment of you or your employees.

Inducements:

St. Johns offers the following inducements to new industries, attractions that are unparalleled.

Fifteen years' exemption of taxes; period subject to extensions.

All public improvements required, such as extension of streets, sidewalks, waterworks and sewerage.

A bonus of five per cent. on your payroll for five years. If desired, we shall advance this to you to be applied to the purchase or erection of any building suitable to your purpose.

The Chamber of Commerce, St. Johns, Quebec, Canada

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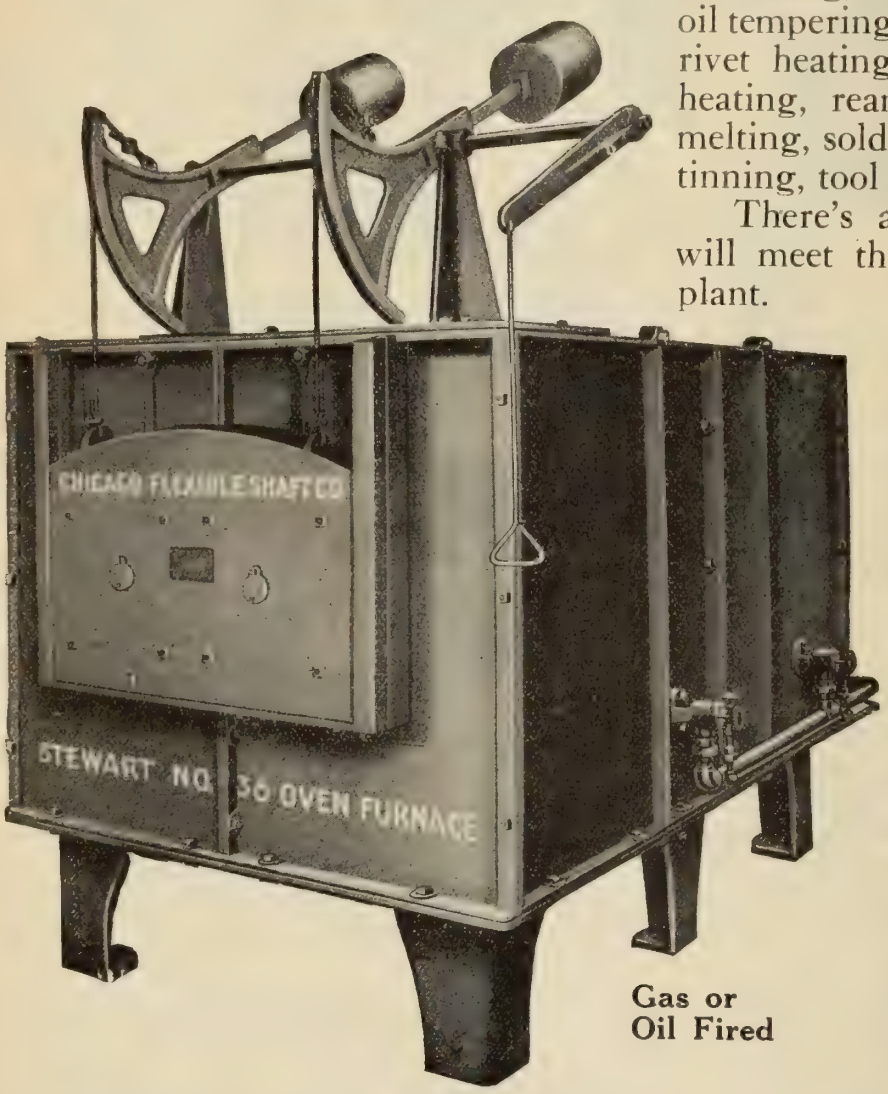
Stewart Furnaces

Cover a Wide Range of Heat Treating

THERE is Stewart equipment for the most exacting and unusual requirements. Stewart Furnaces, Forges and other Heat Treating Equipment meet the practical needs of modern industrial plants. They are result-getters—with a saving in time, fuel and material.

Stewarts are used for annealing, brazing, brass melting, case hardening, cutter hardening, cyanide hardening, die hardening, drop forging, high speed steel hardening, knife and shear blade hardening, lathe tool hardening, lead hardening, milling cutter hardening, oil tempering, pre-heating, re-heating, rivet heating, rod heating, rod end heating, reamer heating, soft metal melting, soldering, spring hardening, tinning, tool hardening, welding, etc.

There's a Stewart Furnace that will meet the requirements of *your* plant.



Gas or Oil Fired

Stewart No. 36 Oven Furnace

For Case Hardening, Heat Treating, Annealing, etc.

Specifications:

Opening, 20″ x 36″.
Depth, 72″
Floor space, 68″ x 94″
Gas connections, 2″
Air connections, 2″
Special composition fire brick walls
2½″ special insulation
Shipping weight, 12,000 lbs.

A furnace embodying strength and solidity, very efficient in results and of ample capacity.

Complete description of the No. 36 and more than fifty other oven furnaces in our new Catalogue No. 75. Send for your copy to-day.

Chicago Flexible Shaft Company

1148 SOUTH CENTRAL AVE., CHICAGO, ILL., U.S.A.

Stewart Furnaces

Large Capacity---Quantity Production

STEWART EQUIPMENT fills the bill everywhere, whether it be a small, compact unit for the tool room, or a large capacity furnace for quantity production.

Our furnaces of the heavier type are of thoroughly dependable construction—high grade materials, minimum heat radiation, effective production results in continuous operation—results that combine both quality and quantity.

On this page and the one opposite are illustrated and briefly described two of our large capacity furnaces of the oven type. There are many others, of varying capacities—adapted to a wide range of heat-treating requirements.

Stewart Furnaces mean perfectly hardened tools, dies and machine parts, *accurate, certain results;* elimination of spoiled material; saving of time and fuel; comfort and convenience for the furnace man.

There's a Stewart Furnace that will meet the requirements of *your* plant.

Stewart No. 25 Oven Furnace

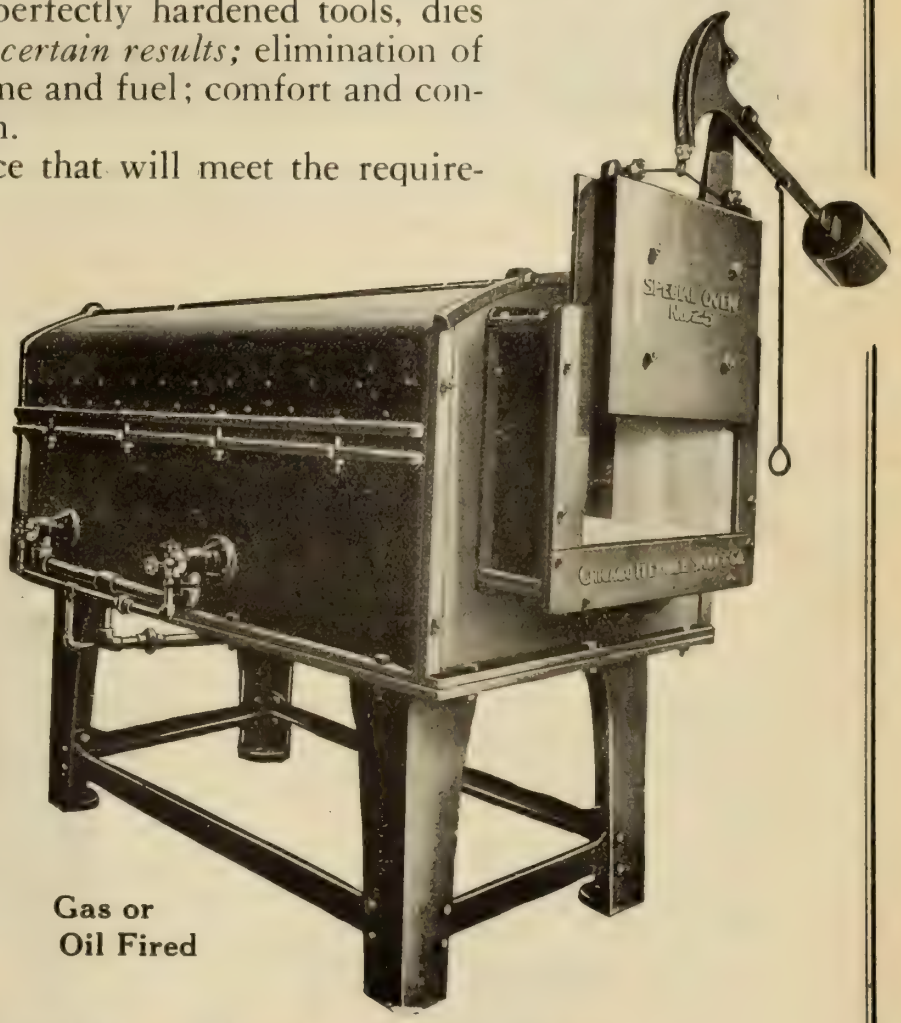
For Case Hardening, Heat Treating and Annealing

Specifications:

Opening, 14" x 22"
Depth, 60"
Floor space, 50" x 74"
Gas connections, 1½"
Air connections, 1½"
Shipping weight, 7,000 lbs.

A furnace adapted for large and long work, or for holding medium and large annealing and case hardening boxes.

Complete description of the No. 25 Oven Furnace and a hundred and fifty other sizes and types of Stewart heat treating equipment in our new Catalogue No. 75. Send for your copy.



Gas or Oil Fired

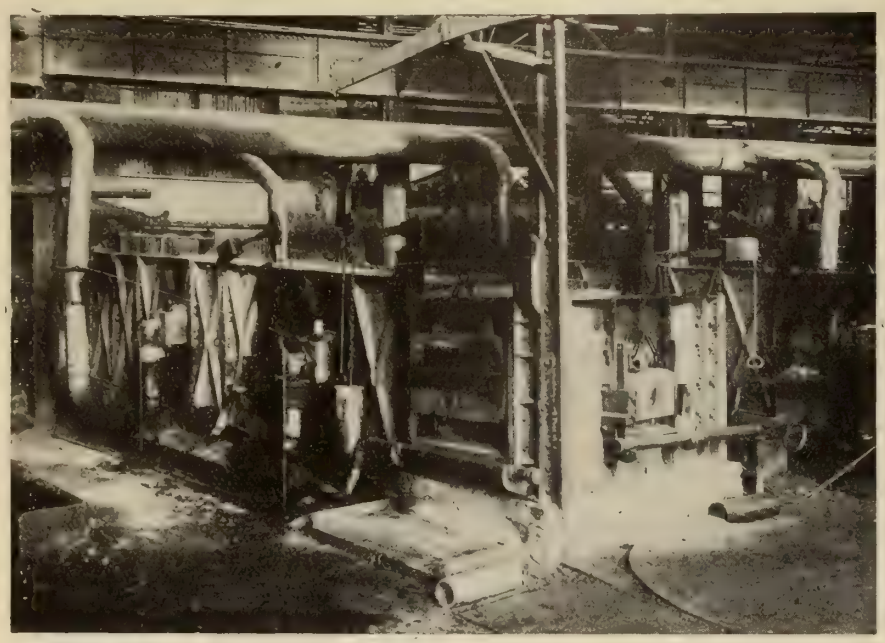
Chicago Flexible Shaft Company

1148 SOUTH CENTRAL AVE., CHICAGO, ILL., U.S.A.

If interested tear out this page and place with letters to be answered.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

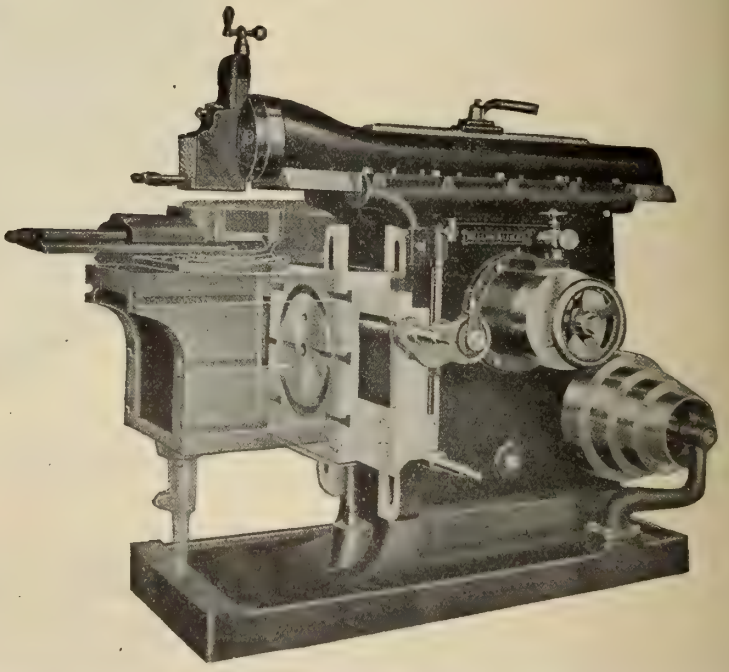
Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

Milwaukee Shapers

Are needed in Up-to-date Canadian Shops

Milwaukee simplicity, power and accuracy play an important part in turning overhead expense into profitable production.

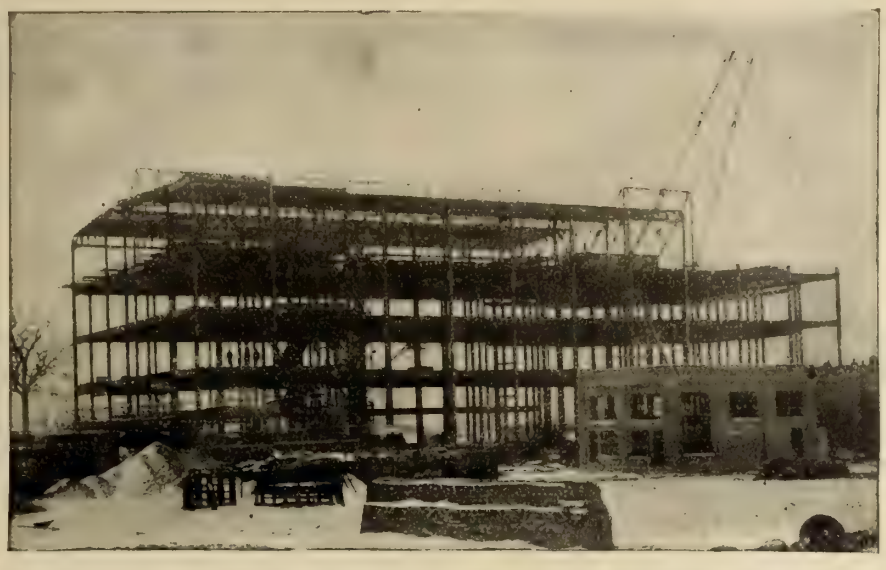
Milwaukee Back Geared Crank Shapers are built in 16-inch, 20-inch and 24-inch sizes.



MILWAUKEE SHAPER CO.

1029 Coldspring Ave.
Milwaukee, Wisconsin

STRUCTURAL STEEL AND STEEL BRIDGES



The above is a building recently erected for the International Plow Co. at Hamilton, Ontario

Steel Railway Bridges
Steel Highway Bridges
Steel Buildings
Steel for Ships
Steel Turntables
Steel Trusses and Columns

CAPACITY, 36,000 TONS

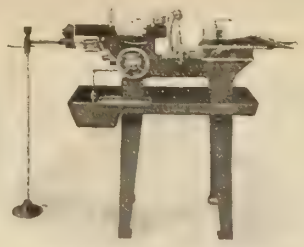
5,000 tons of Beams, Channels, Angles, Plates, etc., in our yards for immediate shipment

Enquiries Solicited

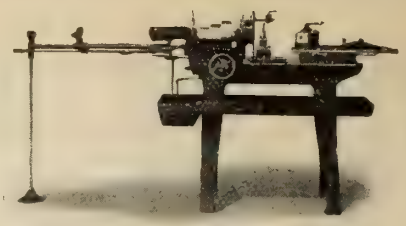
THE HAMILTON BRIDGE WORKS COMPANY, LIMITED

Hamilton - Ontario

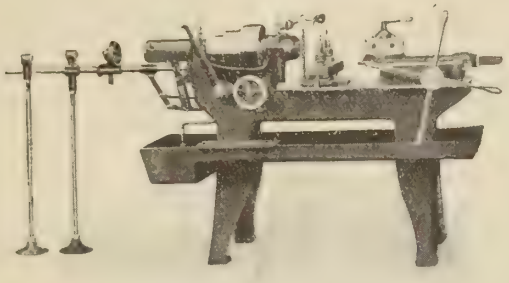
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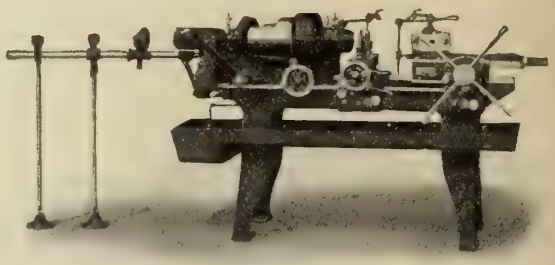
No. 0 P. H. SCREW MACHINE.



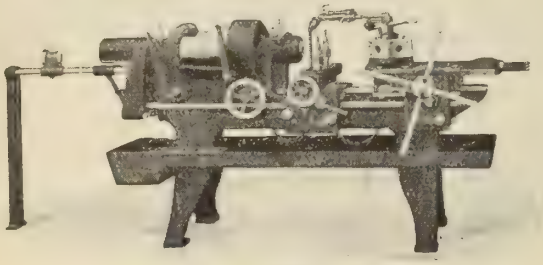
No. 1 P. H. SCREW MACHINE.



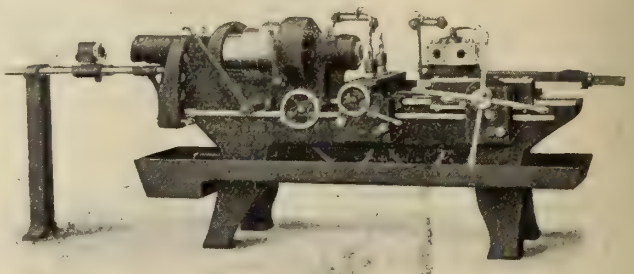
No. 3 P. H. SCREW MACHINE.



No. 3 F. H. SCREW MACHINE.



No. 5 F. H. SCREW MACHINE.



No. 7 F. H. SCREW MACHINE.

Another Proof That We Are Keeping the Lead

We herewith announce a complete new line of hand screw machines

Sizes ranging from 7/16" to 2-9/16".

THE DESIGNING AND PERFECTING OF A COMPLETE LINE OF SCREW MACHINES OF THIS CHARACTER IS AN ENGINEERING FEAT OF NO MEAN SCOPE.

Since we, about two years and a half ago, announced the 1-B Universal Turret Lathe, the new machines have followed each other at regular intervals. Each had incorporated several new ideas in turret lathe design.

The 1-B, 2-B and 3-B Universal Turret Lathes have already become recognized as the undisputed leaders in the turret lathe field. The main points of superiority found in these machines, the tremendous production which they have already demonstrated themselves capable of delivering coupled with an unexcelled ease of operation, have established the name of Foster Machine Company, as that of the leading turret lathe manufacturer.

This announcement is the climax.

To design this new line of hand screw machines the best talents in the country were secured. These men who are experts, not only in the field of screw machine and turret lathe work, but who also have a thorough knowledge of the nature of the materials that enter into machine construction and are well-grounded in the arts of manufacturing, have spared no effort to make these machines as near perfect as human skill and available metals make possible.

The six machines comprising this new line have been thoroughly and severely tested in our own factory for nine months. The result of these tests came fully up to our best expectations.

The features that establish these machines head and shoulder above all competition are too numerous to mention here. They will, however, be taken up and emphasized one by one on this page. Everybody interested will thus be put in a position to judge for himself as to their individual merits.

A complete set of circulars describing these machines are off the press. They ought to be in your file. Write for them to-day.

FOSTER MACHINE CO., Elkhart, Ind.

"About the best investment we ever made"

THAT is how one firm describes their purchase of DENNISTEEL Stools and Chairs. They say that nothing in their plant has given such big value for so little outlay.

DENNISTEEL *Made in Canada* Metal Chairs and Stools

are needed in shops, factories, gyms, etc.



DENNISTEEL Chairs and Stools are practically indestructible. They stand the racket.

Is anything more unsightly in an otherwise well-kept plant than a rickety, lop-sided chair, or a decrepit old wooden stool with string or wire reinforcements?

DENNISTEEL Stools and Chairs are fire-proof, warp-proof, wear-proof and trouble proof. The seats cannot come off nor the legs or rungs come "unglued." They never make that nerve-hurting creaking noise when the occupant happens to move.

DESCRIPTION:—Seats are all-one-piece, stamped out of sheet steel, and have rounded edges. No sharp corners to hurt hands or tear clothing. Legs are angle steel, reinforced at bottom with straps to insure permanent rigidity. Length of legs may be as desired, but standard sizes are 24 inches for the stools and 18 inches for the chairs. Back rest of chair is adjustable.



Finish, usually olive green or black enamel, or white for hospital use. Colors other than these may be had on request. Washable, of course.

Here's how they save time and money!



A workman draws say—forty cents an hour. The leg of his stool comes apart. He spends around thirty minutes in repairing it. He looks around for some wire, a piece of board, some nails or a hammer. The time spent in repairing goes on the job ticket; and, perhaps, the fact that you have never seen these items represented as wooden stool repair costs is the reason you have never raised an objection and an inquiry.



If these wooden stools were sent to an outside repair shop every time they broke down and a bill was sent you each time, equal to the cost of the time it takes your mechanic to repair them, you would realize the great premium you pay simply for the privilege of owning wooden stools. You would find it costs you more to keep them than to buy them. We believe you would then readily be willing to equip your entire factory with DENNIS steel stools, which are indestructible, never require repair, and last a lifetime.

In the list of satisfied users of DENNIS Indestructible Steel Stools are the names of many concerns of national reputation, who have found them to effect a saving of time and money.

We also make Steel Lockers, Shelving, Bins, Cabinets, Etc., Etc.

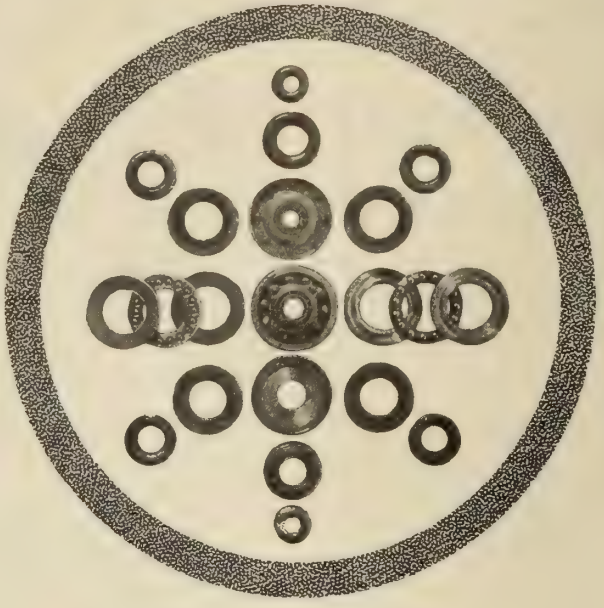
HALIFAX
MONTREAL
OTTAWA
TORONTO

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

HAMILTON
WINNIPEG
CALGARY
VANCOUVER

If interested tear out this page and place with letters to be answered.

Ball Bearings



Thrust Bearings, Cup and Cone Bearings, Self-aligning Bearings
made to meet your requirements.

High Grade Annular Bearings--Single and Double Row
carried in stock.

The largest variety stock of Ball Bearings in Canada

Steel Balls of all sizes always in stock

HEAVY AND DIFFICULT STAMPINGS and AUTOMOBILE PARTS

Our Presses range up to Nine Hundred Tons Capacity

HEAT TREATMENT AND GRINDING

OUR EQUIPMENT: Large Carbonizing Furnaces, Radius Grinders, Plain and Cylindrical Grinders, Universal and Special Grinders.

The Gray Ball Bearing Co., Limited

686-692 St. Clarens Ave., Toronto

Handled by the Handle

"The HOLYOKE"

In factories, store-rooms, warehouses—wherever materials or products have to be moved—"The HOLYOKE" Transfer System soon pays for itself and increases profits by saving in storage-space and in time and labor required to handle the materials.

All that is needed with the transfer truck is a number of simple, wooden platforms or skids upon which to pile the materials or products. To operate, **just shove a HOLYOKE Transfer Truck under the loaded platform and raise the load**—a simple backward and downward pressure of the handle does it—and the truck with its load is ready to move.

"The HOLYOKE"
Transfer Truck

We will send as a sample our **Model RL2 HOLYOKE Truck** for $160 f.o.b. New York City. This model will lift and transfer loads of 2,500 pounds. It will move platforms 28″ to 30″ in width by 30″ to 45″ long. Wheelbase, 44″. Net weight, 233 pounds.

Dealers and Distributors Wanted
We make 14 different models in various sizes and capacities. Connections wanted in all business and industrial centers of the world. Dealers are invited to send for our catalog and trade discounts. Correspondence in all languages.

Holyoke Truck Co.
115 Race Street
HOLYOKE, MASS.



Used by Fyr-Fyter, Dayton, Ohio

1855-1920

Established in Toronto
65 Years

INGOT AND SHEET METALS

ALL GRADES

M. & L. Samuel, Benjamin & Co.
Cor. King St. & Spadina Ave.
Toronto

ELK BRANDS FIRE BRICK

Give maximum service on the work for which they are intended

Each brand has some particular qualification which fits it to give better results in certain places than other brands we produce. It differs from the others either in grind, mixture of clays, or in method of manufacture, or possibly in chemical composition.

Our Brands:
"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Ladle"
"Elk Dust"
"Keystone Dust"
"Rotex Dust"

Try us on your next fire brick needs. You'll find both our quality and service right

rge Stocks of various shapes carried in warehouse in Hamilton

ELK FIRE BRICK CO. OF CANADA
LIMITED
Sun Life Building, HAMILTON, ONTARIO

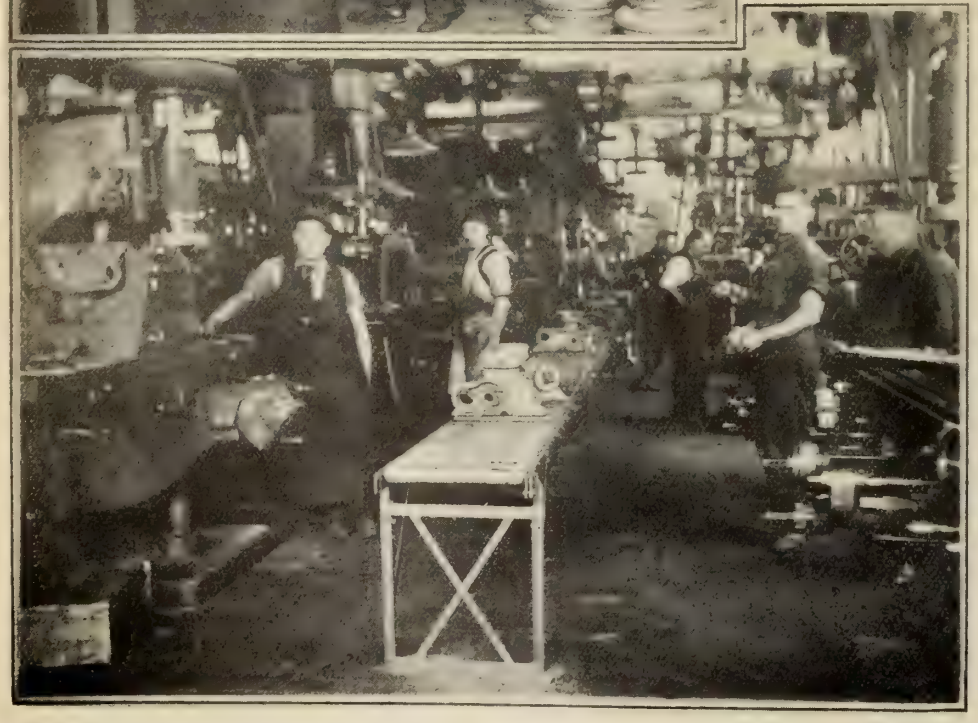
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Here They Are Again!

This time handling engine castings in a large Canadian Motor Car Manufacturing plant.

You find them in every line, wherever you go in Canada, in the plants that are humming with industry.





To-day you may be in a manufacturing plant, to-morrow in a Cannery, the next day in a Lumber Mill. It doesn't really make much difference where you are, MATHEWS GRAVITY CARRIERS, AUTOMATIC ELEVATORS, BELT CONVEYORS, PALLET AND FLIGHT CONVEYORS, and CHUTES will be found quietly and efficiently doing their work.

Profit by the experience of others and put in MATHEWS CONVEYING SYSTEM. If you haven't room on the floor hang it from the ceiling up out of the way. Do away with the old-fashioned system of trucks and other devices that must be pushed back empty to get the next load. Make your system continuous.

Send us a card and our nearest Sales Engineer will call at your convenience and without any obligation.

CANADIAN MATHEWS GRAVITY CARRIER CO., LTD.

Lake Street

PORT HOPE, ONT.

ELECTRIC FURNACES



SIX TON FURNACE POURING
FIRST HEAT, U.S. NAVY YARD

A new feature of our furnace is the electrode economizers, which are designed on scientific principles. In one instance, the electrode consumption was reduced from 30 lbs. per ton of steel to 11 lbs. by the installation of these economizers, and at the plant of another concern using them the consumption is 9¼ lbs. per ton of steel, melting from cold metal and refining.

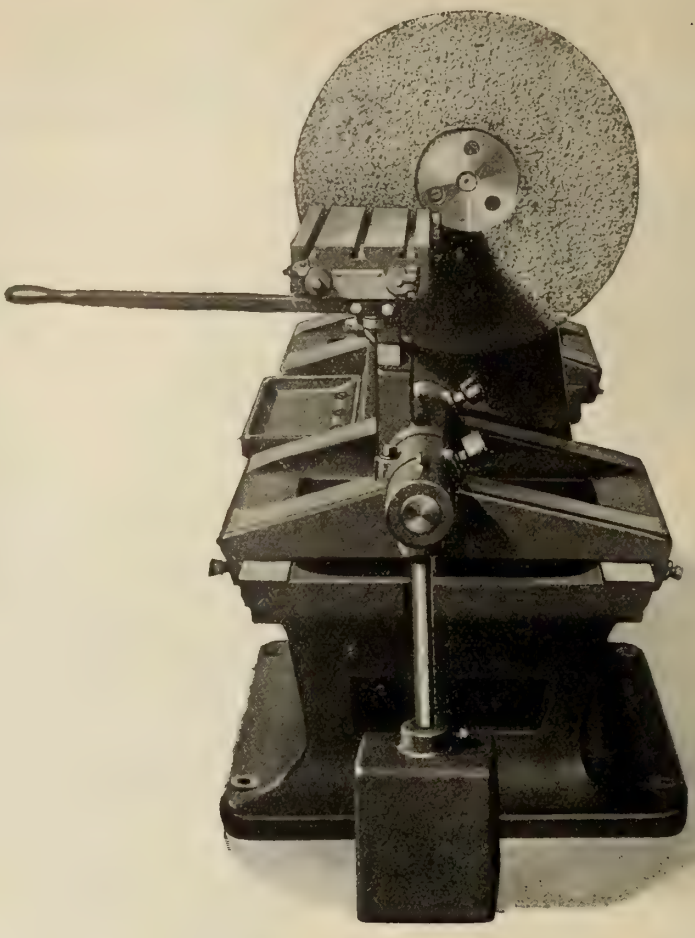
"GREAVES-ETCHELLS" SYSTEM

ELECTRIC FURNACE CONSTRUCTION CO.

FINANCE BLDG. PHILADELPHIA, PA.

If interested tear out this page and place with letters to be answered.

End View *of a* BADGER GRINDER



Compare this machine with the ordinary type of disc grinder construction. It does not take much of a mechanic to immediately see the increased stability of the Badger Grinder.

Instead of an unsupported rockershaft permitting destructive vibration, the Badger Grinder is designed with the rockershaft positively located in a rigid saddle carried on an extremely stiff and well ribbed boxed knee. There is no such thing as a "springy" rockershaft in the Badger Grinder. All other essentials on these machines are designed with proportionate strength. The result is increased accuracy on a real production basis.

The Badger Grinder is not an experiment. If you want to learn how much faster or closer to requirements this machine will produce your work you have only to send us a few of your unfinished parts for a free demonstration. We guarantee to give you authentic data on the disc grinder method of finishing your parts at a speed and tolerance which was never before considered possible.

We have a complete line of grinding discs, cylinder wheels, soft metal wax, and disc wheel cement

Badger Tool Company

E. B. Gardner, Pres. R. D. Gardner, Treas.

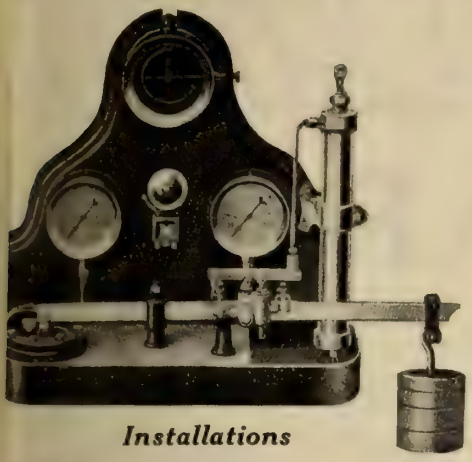
Beloit, Wisconsin, U. S. A.

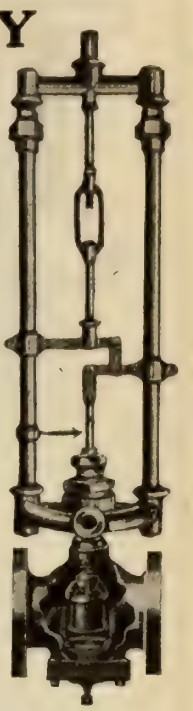
Representatives in all principal cities and foreign countries

ASSURES EFFICIENCY---SAVES MONEY

"McDONOUGH" SYSTEM

for the Automatic Regulation and Control of Air, Fuel and Water





THE McDONOUGH DAMPER REGULATOR

This Damper Regulator saves $300 per boiler annually in many plants. It will on ½-lb. variation regulate Dampers, Stoker Engines, Stoker Motors, Forced Draft Engines, Gas Supply to Boilers. We put in the Quality before we put on the name.

We install this Damper Regulator in your plant for 30 days' trial, free of cost to you.

THE FEED WATER REGULATOR

We know positively that this Feed Water Regulator does what other Regulators try to do—maintains a flow of water to your boilers at the exact rate it is being evaporated into steam, that means boilers give drier and more steam for less money than is possible with other Regulators.

Two Good Reasons WHY:

Pittsburgh, Pa., Sept. 19, 1918.
We have your letter of August 9th and wish to advise you that we have your Automatic Regulator installed in our power plant, in this city.
We have been keeping record of the coal used in anticipation of this installation, and find that we have an actual saving in coal alone of twenty-five (25) per cent. for the past three months, with considerable of an increase in our factory production.
JAS. H. MATHEWS & CO., INC.,
(Sgd.) Jas. H. Mathews, Pres.

TORONTO, November 17th, 1919.
"We have had the McDonough Automatic Damper Regulator System and Feed Water Regulators System in use for more than six years in our Old and New Plants and we are pleased to state that these two controlling systems have been satisfactory and we find same a great fuel saving equipment giving us steady water level in our boilers and a steady head of steam as well. We will be glad to recommend these controlling systems to prospective purchasers of steam plants."
THE WM. DAVIES CO., LTD.,
(Sgd.) J. C. GILLIES, Mech. Supt.

Write us to-day for full particulars

Installations

ORONTO

Sheet Metal Products of Canada, Limited
T. Eaton Co.
Davies Packing Co.
Harris Abattoir
Canadian Kodak Company
Hinde & Dauch Paper Co., Limited
Consumers Gas Co. (3 plants)

McDONOUGH AUTOMATIC REGULATOR CO.

JAS. McDONOUGH
323 MARKHAM STREET
TORONTO

Phone, write or wire for full informatio
College 3986

WILTON MASTER BLOCKS

Are accurate to within ten millionths of an inch

Recent developments during the war have revolutionized the science of measurement and the production of accurate gauges.

These achievements are yours in Wilton Master Blocks—produced in quantities by scientific methods and standardized by light wave measurement.

Set C in Walnut Case priced at $175.00 is composed of 35 gauge blocks which wring together in combinations and give all sizes from 3/10" to over 12" in steps of 1/10,000" (over 120,000 sizes).

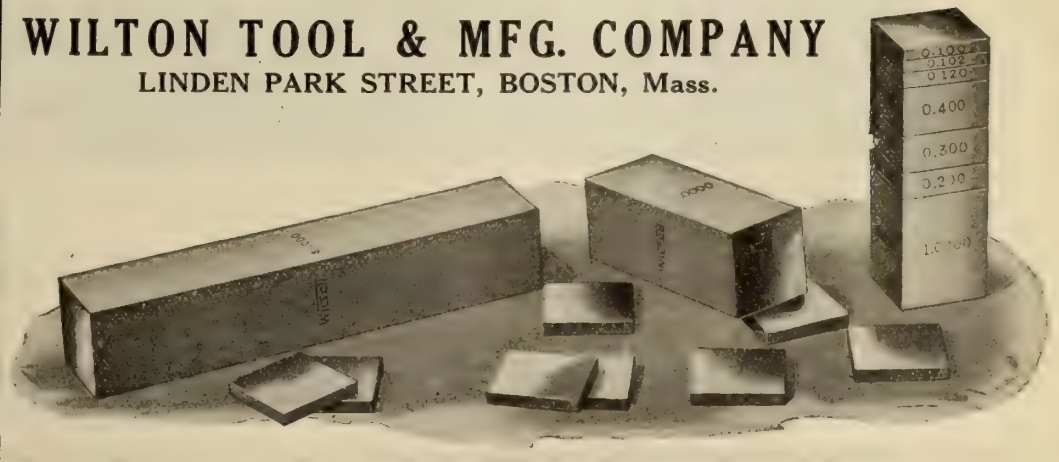
Other sets to meet your requirements as low as $10.00, as high as $405.00. Write for catalogue No. 24.

Complete and Self-Contained Gauging System

Priced Well Within the Reach of All

WILTON TOOL & MFG. COMPANY

LINDEN PARK STREET, BOSTON, Mass.

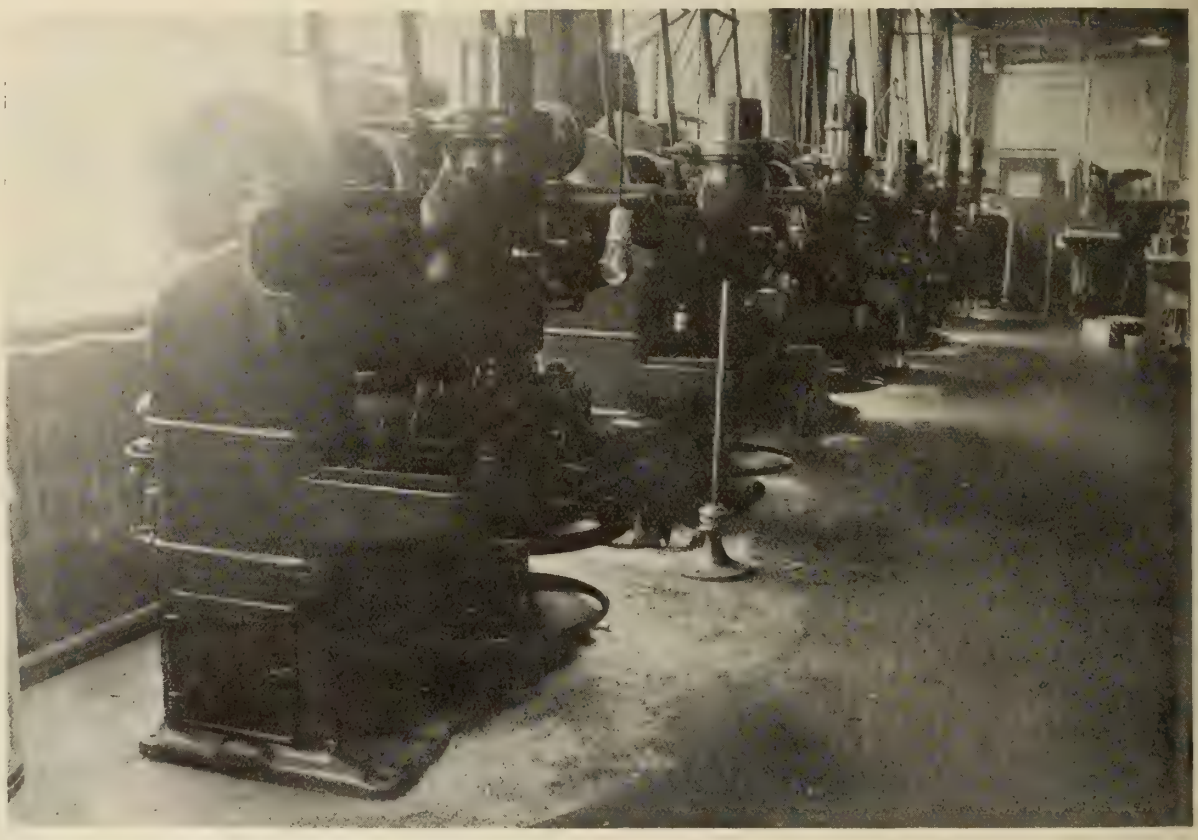


If interested tear out this page and place with letters to be answered.

FELLO

GEAR SHA

THIS photograph shows a battery of Fellows Gear Shapers in the "Canadian Plant" of the Willys-Overland Co., doing general gear cutting, and cutting transmission gears for Overland cars.

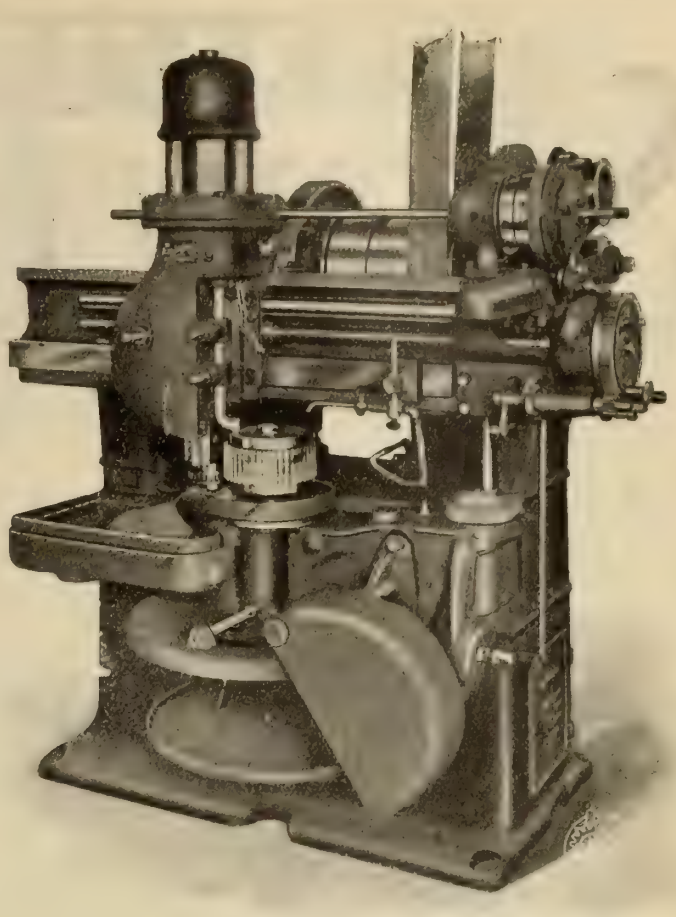


The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Ltd., Calcutta, India; and A. B. Galco, Ltd., Stockholm, Sweden.

WS
PERS



The Fellows Principle of Gear Generation

The principle upon which the Fellows Gear Shaper works, explained in simple terms, is as follows: Suppose we take a spur gear and roll it along in some plastic substance such as putty. If we do this operation carefully, we will generate gear teeth in the plastic substance. If our gear has accurate involute teeth, the teeth of this rack so generated will be straight sided. This is a simple demonstration of one of the properties of the involute curve.

The Fellows Gear Shaper employs this correct mathematical principle in the manufacture of the Gear Shaper Cutter. After the cutter has been hardened, it is ground all over. Then the involute sides on the teeth are generated by a precision grinding process. Every Gear Shaper Cutter is thus manufactured on the correct principle, and for this reason the great accuracy of the Gear Shaper Cutter cannot be duplicated by any other gear cutter. It is therefore evident that spur or helical gears generated by this process must be exceedingly accurate.

The Fellows Gear Shaper is adapted equally well to the accurate generation of either spur or helical gears.

Another advantage—There is only one commercial machine on the market that is adapted to the cutting of one-piece step gears and internal spur or helical gears, and that is the Fellows Gear Shaper.

A full description of this Gear Shaper and its many features will be found in our general catalog "Commercial Gear Cutting," a copy of which is yours for the asking.

Our Engineering Department also stands ready at any time to help you with your gear problems. Our service is gratis. Why not send us your blue prints for suggestions?

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Ltd., Calcutta; India; and A. B. Galco, Ltd., Stockholm, Sweden.

If interested tear out this page and place with letters to be answered.

WIRE Safety Guards

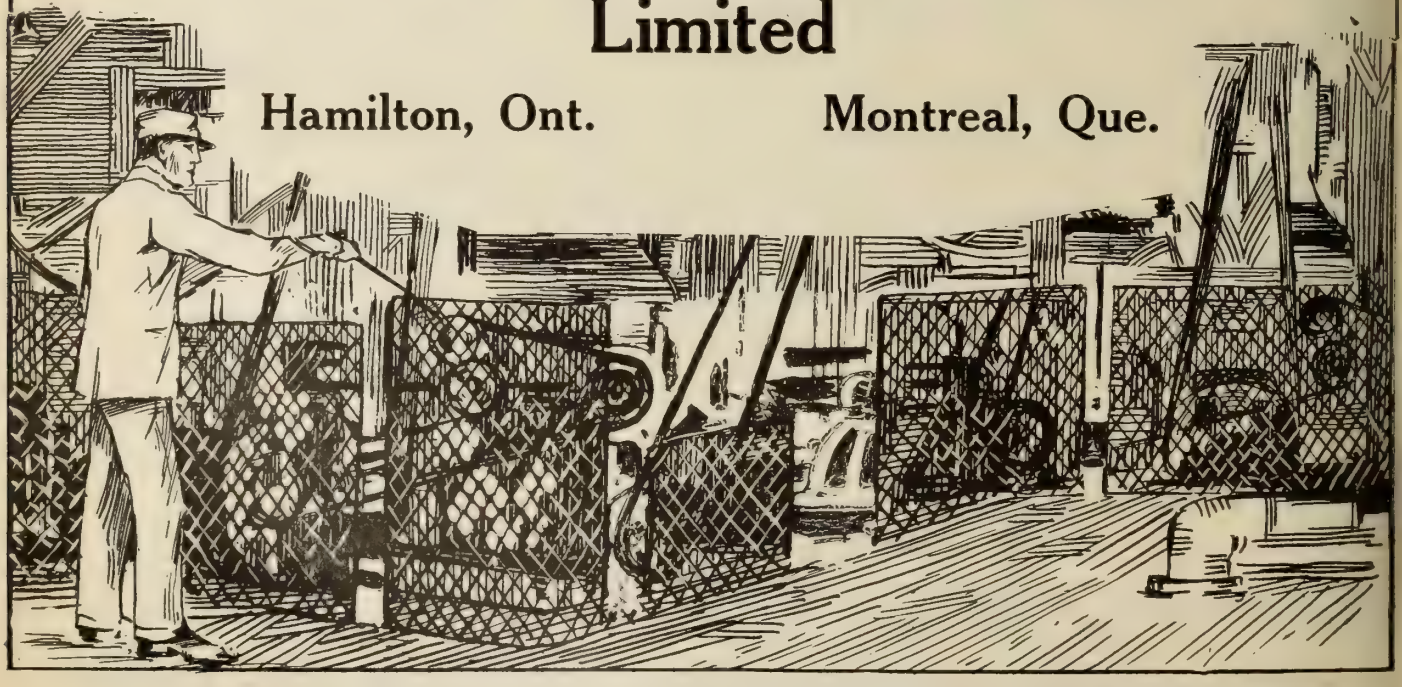
Last year approximately $3,000,000 was awarded to Ontario workmen under the Compensation Act. Ontario manufacturers had to foot the bill one way or another.

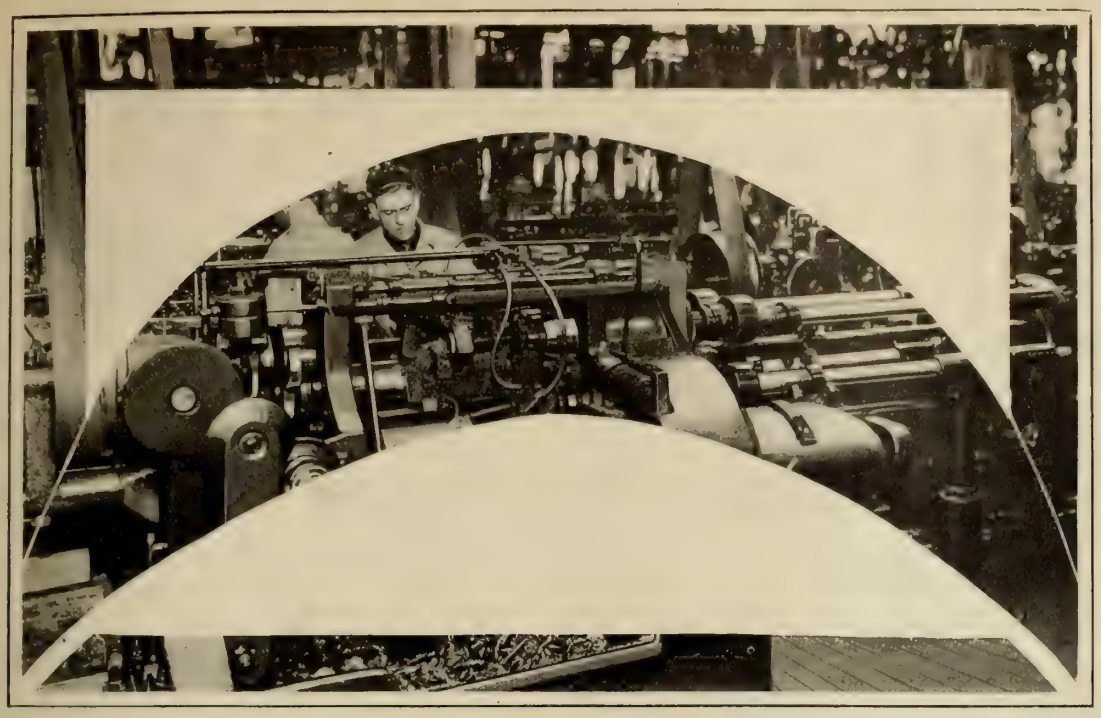
GREENING SAFETY GUARDS offer SURE PROTECTION. They are strongly built and designed for convenience.

Avoid 90 per cent. of these accidents. Equip with the GREENING SAFETY GUARDS.

The B. Greening Wire Co., Limited

Hamilton, Ont. **Montreal, Que.**





We're Equipped to Build

SPECIAL MACHINES

To Meet the Most Exacting Requirements

DESIGNERS & BUILDERS

Of All Kinds of

Dies, Jigs, Fixtures, Gauges, Models

We Specialize in Making Things Right!
Our Experience and Facilities are
AT YOUR SERVICE
Let Us Be Your Tool Room

THE
CRESCENT MACHINE CO.
Limited

20 Longueuil Lane, Montreal, P.Q.

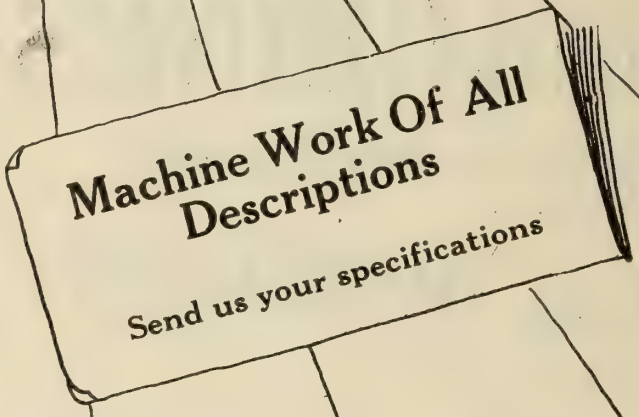
If interested tear out this page and place with letters to be answered.

The WILLIAM HAMILTON Co.,Ltd.
PETERBORO, Ont.

Steel Plate Work

Stuctural Steel Work

Grey Iron Castings



Flumes

Smokestacks

Hoppers

Bins

Tanks

Rivetted Steel Pipes

Boiler Breechings

Stand Pipes

Penstocks

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL



Alundum Snagging Wheels

Manganese steel combines extreme hardness, toughness and ductility. Steel tools cannot remove excess material from this alloy steel commercially. **Alundum grinding wheels can.**

Made of No. 66 Alundum abrasive with the special temper, Norton grinding wheels remove the jagged edges and rough fins from these castings

Rapidly
With a minimum of heat
At the lowest cost

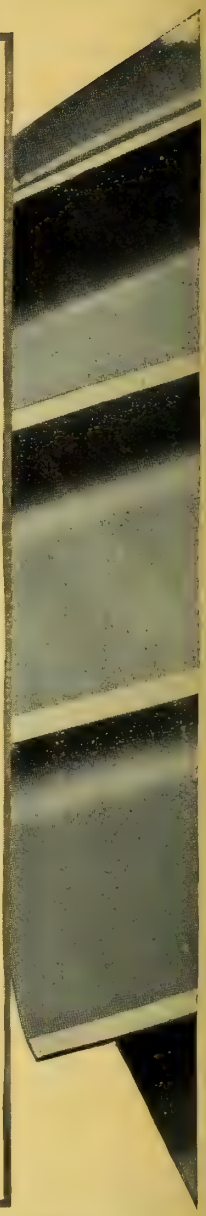
The illustration shows a 20 x 2 x 2" wheel, with a 3-4" taper, grain 6614 grade U being used for snagging a dredge tumbler.

NORTON COMPANY, WORCESTER, MASS.

Electric Furnace Plants: Niagara Falls, N. Y; Chippewa, Ont., Canada

Canadian Agents: The Canadian Fairbanks-Morse Co, Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria, F. H. Andrews & Son, Quebec, Que.

Now Comes the New Era



THE history of machine production has been the history of tools and their improvement. Step by step, structural advances in tool steel have won recognition and adoption.

Carbon Steel conceded superiority to self-hardening steel, slowly but inevitably. Self-hardening steel in turn, yielded to High-Speed Steel with corresponding reluctance.

And now Davidsonized Steel has come. It is not only a high-speed steel, but a structurally new steel, new in its very fundamentals, as far superior to ordinary high-speed steel as the latter is to Carbon Steel.

Davidsonized Steel has passed through the historic stages of unbelief and doubt. For many months past, it has been going through the period of trial by the more progressive spirits in the field of machine production.

The overwhelmingly favorable verdict has been indicated to you in slight degree by the few instances which have been advertised during 1919. A summary of all performances by Davidsonized Steel Tools, throughout the past year and under conditions of widely varying character, reveals the amazing fact that they are capable of producing from two to six times as much work as former types of tools, to the life of the cutter, and of increasing production speed by 20% to 75%, and in some cases more than 100%.

Sooner or later, you are certain to investigate and adopt Davidsonized Tools. How soon you do so will have a vital bearing upon your production for 1920.

D M CORP.

THE DAVIDSON TOOL MFG. CORPORATION

Main Office: 118-122 Maiden Lane, New York
Works: 56-62 North 6th Street, Brooklyn, N.Y.

Detroit Office
864 Woodward Ave.,
Alex Hart, Jr., Mgr.

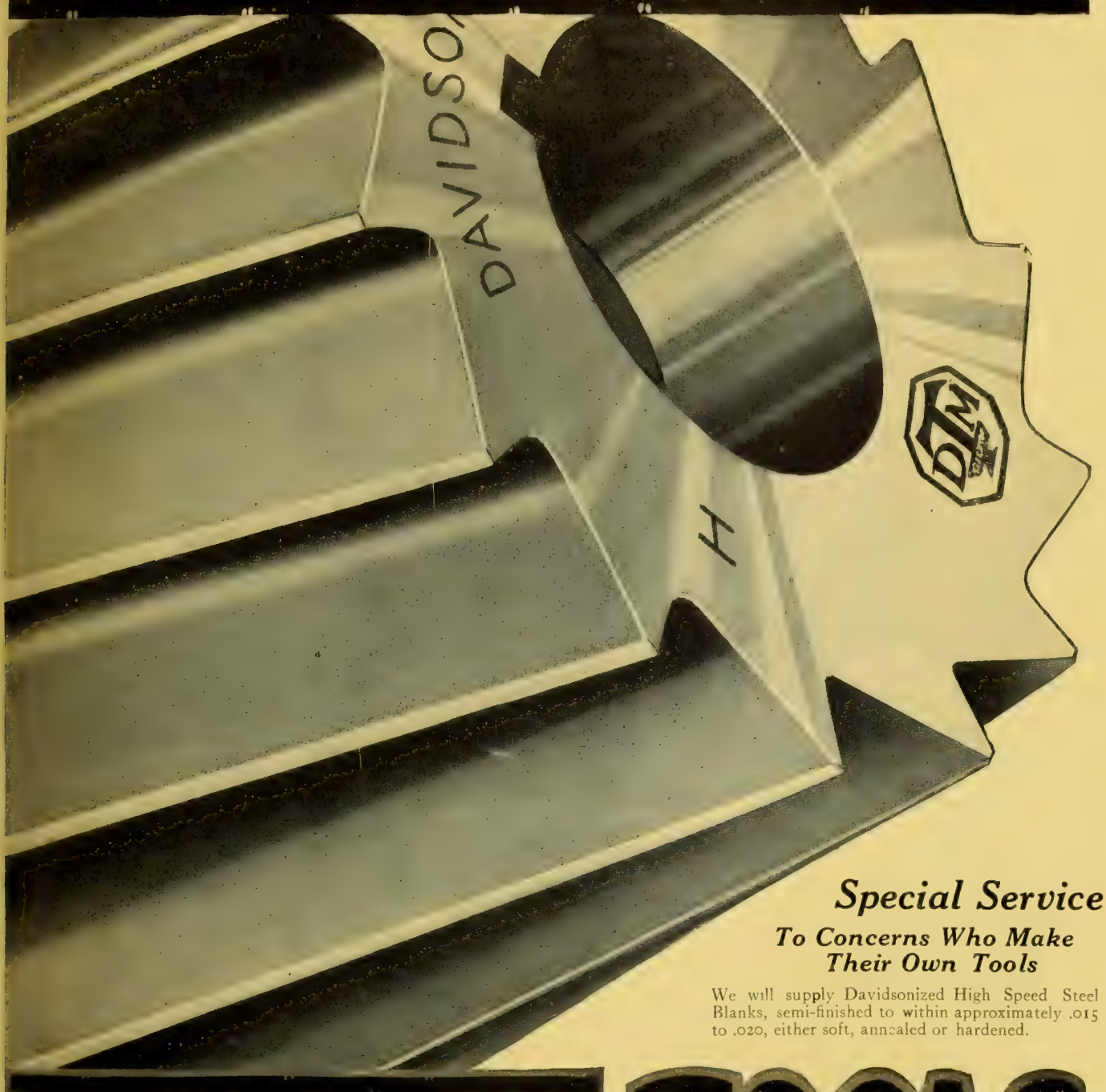
Pittsburgh, Cleveland, Buffalo
Knox Andresen Tool Co.,
Exclusive Selling Agents

Philadelphia Office
26 So. 15th St., Suite 41.
S. E. Weaver, Mgr.

In Canada—The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Winnipeg
In Scandinavia—Aktiebolaget A. Bonthron, Stockholm, Sweden

DAVIDSONIZED

in Production Practice



Special Service

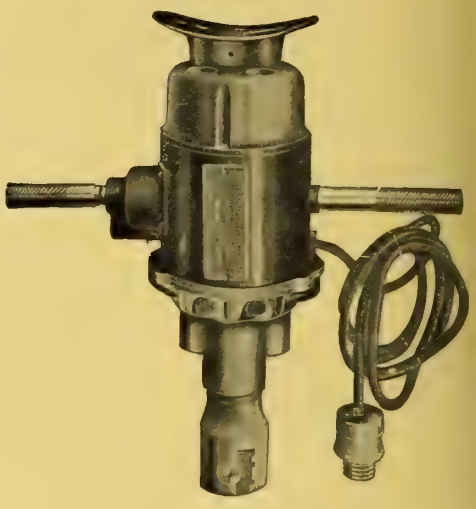
To Concerns Who Make Their Own Tools

We will supply Davidsonized High Speed Steel Blanks, semi-finished to within approximately .015 to .020, either soft, annealed or hardened.

HIGH SPEED STEEL TOOLS

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Take the tool to the work —it's cheaper

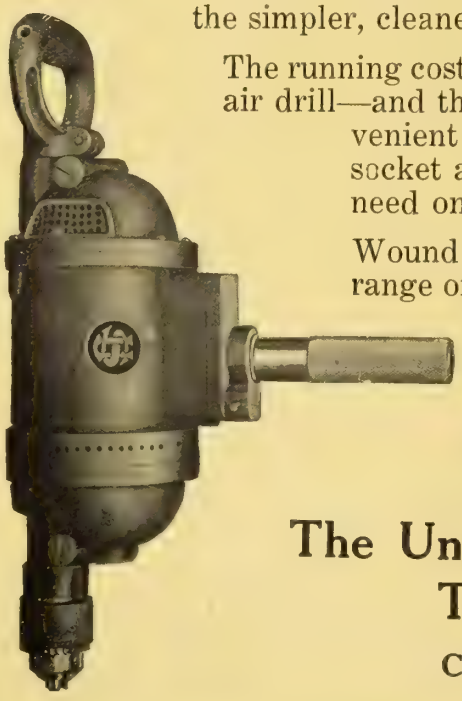


Our 25 years' experience has shown that 80% of the time spent on the average job can be saved by moving the tool instead of the work.

That's why we have concentrated on the development of thoroughly practical and fool-proof portable tools, designed and built for long, hard service.

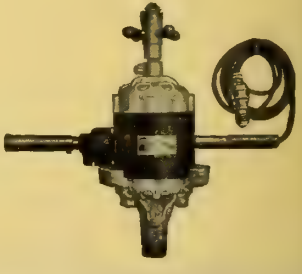
That's why U. S. Portable Electric Tools

have been a source of greater profit in shops like yours, have earned an enviable reputation as the tools that double output in the simpler, cleaner, speedier way.



The running cost of a U.S. Electric Drill is only half that of an air drill—and the electric drill is a hundred times more convenient and reliable. Just plug into the nearest lamp socket and you have more power on tap than you'll need on the toughest jobs.

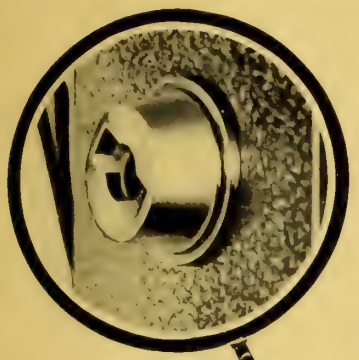
Wound 110 or 220 Volts, D.C. or A.C., in a large range of sizes, single- and two-speed. Our catalogue describes the tools and shows how they save money. Write for your copy.



The United States Electrical Tool Company

CINCINNATI, OHIO

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL



The Taper Nose Spindle

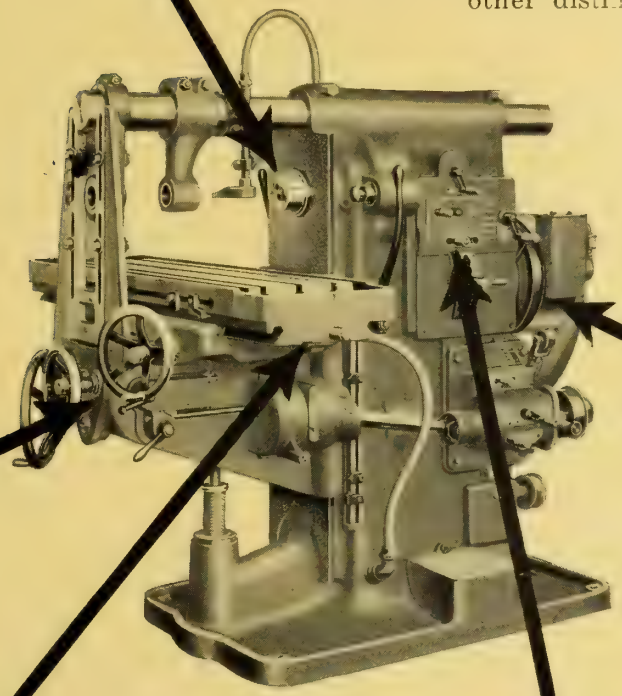
Another Reason for Brown & Sharpe Milling Machines

The simplicity and fewness of parts is particularly noteworthy—No plates, screws or loose parts are used and when arbor, collet or cutter is in place it is essentially as firm as though a part of the spindle.

It will pay you to know about the details of the Taper Nose Spindle and the many other distinct features described in our New Milling Machine Book.

Brown & Sharpe Mfg. Co.,

Providence, R.I.



Knee of Rigid Design

Heavy sections—interior transverse ribs—long and wide bearing surfaces overcome vibrations and sagging.

Large Driving Pulley

Large diameter, wide face—runs on ball bearings—has cast iron pulley guard.

Reinforced Ribs

Wide bearings extend from outside nearly to the centre—reinforced ribs resist buckling tendencies.

Direct Reading Index Plate

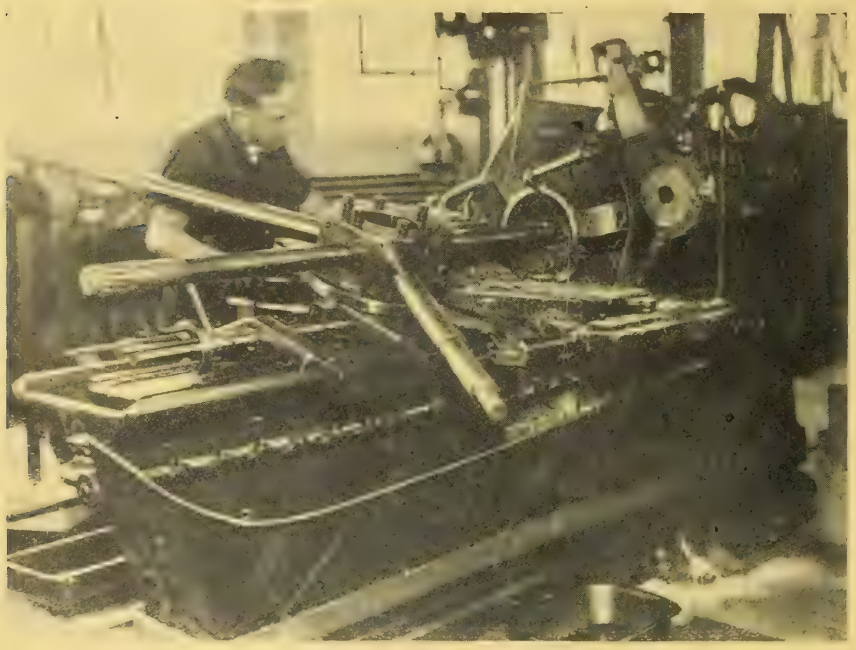
There are no combinations of figures to puzzle out, the proper positions of the levers are pictorially shown.

Brown & Sharpe Milling Machines

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

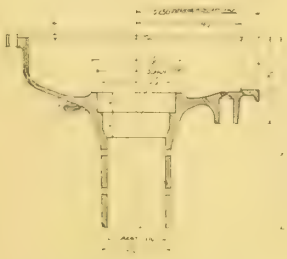
GIS

An important operation



The illustration on the left shows a Gisholt Turret Lathe performing an important operation at the Willys-Overland plant. The operation is that of boring, reaming, counter-boring and facing the rear axle housing.

When it's an important turret lathe job, with speedy production necessary, you will find the answer in Gisholt.



Operation on Rear Axle Housing, Boring, Reaming, Counterboring and Facing.

Gisholt turret lathes are made in sizes ranging from 13″ to 41″ swing, to cover a vast range of requirements.

GISHOLT MACHINE COMPANY, 1207 EAST
Builders of Standard and Automatic Boring Mills, Tool Grinders,
Eastern Sales Office: 30 Church St., New York.

Canadian Agents: The Canadian Fairbanks-
Ottawa, Toronto, Hamilton, Windsor, Winn

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

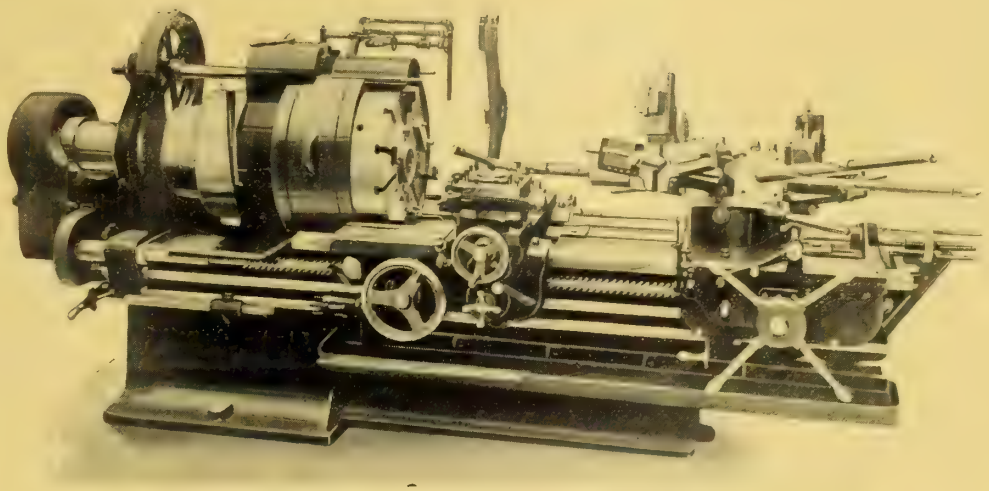
HOLT

in the Willys-Overland Plant, Toronto, Ont.

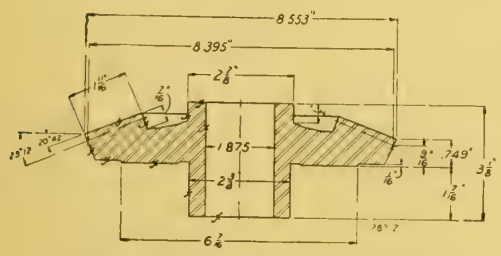
Many advantages can be gained by using this lathe and the standard chucking tools, as many pieces of work can be finished by simply changing the cutting tools to fit the dimensions of bore in part to be finished.

Below are two pieces which have been finished in the time named, on a Gisholt Turret Lathe, using only standard chucking tools. If you have similar pieces, compare your time with the time given.

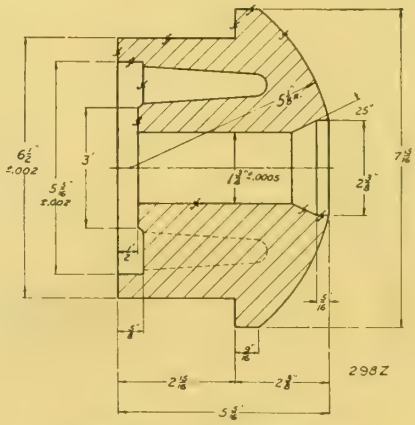
Send for our turret lathe catalog.



Standard Gisholt Turret Lathe with Standard Chucking Tools



Steel Forging, Bevel Gear
Finished as indicated, in 20 MINUTES



Cast Iron C. I. Value Part
Finished as indicated in 13 MINUTES

WASHINGTON AVE., MADISON, WIS., U. S. A.

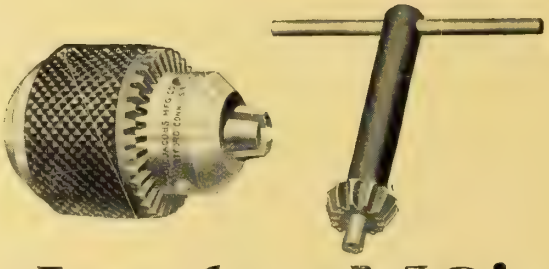
Turret Lathes, Vertical and Horizontal
Small Tools, Special Machinery, etc.
Works: Madison, Wis., Warren, Pa.

Morse Co., Ltd., St. John, Quebec, Montreal,
ipeg, Saskatoon, Calgary, Vancouver, Victoria

CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Jacobs Chucks

The calibre of an organization can best be judged by the service of its merchandise. Users of Jacobs Chucks know that to manufacture them, there must be a cohesive, contented personnel. It shows in the product.



The Jacobs Mfg. Co.
Hartford ~ Connecticut.

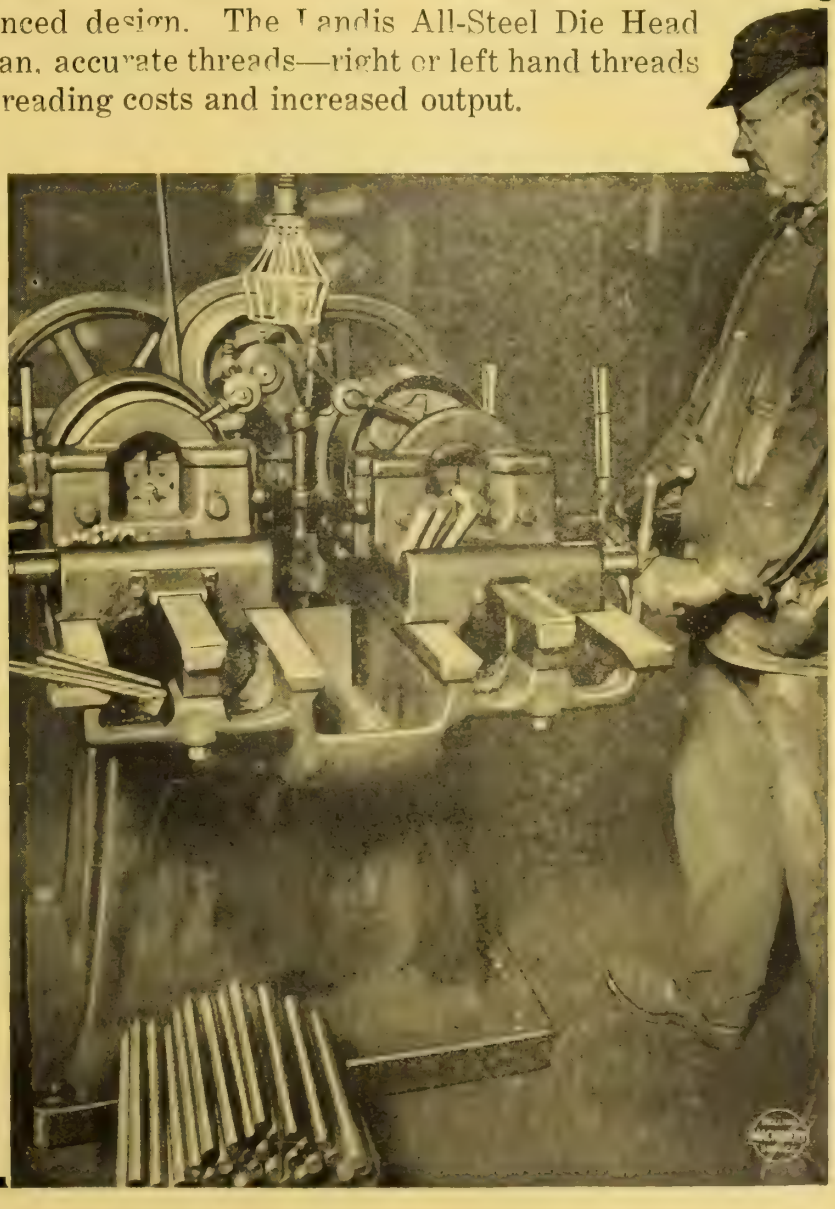
CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Landis Threading Machines Are Ideal R. R. Shop Tools

Talk thread cutting to the men at the Delaware & Hudson R. R. Shops, Colonie, N.Y., and you're pretty apt to hear about Landis advantages. Landis Machines are popular in railroad shops because of their speed, accuracy and ease of operation, and the readiness with which the Landis Die Head can be adjusted to take work of various sizes. The Landis Double Head Threading Machine, shown in the picture, is running true to form with two jobs going at the same time. On one side the operator is cutting the thread on wedge studs, 7/8" diameter, 9 pitch, 12" length. Studs are threaded 2" at one end. Threading 3/4" diameter, 16 pitch jacket studs is the second job. These are 8" long and have 3½" of thread on each end.

Landis Machines are rigid, smooth-running, durable threading machines—high production tools of advanced design. The Landis All-Steel Die Head works in any material, cuts clean, accurate threads—right or left hand threads with same chasers—reduces threading costs and increased output.





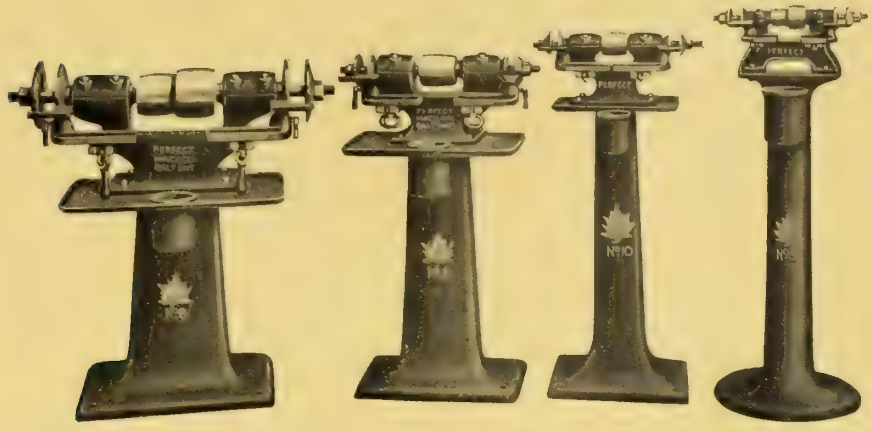
Write for latest catalogue.

Canadian Fairbanks-Morse Co.
TORONTO, ONT.
Exclusive Agents for Ontario

Landis Machine Company, Inc.
Waynesboro, Pa.
U. S. A.

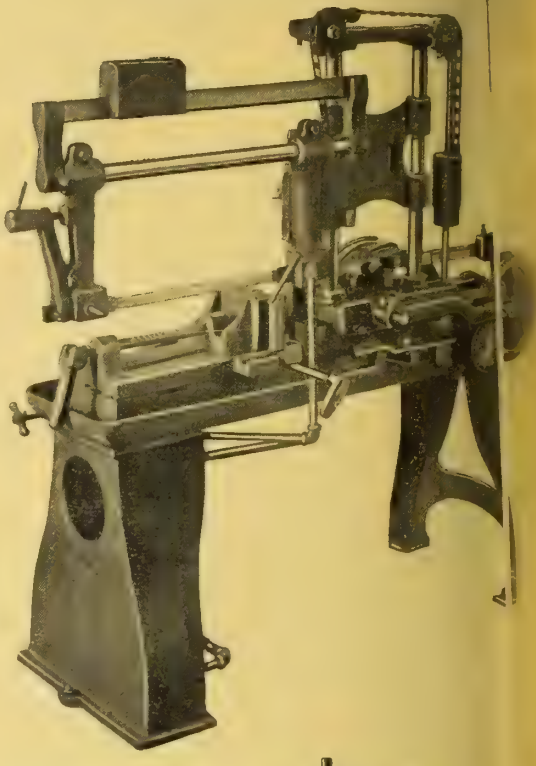
Perfect Machine Co., Limited

Galt, Ontario, Canada



The Perfect Grinders. They've stood the test; the oiling device can't go wrong: the material, workmanship and service is guaranteed. Guards and exhaust hoods furnished on request, and the price is very moderate when compared with others.

Represented by the
Leading Machinery Houses in Canada
and
in Great Britain
by
Fry's (London) Limited





No. 0
PERFECT
HACK SAW

Capacity
0″ to 5″
or more, on
request.

Speed:
120 R.P.M.

Weight:
600 lbs.

It's a Perfect
Machine.

No. 1
PERFECT
HACK SAW

Capacity:
7″ x 7″.

Speed:
120 R.P.M.

Automatic
Lift.

Adjustable
Frame

Milled Gears.

Swivel Vise.

Weight:
550 lbs.



No. 2
PERFECT HACK SAW

Capacity: 5″ x 6″
Speed: 80 R.P.M.

This is a nice
smooth-running
machine,
well worth the price.
You'll appreciate it.



No. 3
PERFECT HACK SAW

Capacity: 6″ x 6″

An ideal, all round
Machine Shop Saw,
always ready,
automatic shut-off,
adjustable arm and saw
guide.

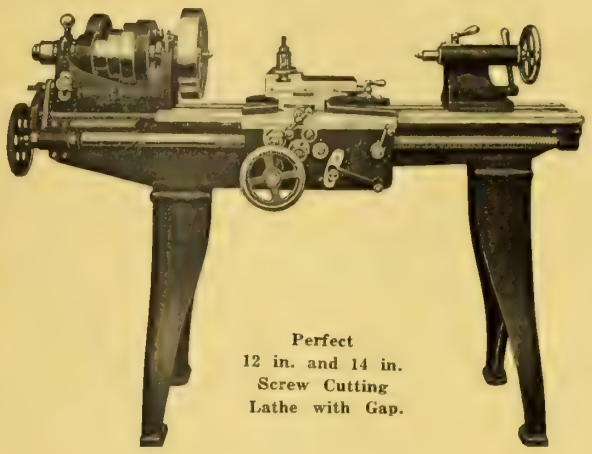
CANADIAN
FAIRBANKS-MORSE
EVERYTHING MECHANICAL

Perfect Machine Co., Limited
Galt, Ontario, Canada



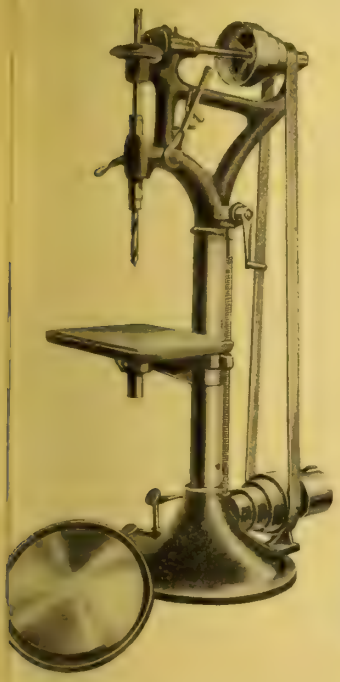
The Perfect 18-in Lathe—all that it looks to be.

For tool room or machine shop. Capable of delivering the most accurate work at a high rate of speed. A lathe of great power and rigidity. Quick change gear, double back gear, any length you want. You'll be pleased you put this tool in your shop and so will the man who runs it. Our price is right. We have a reputation for accuracy, fine workmanship and finish and our guarantee stands behind every piece of every machine we manufacture.

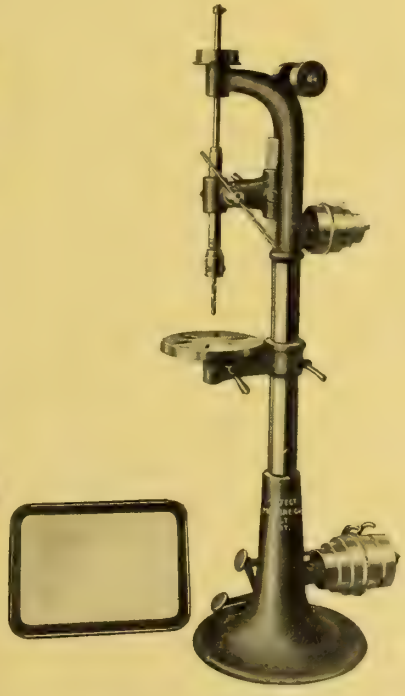


Perfect
12 in. and 14 in.
Screw Cutting
Lathe with Gap.

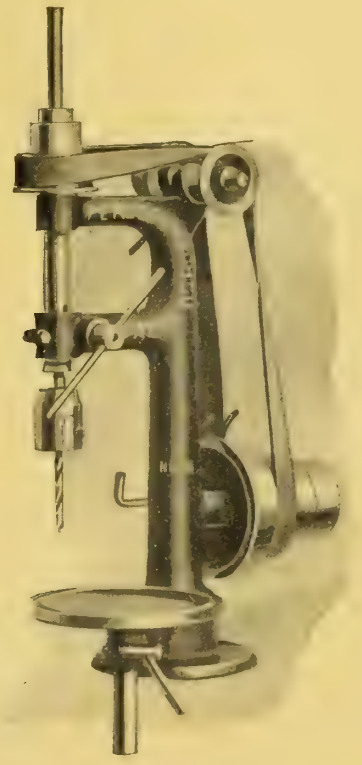
Furnished in 6′ or 8′ lengths. Just the lathe for machine shops, experimental shops, technical schools, garages, etc., nice convenient design, small consumption of power, and low price. This tool is in a class by itself. If you want a small lathe, you can't afford to overlook this machine. Ask for catalogue.



Perfect No. 19 Drill, geared 2 to 1, driven by a 2-in. belt; has lots of wer; handles a drill from 0 to 29/32. u don't realize its value until you mpare it with other 18 x 20 in. ills.



NO. 14 PERFECT
A high-class drilling machine, speed 2,000 R.P.M. Drills from 0 to ½ in.
Look right—
Act right—
Because it's built right.



NO. 18 DRILL.
Drills to centre of 10 in. Speed 2,500 R.P.M.
Purchase our machines for efficiency, accuracy, durability and ease in handling.

Every machine we manufacture is guaranteed. You take no chances when buying the product of our factory.

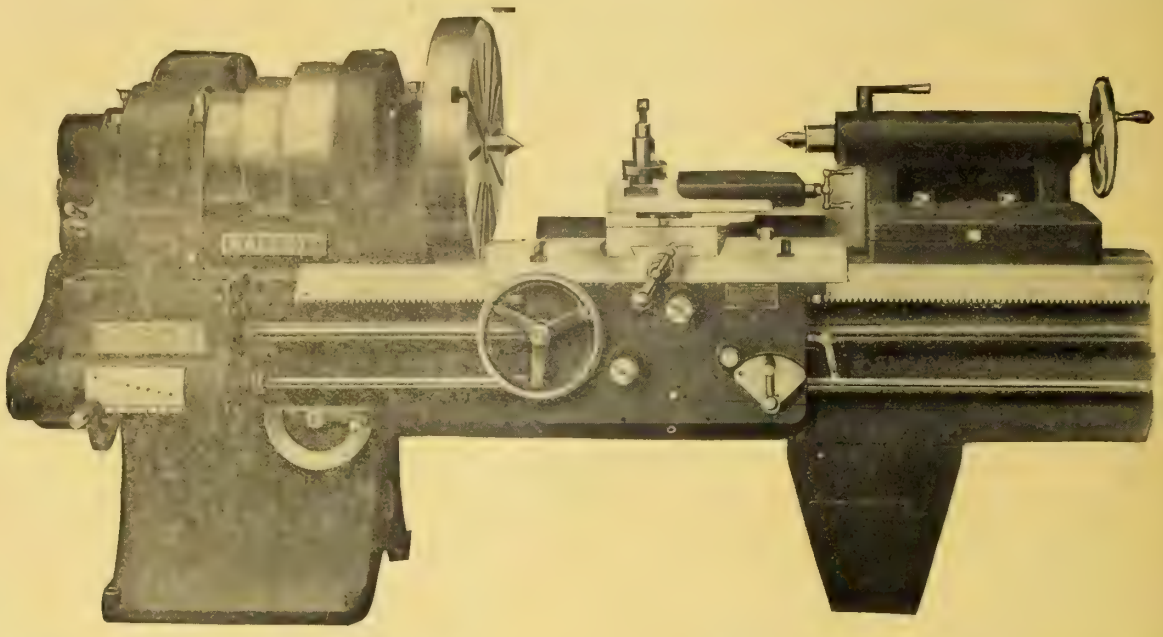
Every tool is thoroughly tested by an expert before they leave our plant.

Perfect Machine Co., Limited
Galt,
Ontario,
Canada

Representatives in Canada:
The Leading Machinery Dealers from Coast to Coast

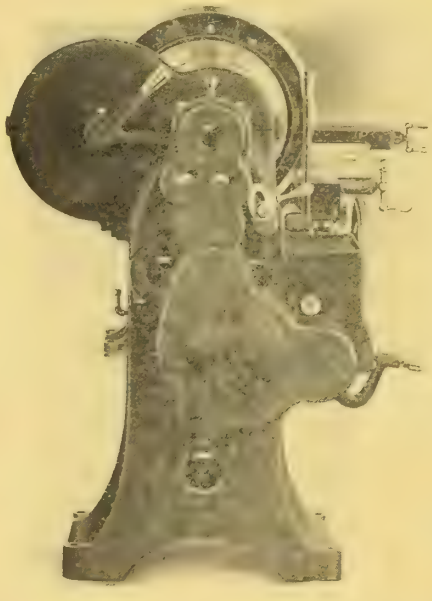
In Great Britain:
Fry's (London) Limited

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EVERYTHING MECHANICAL



Walcott Lathes—Time Tested

It did not take 38 years to establish a reputation, but you can benefit by that experience.



YOU can subject this 26″ Engine Lathe to any test and at the outcome you will find that 38 years of lathe building have enabled us to present a machine that answers the most rigid requirements.

Reinforced and strengthened at the points of stress, this machine includes such features as: double apron plate, drop forged gear in apron, rigid compound rest, back gear arm reinforced by one-piece gear guard and headstock, not a single tooth exposed, feed gears run in oil, large frontway on bed, and quick change gear box. The lead screw and feed rod are separate.

Made in 14″, 16″, 18″, 20″, 26″, and 29″ sizes.

Our experience and co-operation are entirely at your disposal. Write us.

WALCOTT LATHE COMPANY

135 Calhoun Street *Established 1881* **Jackson, Mich.**

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

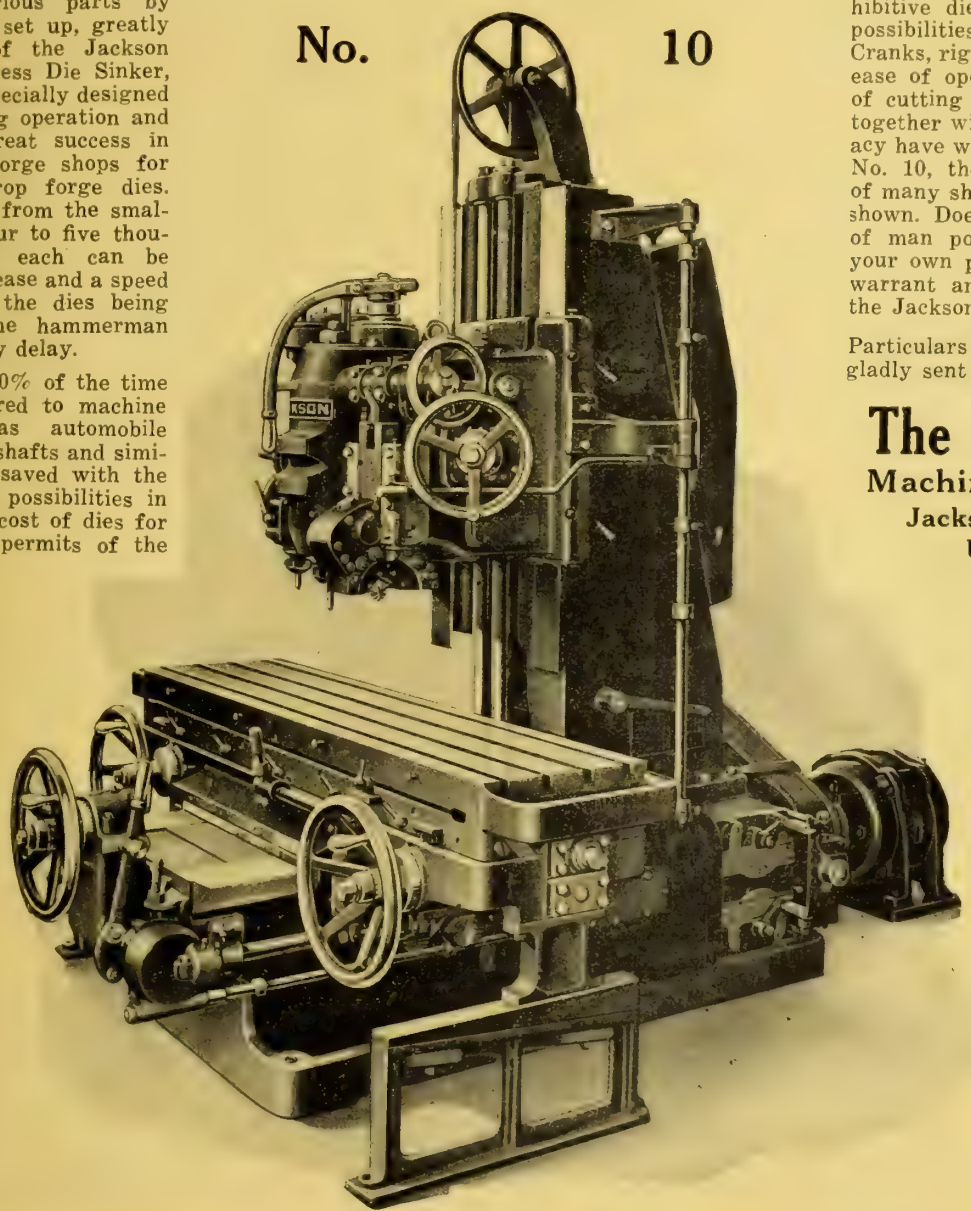
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The Jackson *Duplex Typeless* Die Sinker

WHAT are you going to do for dies with the increasing shortage of skilled labor? Man power is the most difficult problem of the essential industries to-day. Labor-saving equipment, especially such equipment as is designed to save the time of the skilled workman, not only reduces present cost of production, but enables many shops to keep up their production and even to increase it, being driven as they are by increased demands on all sides.

The usually slow and tedious process of machining die and finishing various parts by hand can be set up, greatly by the use of the Jackson Duplex Typeless Die Sinker, a machine especially designed by die sinking operation and used with great success in many drop forge shops for machining drop forge dies. Forging dies from the smallest up to four to five thousand pounds each can be handled with ease and a speed that insures the dies being ready for the hammerman with no costly delay.

From 50 to 90% of the time usually required to machine such dies as automobile cranks, hand shafts and similar pieces is saved with the Jackson. Its possibilities in reducing the cost of dies for small pieces permits of the production of forging in the wider field where before prohibitive die cost limited the possibilities of forge pieces. Cranks, rigidity, accessibility, ease of operation and range of cutting speeds and feeds, together with absolute accuracy have won for the Jackson No. 10, the recommendation of many shops who had to be shown. Does not the shortage of man power as it affects your own particular problem warrant an investigation of the Jackson No. 10?



Particulars and full data gladly sent on request.

The Jackson
Machine Tool Co.
Jackson, Mich.
U.S.A.

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WALCOTT

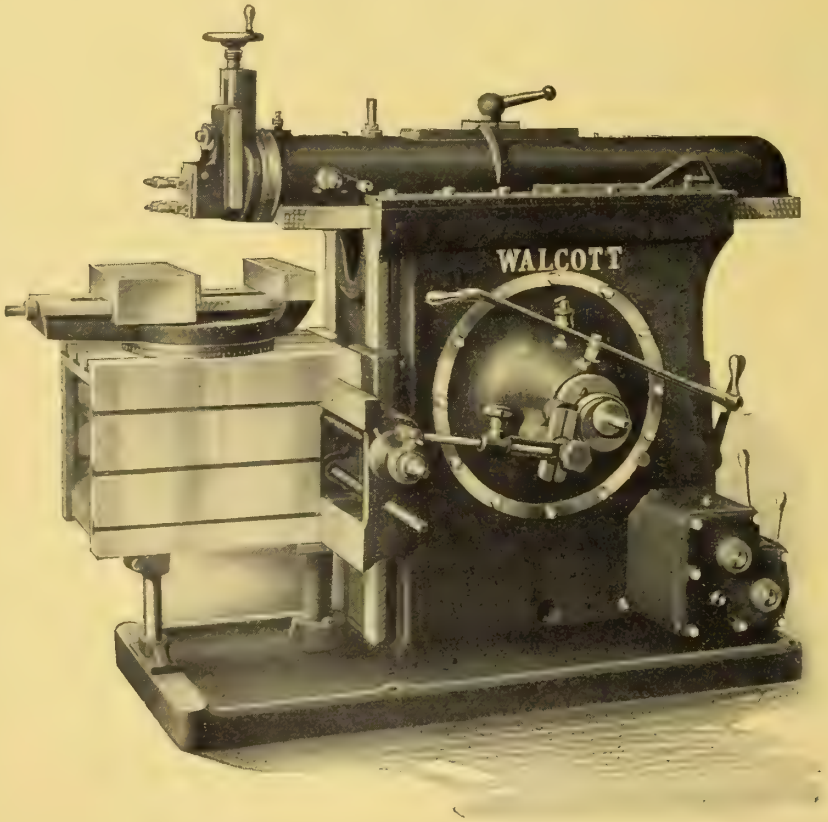
Single Pulley and Motor Drive Crank Shaper

General Description

Power is transmitted through a friction clutch. All gears and shafts are hardened and ground and run in oil. Four changes of speed are obtained with positive clutches, and these are multiplied by sliding gear in column of machine, giving eight ram speeds in geometrical progression.

All levers are conveniently located on the working side of machine, the control being within easy reach of the operator. A brake spool is provided in connection with friction clutch, which enables ram to be stopped in exact position desired.

All gears in machine are of helical design, course pitch and wide face, and are cut on a machine especially designed for that purpose. These gears insure a quiet running machine, with a steady, powerful stroke, and an absence of any chatter or roughness.



Power feed to tool head may be furnished if desired, and each machine is regularly equipped with vise, table support and all necessary wrenches.

Built in three sizes 16-in., 20-in. and 24-in. Cone drive double back gear and motor drive thru gear box.

Write for complete details, prices, etc.

THE JACKSON SHAPER COMPANY

Jackson, Mich.

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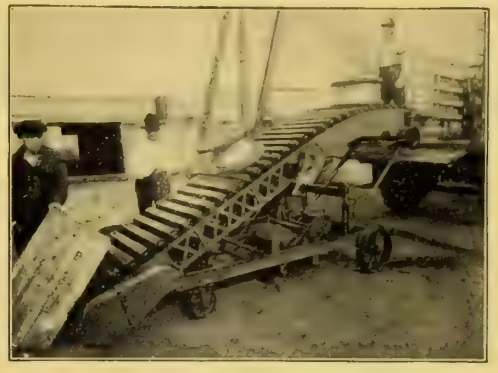


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INCREASE your PROFITS
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"BROWN-PORTABLE"
Materials-Handling Machines

Inclined Portable Elevators
Vertical Tiering Machines
Car, Truck and Boat Loaders and Unloaders
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Floor to Floor Elevators
Handling machines for every purpose, for packed or loose commodities, for the small handler and the large handler

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Handled in Canada by
Canadian Fairbanks-Morse Co.
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BROWN PORTABLE
CONVEYING MACHINERY CO.
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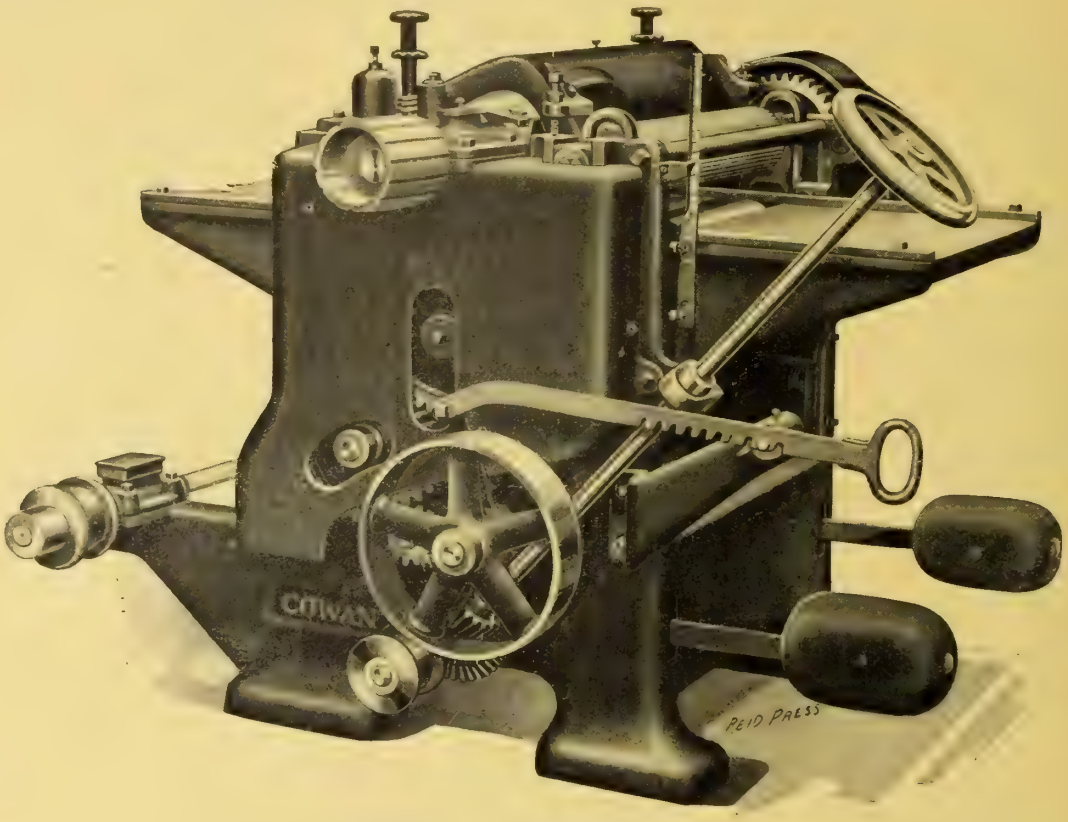
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Cowan Woodworking Machinery

FOR

Pattern and Carpenter Shops; Planing Mills; Sash, Door and Furniture Factories; Shipbuilding Plants; Carriage and Wagon Shops, etc., etc.



SURFACE PLANER 141

A Substantial Medium Weight Machine.
Capacity 20″, 24″ or 26″ wide x 8″ thick.

A Favorite Pattern, Carpenter and General Wood Shop Machine.

—We Make—

PLANERS	MORTISERS	BAND SAWS	SANDERS
MOULDERS	BORERS	SCROLL SAWS	GRINDERS
SHAPERS	LATHES	CROSS CUT SAWS	CLAMPS
TENONERS	RESAWS	RIP SAWS	VENEER PRESSES

Cowan & Company of Galt Limited

Galt, Ontario

For Sale by The Canadian Fairbanks-Morse Co., Limited

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DURABLA

TRADE MARK REGISTERED

STRENGTH — GOODNESS — QUALITY

Performance Facts of Durabla Gasket Material

Tight joints are made and maintained by DURABLA under the following severe services and conditions:

Steam:	275-300 lbs. pressure; 275°-300° superheat.
Oil:	Pressure still joint re-made over 160 times.
Gasoline:	Cylinder heads of gasoline engines and pumps.
Acids:	All acids that can be carried in pipe lines.
Water:	Equally satisfactory with temperature of 40° or 210° F., at any pressure.
Ammonia:	Both absorption and compression systems of refrigeration.
Air:	Air lines and cylinder heads of compressors—all types.

One Standard material for all gasket work—Sold on a Service Basis

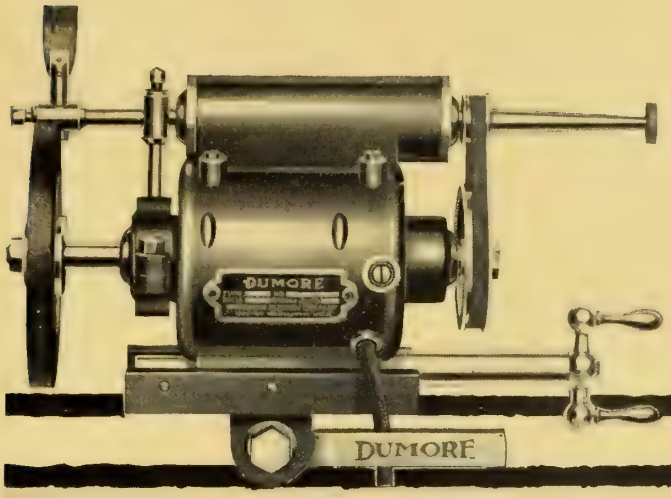
DURABLA is sold in sheet or gasket form and the trade mark is stamped all over the material.

Manufactured by
DURABLA MANUFACTURING CO., NEW YORK

Sole Canadian Distributors: The Canadian Fairbanks-Morse Company, Limited

DURABLA

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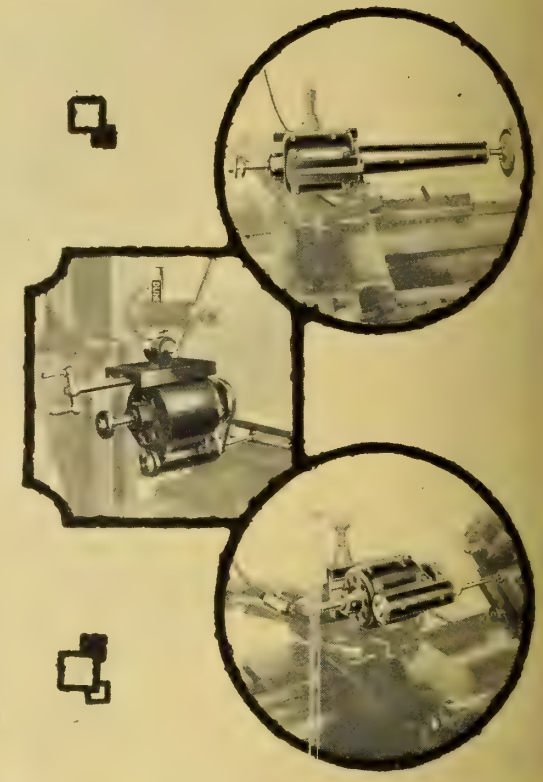
Just What You Need For Grinding Your Hardened Tools

Mechanics everywhere specify the DUMORE when buying grinding equipment because of the tool's reputation for service and satisfaction. It easily handles all kinds of work—longitudinal, cylindrical or internal.

Because each armature is dynamically balanced, the high speeds of the DUMORE, ranging from 10,000 to 50,000 R.P.M., are found not only practical, but indispensable to correct cutting speeds for small emery wheels. Jobs are consequently free from danger from chatter, taper or bell mouth.

Let us demonstrate what a big saving you can realize with a DUMORE Grinder in your shops.

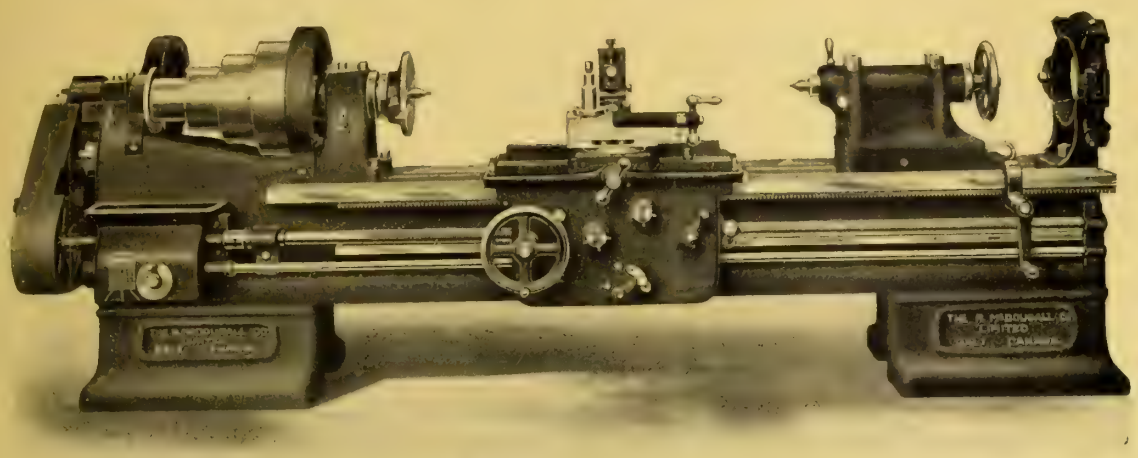
Wisconsin Electric Co.
2919-16th Street, Racine, Wis., U.S.A.



DUMORE HIGH SPEED GRINDERS

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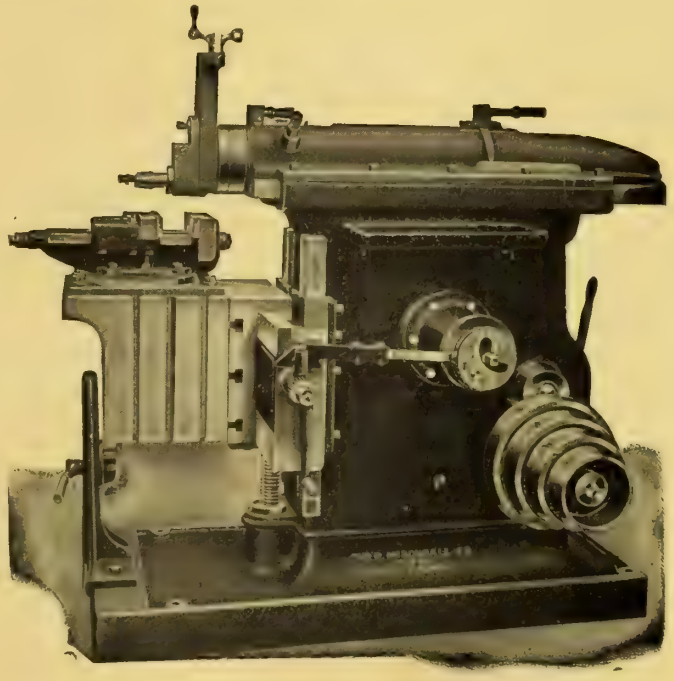
Machine Tools that bear the "earmarks" of expert workmanship



McDOUGALL GAP LATHES

Every feature is proof of our aim to produce a machine of unusual merit.

An examination of the construction will reveal features that make for increased production, ease of operation and accuracy.



McDOUGALL SHAPERS

Combine the best features of all machines which have hitherto been placed upon the market, and nothing has been included, except those points which experience has shown to be essential.

Our circulars, containing complete specifications and descriptions, are ready. May we send one?

THE R. McDOUGALL CO., LIMITED

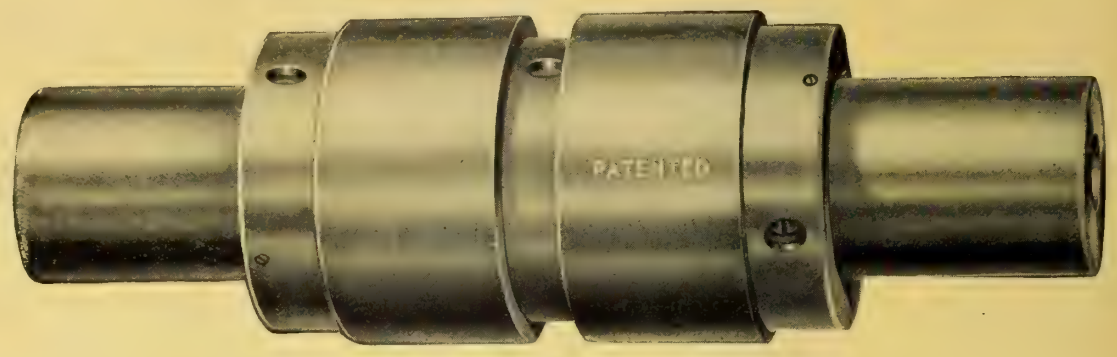
GALT, ONTARIO, CANADA

CANADIAN FAIRBANKS MORSE CO., LIMITED, SALES AGENTS

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Johnson Friction Clutches

Wherever Power-Driven Machinery Is Used



In your plant, as in every other, there are many light drives where a friction clutch could be used to advantage—if the right clutch could be found. That is where we can help you. No matter what your requirements are, if we haven't a clutch that is just what you want, we can make one. Johnson Clutches are universally serviceable.

That's why so many of the leading machine builders select Johnson Clutches in preference to all others. They find in the Johnson design a compactness and flexibility that makes each installation exactly correct. They find in Johnson service dependability that is hard to equal.

Do you know all the facts about Johnson Clutches? Our new booklet,

"Clutches as Applied to Machine Building"

gives a comprehensive view of their possibilities. We will be pleased to send you a copy.

Write for our Yellow Catalog.

The Carlyle Johnson Machine Co.

Manchester, Conn.

Canadian Representatives :

The Canadian Fairbanks-Morse Co., Limited

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COLUMBIAN
Sledge-Tested VISES





Series 500



Series 600



Series 300



Series 400

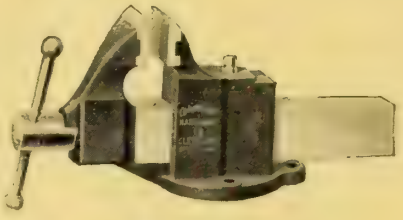
The Only Malleable Iron Vises In The World

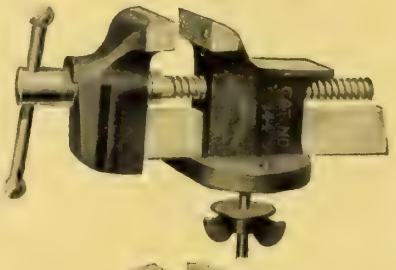
BESIDES being the only line of malleable iron vises in the world Columbian Sledge-Tested Vises include practically every type of metal and wood-working vise that is made.

Columbian Sledge-Tested Vises are twice as strong as cast iron vises—they will not chip, crack or break. Tool-steel separately-tempered removable jaw faces, cold-rolled steel handles with forged ball ends, self-aligning screws, and other improvements in design make Columbian Sledge-Tested Vises the easiest-working, longest-lived vises you can buy.

Send for our new illustrated booklet "Actually Sledge-Tested" and a miniature movie of the sledge-test. These are free if you send your name and the name of your firm.









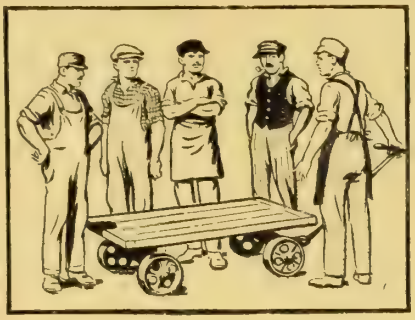
Series 200

THE COLUMBIAN HARDWARE CO., CLEVELAND, U. S. A.

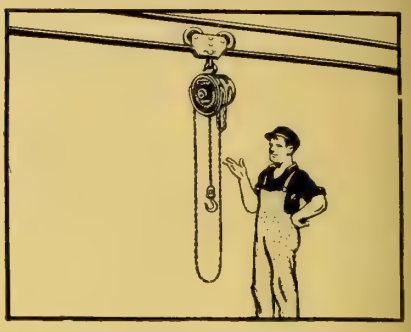
World's Largest Makers of Vises and Anvils

CANADIAN FAIRBANKS-MORSE CO., LTD., DISTRIBUTORS

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Five Men and a Hand Truck.



One Man and a Yale Spur-Geared Chain Hoist on an I-Beam Trolley.

And the one man with the Yale equipment will perform the same work in the Safest Way, taking up less working space, and do it quicker.

For handling the product, crude or finished, for serving machines, loading and unloading trucks and cars, for handling forgings, castings, anything that has to be lifted and moved, Yale Spur-Geared Blocks on I-beam trolleys multiply men and machine power.

'From Hook-to-Hook-a-Line-of-Steel'

The new Yale 19D catalog shows you many ways to save money and increase production in your plant by using Yale Chain Blocks and Electric Hoists.

Let us send you your copy.

For a factory locking equipment use a Yale Master-Key System.



THE YALE & TOWNE MFG. CO.

Makers of the Yale Locks

9 East 40th Street New York City

TRADE YALE MARK



The Experienced Engineer Says:

Voorhees Rub-Steel Valves

Give Best Results—Last Longest

BECAUSE--

There's that Solid Steel Core
Reversible RUBBER Seating Surfaces
Thinness Sacrifices No Strength
Highest Pressures Supported
Intense Heats Easily Overcome
Allow Removal of Seat Bridgings
A True Seating AT ALL TIMES
Just Four Grades Cover the Field
Require No Special Equipment

Ask for Booklet

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Exclusive Canadian Agents for

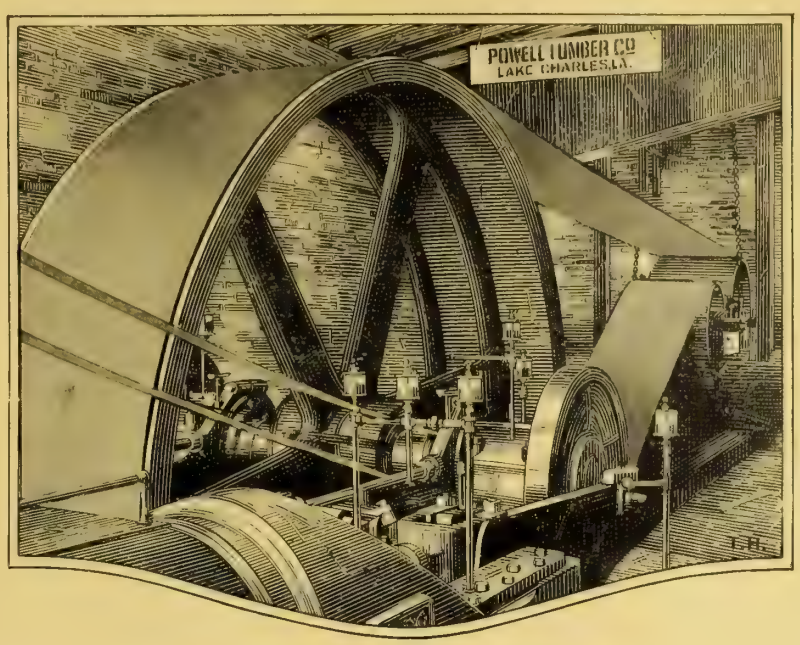
Voorhees Rubber Mfg. Co., Jersey City, N.J.



Canadian
Fairbanks-Morse
Trade Mark

A Strong Right Hand with a Scale Test Weight. Symbolizing a well-knit human organization upholding a well-balanced mechanical business.

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Why Not Standardized Belting?

You buy standardized tools, standardized machinery, and a hundred other standardized things instead of having them made to order. It is safer, easier and more economical.

Why not buy standardized belting?

You will find that the requirements of power transmission fall into about a dozen sharply defined classes.

Standardized Belting offers you a standard belt exactly suited to each one of these classes. You select the one that is fitted to the needs of your own work.

Graton & Knight Standard Brands are all standardized on the basis of **the work to be done.**

We have specified belting for many of the best belted plants in Canada. The ledgers tell the story of maximum service at smallest possible cost.

The G & K Standardized Series Leather Belt shown above has been running since Dec. 1915, at a cost to date of 1-1/3c per horse power per week with several years' service to come.

Let us help you select your belting on the basis of **the work to be done.** That's the way to make belting dollars go farthest.

Canadian Graton & Knight Limited

84 St. Antoine Street
Montreal, Canada

MADE IN CANADA

Representatives: THE CANADIAN FAIRBANKANKS-MORSE CO., LIMITED, St. John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Vancouver, Windsor, Winnipeg, Victoria

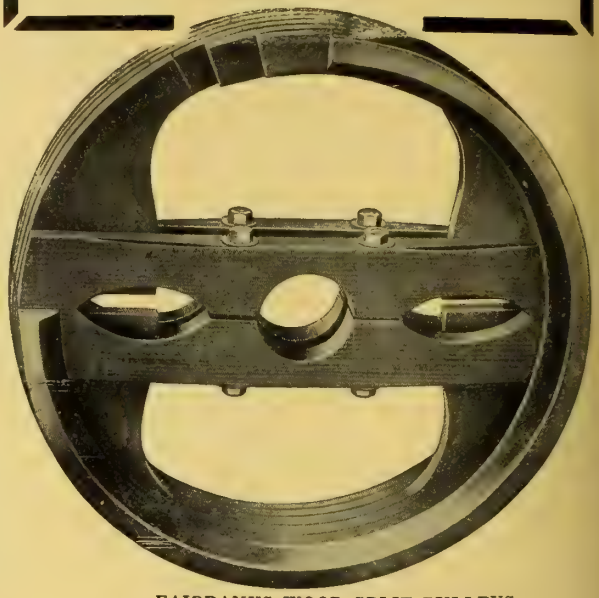
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TRADE YALE MARK



THE YALE SPUR-GEARED BLOCK

FAIRBANKS



FAIRBANKS WOOD SPLIT PULLEYS



FAIRBANKS-MORSE FACTORY EQUIPMENT

Yale Hoists

The Yale Spur-geared Blocks Their Universal Application.

The adaptability of the Yale Spur-geared block is proven by the general use for all classes of hoisting under all conditions of service.

It is widely used under the trying atmospheric conditions met with in ice manufacturing plants; and in foundries where extreme heat is ever present.

The universal adaptability of the Yale Spur-geared block is the result of a half century of intensive study and application and test—reflected in scientific design, highest grade materials and sound construction.

Each part—its shape, size and material—is based on thorough study and understanding; to add a part or take a part away would spoil a perfect block.

Put your hoisting problems up to us.

Transmission

Transmission of Power or Materials can best be done on Fairbanks-Morse Equipment.

Fairbanks Power Transmission includes everything from the Engine to the Cutting Tool, Belting, Shaft, Pulleys, Hangers, Clutches, Machine Tools.

Fairbanks Material Transmission includes nearly every device for handling coal and ashes to the finished product—Elevators, Conveyors, Trucks, Travelling Cranes, Hoists, Portable Elevators, etc.

Put your transmission problem up to our experts. They will gladly help you from their long experience in solving many similar problems.

Everything Mechanical

THE CANADIAN FAIRBANKS-MORSE CO.
LIMITED

"Canada's Departmental House for Mechanical Goods"

HALIFAX ST. JOHN QUEBEC MONTREAL OTTAWA TORONTO
HAMILTON WINDSOR WINNIPEG SASKATOON CALGARY
VANCOUVER VICTORIA

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII. No. 2 January 8, 1920

1920 Will Be What You Make It

LET us start out with the idea of making 1920 a better year than 1919. From many angles the year just closed has been a mistake. Industrially it has been a nightmare.

Following the war we looked for more humanity in industry and we have looked in vain. The details of the peace treaty had not been signed when Capital and Labor were ready in Canada to stage a contest that was as bitter as it was unnecessary.

The man in the shop is human. Don't use him as a bit of material. He will respond to an incentive, but he will not be driven.

The man in the shop does not like to feel that the only notice taken of him is when his metal tag shows him late or absent.

Now, in all seriousness get away from the idea that you can "run your men" on the card index system.

Remember, each of those metal numbers represents a man—in many cases a married man. Follow along. It represents a home, a family—it represents disappointment or joy, hopes and aspirations along sane and proper lines, or else it represents a discontented mind, ripe for the teaching of the extremist and tilled for the seed of revolution.

By all means have your shop efficient, but take care not to efficiency-expert all the ambition and genius out of your men.

The shop that is efficiency-experted to death is hanging out a streamer calling upon the labor leader to come along and do his worst.

Don't say you have so many men in your plant that you don't know them personally. The man on the machine or on the bench likes to know the man or men he is working for. You'll be surprised how many of them you can know if you set seriously to the task.

There are manufacturers who have their happiest moments putting across plans to make life worth living for the men who are turning out the work for them.

There have been manufacturers whose death has been the signal for an open celebration among the men at the works.

These are absolute facts, and you can put yourself largely in the class of your own choosing.

The man in the shop should watch out for the agitator. He should watch out for the man who makes money out of strikes.

Strike pay at best is a joke when stacked up against the cost of living at the present time.

If you have a grievance, make sure it's a real one. If it is, get busy and take it up with the proper parties.

If your supposed grievance is only a grouch, forget it. If you keep on nursing the thing it will spoil you.

If you have a good place to work, help to keep it in that state. Don't make yourself the excuse for calling in the efficiency engineer.

The strike should be the last resort. There have been times when men could not honorably take any other course. But don't let the agitator do your thinking for you.

Grow a big crop of common-sense in 1920, both in the office and the shop. Rehashing old scores is the pastime of fools.

Keep the office close to the shop, not in actual feet and yards, but in sincerity of purpose, frankness of dealing and honesty of endeavor.

There are greater things in the world than piling up dividends, and more worthy objects than earning the mercenary plaudits of shareholders.

Put yourself—manager and mechanic—in the other fellow's position now and then. It broadens the vision and irons out a whole lot of picayune conceptions.

Give 1920 a better chance than you gave 1919. A little give-and-take is good for both ends of the business. No one side to a controversy ever had a monopoly of all the good points.

1919 Was a Period of *Growth* and *Expansion*

Reports From Industrial Centres Tell a Story of Progress and Growth—Old Plants Enlarging and New Ones Entering the Field for the First Time

THE year just closed was not the blue ruin period of time that was supposed to follow on the heels of the armistice. Canadian industries had a busy time. They were building extensions and taking on more men, buying equipment and looking about for improved methods for speeding up operations in all branches.

The markets of the world were depleted—sadly so. There was a great chance to sell almost anything that the shops could or would turn out. Strikes and labor troubles hurt business early in the season, and shortage of material since then has not helped matters. But the industrial centres of the Dominion have gone ahead in a remarkable way, as the following resume will show. CANADIAN MACHINERY is indebted largely to the secretaries of Boards of Trade and Chambers of Commerce for the information on these pages:

Growing in Spite of Strike

WINNIPEG.—Building in Winnipeg was hampered to a great extent on account of the general strike, covering a period of nearly seven weeks. Many contemplated additions to industrial plants have, as a result, been held over until the beginning of 1920. Indications are that the new year will see a resumption of building in this city on a very large scale.

Following are completed or under way:

Western Wheel and Foundry Co., plant covering 15 acres in St. Boniface, across the river from Winnipeg, $75,000; City Light and Power Dept., show-room, $42,000; R. S. Robinson, warehouse, $60,000; Allen Theatre, $200,000; Reliance Ink Co, warehouse, $8,000; J. H. Parkhill, bedding factory, $49,000; Alaska Bedding Co., factory additions, $26,800; Brett Mfg. Co., factory, $20,000; Chevrolet Motor Co., sales-rooms, $23,000; Bemis Bag Co., warehouse add., $25,000; Manitoba Government Telephones, additions, $51,200; Quinton Dye Works, additions, $30,000; Manitoba Creamery, additions, $10,000; Northland Knitting Co., factory addition, $24,000; J. K. L. Ross, garage, $50,000; Weidman Bros., factory addition, $9,000; Ames-Holden-McCready, warehouse, $60,000; University of Manitoba, institution, $85,000; Canadian Fairbanks Morse Co., warehouse, $10,000; Rumley Mfg. Co., warehouse addition, $40,000; V. Rubin, factory, $7,000; Twin City Separator Co., warehouse, $21,000.

New bank branches:—Bank of Commerce, $68,000; Merchants Bank, $29,500; Union Bank of Canada, $37,000.

School additions, $142,000.

Everything points to a banner year for residential building in the City of Winnipeg in 1920. Applications for loans under Winnipeg's Housing Scheme are being received at the rate of five a day. A permit has just been issued for another new theatre, costing nearly half a million dollars. Marshall Wells, wholesale hardware company, are erecting a warehouse on the east side of the Red River, which will cost $175,000.

Five New Ones in Guelph

GUELPH.—Five new industries have commenced operations in Guelph:

(1) The Shinn Mfg. Co., automobile wire and lightning protection. This is a branch of an American concern.

(2) The Northern Rubber Co.—A new reinforced concrete building, four stories in height. Cost of building, $150,000. Total investment, $500,000. Number of employees when completed and in operation, 500. Will make rubber footwear.

(3) Lang Mfg. Co., manufacturers of special machinery and garden seats. Purchased an existing building and enlarged it, $20,000.

(4) Live Wire Co., manufacturers of insulated rubber wire. (Branch of an American Co.), $100,000.

(5) Flax Spinners, Ltd., linen, yarns and threads, $50,000.

The following firms have erected additions:

Partridge Rubber Co., $150,000 expenditure, four stories.

Guelph Carpet and Worsted Spinning Mills, a $400,000 new addition, including a new reinforced concrete four-storey building, and additions to the existing plant.

The Sterling Rubber Co., a new addition, being the first of several units planned, cost $15,000.

Taylor-Forbes Co., additions to the foundries, $20,000.

Dominion Linens, Ltd., $20,000 addition.

International Malleable Iron Co., new pipe-fitting works, total investment, $100,000.

Gilson Mfg. Co., new addition, $15,000.

White Sewing Machine Co., new addition, $20,000.

Sherer-Gillett Co., new building and additions, $25,000.

The building operations at Guelph at the present time are abnormally active, due to the above-named additions and improvements, and also to the big housing expansion now going on. A new school, $80,000; skating rink, $50,000; and several very large additions to the Ontario Agricultural College are now being carried to completion.

Stratford Has Busy Year

STRATFORD.—The close of the year 1919 finds Stratford in a very healthy condition industrially. Stratford is pre-eminently a wood-working centre, and our furniture factories are all taxed to capacity in an effort to meet the unprecedented demand for their output.

The phonograph division of the McLagan Furniture Company, Limited, has assumed large proportions and even larger growth is looked for during the coming year. The Kindel Bed Company, Limited, who moved to Stratford from Toronto in 1916, are erecting an addition 75 ft. x 185 ft., three storeys and basement, this addition being necessitated by the rapid increase in their business since moving here.

Stratford has acquired two splendid industries this fall. The first is the Canadian Edison Electric Appliance Company, Limited, who have purchased the Mooney plant with 120,000 feet of floor space. They will manufacture electric household appliances of all kinds, and it is expected that this industry will develop into one of the most important ones in the city.

The Grosch Felt Shoe Company, Limited, of Milverton, have purchased this week the Stratford Desk Company plant with 25,000 feet of floor space, and will begin the manufacture of felt shoes early in the year. Their business has been making such strides that the Milverton plant could no longer supply the demand, and it is expected that both plants will be operated to capacity.

Practically all other lines in the city have all the business on hand they can well look after, and the year has been a prosperous one for our industries.

Established Firms Expanding

ST. CATHARINES.—The industrial growth of the city of St. Catharines and surrounding district during the past year has been, considering the conditions that have

existed, very encouraging. Two new industries have been located here, and while operations are being confined to a few lines at present, it is the intention of these concerns to gradually add other lines to their product, and there is every prospect that they will very rapidly develop into industries of considerable magnitude.

The principal industrial development, however, that has taken place in this district during the past year, is the large increase in the capacity of the majority of the well-established industries. One of the largest concerns has added many new lines to their product which will practically double their capacity. Another company has purchased a site for the erection of a new factory, which will enable them to triple their output, while several others are building additions to their plants in order to take care of the increased demand in their different lines.

In so far as the industrial future of St. Catharines is concerned, with its many natural advantages, such as an abundance of cheap electric power, rail and water transportation facilities, high-grade labor market, close proximity to large centres, etc., together with the added advantages of being located adjacent to the New Welland Ship Canal now under construction, and within a few miles of the 300,000 h.p. electrical development at Queenston, there is every prospect that this city will eventually become the centre of one of the largest industrial sections in the Dominion.

Niagara Falls Gets Big One

NIAGARA FALLS.—The industrial activities in the city as suggested by new factories are:

A new brick building for the Niagara Wire Weaving Co., Ltd. The building is well along towards completion and will represent an investment of $220,000. They will employ about 150 hands, and the product will be wire-weaving machinery and wire cloth, to be used largely in pulp and paper mills.

The Carbon Alloy Steel Co. have purchased a site and broken ground for a large factory adjacent to our city. They will soon be in a position to give more particulars as to proposed output, etc.

The American Can Company have enlarged their plant by taking over the premises formerly occupied by the Thompson and Norris Co.

Prospects for American manufacturers locating branches here in the near future are bright, being attracted by the unique power situation. Located as we are at the very source of power development, we are able to furnish comparatively cheap energy and avoid all transmission difficulties.

New Industries at Belleville

BELLEVILLE.—Distinct and material progress has been made during 1919, not merely in the addition to our population, but also by the establishment of several new industries, such as:

The Judge Jones Milling Company, Limited (Dominion charter).

The Elliott Woodworking Machinery Company.

The Teco Manufacturing Company (Pancake Flour, etc.)

The Weed Harvester Company, Limited.

W. A. Wood Valve Company.

The Peaso Company, Limited.

The building permits have, in spite of the excessive price of materials and labor, been very satisfactory, and the council have adopted the Housing Scheme. The new Albert College will break ground next year. There is also to be a new Public School, and the new main building of the Ontario School for the Deaf has actually been commenced. The C.P.R. freight sheds are in course of construction. Everything points to a prosperous and progressive 1920.

Peterborough's New Industries

PETERBOROUGH.—The new industries in Peterborough this year include:—

The Western Clock Co., of La Salle, Ill., makers of the well-known Westclox line of clocks and watches. This company has purchased a building on George Street South, 80 x 33 feet, three storeys and basement, which it will occupy this month. In the meantime they are occupying space in the Barrie building and are building up their organization, and expect to have 200 hands employed within a year.

The Albion Knitting Co. leased, with an option to purchase, a building on Park street, 35 x 55 feet, two storeys, and are making good progress in building up a staff and business.

The Bon Marche Manufacturing Co. was organized and leased premises on Simcoe street, and is engaged in the manufacture of whitewear.

The Nashua Gummed & Coated Paper Co., of Nashua, N.H., have leased the premises on Aylmer street which had been used by the Renfrew Manufacturing Co. for a munition factory. There is in the building 40,000 square feet of factory space, besides a warehouse, 348 x 50 feet, and an office building, 30 x 48 feet, two storeys. Improvements are being made in the building and the company expects to begin manufacturing operations before the end of the year.

The Canadian Aladdin Co. has arranged with the city for a site of about six acres on the Monaghan Road, and will erect a building 100 x 200 feet, and invest $70,000 in building and plant for the manufacture of their ready-cut houses.

Alexander Stewart has put up two buildings on Gladstone avenue, 40 x 20 feet and 30 x 15 feet, for a wool stock factory.

Several of the established factories have enlarged their space.

The Canadian Woollens, Limited, are erecting a factory building at their Bonner-Worth plant on McDonnell street, 114 x 56 feet, three storeys and basement, at a cost of $40,000.

At their Auburn factory on Auburn street, Canadian Woollens, Ltd., are putting up an addition to provide additional weaving space, 140 x 70, one storey and basement, at a cost of $35,000.

On McDonnell street, also, Canadian Woollens, Ltd., are erecting an office building, 66 ft. 4 in. x 37 ft. 6 in., two storeys and basement, which will cost $10,000.

The Alfred McDonald Lumber Co. are erecting a building, 50 x 50 feet, on Rink street for a box factory, to enable them to increase their output in this line, as well as to give more space in their planing mill and sash and door factory.

The Canadian Chicle Co. purchased a building, 115 x 40 feet, on Rink street and are enlarging it into a three-storey building and otherwise improving it for their growing business at a cost of $8,000 to $10,000.

The DeLaval Co. put up a storage shed, 112 x 32 feet, and Turner Bros. a similar building, 40 ft. x 27 ft. 6 in.

The Peterborough Cereal Co. completed ten concrete elevators and the enlargement of their cereal mill, by adding a storey on the mill and additions, begun last year.

Kitchener Keeps on Growing

KITCHENER.—The year 1919 has been one of very marked industrial activity and expansion in Kitchener. Quite the most important accession to new industries is the Ames-Holden-McCready System, who are erecting a million dollar automobile tire plant here and expect to be turning out tires early in the new year. The A.-H.-M. people are also building a large factory for manufacture of felt footwear and commercial felts. It is expected to be turning out finished product by

February 1 next. This felt factory and equipment is costing about $150,000.

The Dominion Tire Company has met with uninterrupted success and have brought their daily output of tires from 1,200 to 2,100. The factory is being enlarged to double its present capacity and by early spring the output will be again doubled. The company is spending about half a million dollars on expansion.

A new industry with great possibilities that has come to Kitchener this year is the Four Wheel Drive Auto Company, starting with a capitalization of $200,000. This is the Canadian branch of the parent company at Clintonville, Wis., and the Canadian plant will supply not only the home demand for these trucks, but, as well, look after the foreign demand. A factory site has been located beside the railway and building operations are well advanced.

The Kitchener Buttons, Ltd., were obliged to add four stories, 40 ft. x 50 ft., to their already large factory, spending about $50,000 on enlargements. The Lang Tanning Company, which, near the end of last year, embarked upon the manufacture of sole leather, in addition to their big harness leather industry, have steadily expanded this year. Some large additions have been made to their immense plant and but for the difficulty in obtaining materials and shortage of labor, much more would have been done. Their expenditures on new buildings and equipment this year will approximate $35,000.

The Pollock Manufacturing Company, makers of phonograprs and accessories, was recently amalgamated with the General Phonograph Corporation of Canada, Ltd., and considerable expansion is already indicated. An addition to their factory, 65 ft. by 100 ft., is nearing completion.

The Greb Shoe Company, Ltd., makers of men's shoes, have removed to new premises, giving them more than double former floor space, and they now occupy a splendidly built factory, 56 ft. by 100 ft., three storeys and basement. When in full running order this company's present daily output of 300 pairs will be increased to a minimum of 1,000 pairs.

The Merchants Rubber Company felt the effects of increased activity and added a four-storey and basement building to their plant, giving them some $5,000 square feet of additional floor space. Approximately $60,000 was expended on building and equipment.

A. & C. Boehmer, paper box makers, are building a wing to their factory, which will cost about $10,000.

The Mitchell Button Company, organized only four years ago, found it necessary to secure larger quarters last fall and now have a modern and efficient plant, working to capacity. They spent some $15,000 on expansions.

Among the new industries which have become established in the past few months are Watson & Kilby, makers of child's bootees, and the Kitchener Envelope Company, Ltd., the latter located in the premises vacated by the Mitchell Buttons.

The John Forsyth Company, manufacturers of fine shirts and underwear, have opened an additional facory in the adjoining town of Waterloo.

Baetz Brothers Furniture Company have taken two floors of the premises formerly occupied by Star Whitewear Company, and are engaging in the manufacture of furniture specialties.

The Twin City Oil Company have gone into the manufacture of grain crushers upon a larger scale and are also manufacturing gasoline measuring tanks, and put up a large addition to their premises for manufacturing purposes, spending about $10,000 on buildings and machinery.

St. John's Immense Dry Dock

ST. JOHN, N. B.—St. John has experienced a fairly good industrial year, notwithstanding the labor unrest and other disturbing post-war conditions.

About 500 men have been actively employed throughout the year in dry dock construction and in the development of a shipbuilding, ship repair and harbor plant at Courtenay Bay. A breakwater 7,070 feet long has been almost completed, and good progress has been made on the dry dock scheme. The dry dock will be 1,150 feet long by 125 feet wide, and will be the largest dock of its kind in the world. It is designed to accommodate either one large ship or two smaller vessels. The dock area was inspected by Admiral Jellicoe on his recent visit of inspection to the port of St. John, and he expressed himself greatly pleased with the work that had been done so far. The contract is being carried out by the St. John Dry Dock and Shipbuilding Company, who have sublet the excavation to the Bedford Construction Company. A. R. Dufresne, C.E., is the chief engineer on the work.

The Corona Company are now enlarging their building and chocolate manufacturing plant on Union street. The additions to building and machinery will double the capacity of the plant.

The Atlantic Sugar Refineries have made some extensive additions to their sugar storage plant the past season. It is now one of the best-equipped sugar refineries in Canada and is turning out an excellent product. The refinery is located on the water front and has the advantage of having an all-the-year-round connection by water with the sugar producing islands of the West Indies.

The Crosby Molasses Co., Ltd., recently awarded a contract to Grant & Horne for the construction of concrete bases for two steel molasses tanks. The contract is about completed. The tanks will have an individual capacity of over 250,000 gallons.

The same construction firm is rushing work on an extensive addition to the immigration buildings at West St. John. This work is being carried on jointly by the Immigration Department, Ottawa, and the Canadian Pacific Railway.

The Provincial Lime Company, whose plant was destroyed a few months ago, have lost no time in reconstructing their plant on more comprehensive lines. The factory is now turning out a fine grade of lime, for which a ready market is found.

Max Newfield has recently started the manufacture of hosiery at St. John, and is meeting with good success.

Preparations are being made for an early resumption of machine manufacturing at the plant of T. McAvity & Sons, Marsh Road. During the war this company was among the most active shell manufacturers in Canada. In addition to two units of 400 x 80 ft., they have recently erected a large building as a moulding shop. They will make a specialty of valve manufacturing.

The cotton factories, nail works, brush factories, woodworking and lumber mills have all been very busy during the year. A larger number of men have gone into the woods this winter than for several years, so that there is every indication of a greatly increased lumber cut.

No Labor Troubles in This City

FORT WILLIAM.—Industrially, the past year has been a very prosperous one for Fort William. While there were no sensational demands for local products, all industries were kept fully engaged and activities well balanced.

One of the features worthy of comment, while the present year has witnessed almost universal unrest throughout the Dominion, Fort William industries were not affected. All industrial disputes were amicably ad-

justed as they arose and the van of production kept moving steadily.

The plant of the Canada Starch Co. has just completed one of the best years of its history, the increasing demand for their product necessitating large additions to the plant during the past year.

The Ogilvie Flour Milling Co. has just completed extensive additions to its plant and have also added a unit for the manufacture of stock foods.

The Canada Car & Foundry Co. have had a very good year, the car department being fully engaged in the building of new freight cars and the repairing of used cars. Their shipbuilding department has been greatly developed, originally designed for the execution of war orders; it will remain as a permanent unit of the plant. The latest product of the plant, the S. S. "E .D. Kingsley," an oil burning freighter, destined for the West Indies trade, is rated one of the most modern freight boats built upon the Great Lakes. Further ship orders have been booked, and the company contemplates the erection of additional shipbuilding facilities at once.

All iron foundries and engineering plants have been running to capacity, and future prospects are of the best.

The Plymouth Cordage Co. are erecting a five-storey, fire-proof warehouse on the harbor front for the storage and distribution of binder twine for the Western trade.

Wholesale and retail business has been very good, the volume being as great as in any pre-war year.

In spite of high building costs the building trades have been quite active, $500,000 being expended in school buildings alone. Additions have been made to several of the grain elevators. A $50,000 skating rink has also been erected. A number of residences were built under the provisions of the Federal Housing Scheme, and several higher class residences were erected. There is still a brisk demand for housing accommodation, and additional homes must be erected next spring.

The relatively high prices obtained for farm produce has given quite an impetus to the business of agriculture and agricultural lands are in good demand. The spring of 1920 will undoubtedly see an influx of settlers to the agricultural lands of this district, which is especially adapted to mixed farming, abounding in wood, good water and fertile soil.

Since the completion of the Scott Highway, connecting Fort William with Duluth and other American cities by automobile route, summer tourist traffic has grown to be quite a feature in the commercial life of the city.

Labor conditions have been remarkably well balanced, there being absolutely no unemployment, and, on the other hand, there has been no curtailment of industrial operations due to labor shortage.

As an indication of the prosperity of the community, it may be mentioned, during the recent Victory Loan Fort William was asked for $1,300.000. Fort William subscribed $2,050,000, thereby showing that this community is not only prosperous, but is willing to share its prosperity with the rest of the Dominion.

Galt Factories Are Growing

GALT.—Industrial expansion to the tune of $119,420 is the record of which Galt can be justly proud.

In January, $2,400 was spent in new buildings, and in the other months the amounts, as stated below, were utilized: Feb., $4,350; Mar., $3,500; April, $25,000; June to November, $30,975. From January to November, $17,195 was spent in additions of various natures.

In addition to the above, Goldie & McCulloch laid out $25,000 in additions. We make this statement separately as this firm is really outside the corporation limits.

The firms below spent the amounts herein mentioned: Riverside Silk Mills, $50,000; The Perfect Machine Tool Co., $20,000; and the R. McDougall Co., $40,000.

Making Tool Steel in Welland

WELLAND.—The only new industry which is established in this city in the past year is the Dillon Crucible Alloys, Limited, which is already doing a very considerable business in making alloy and a high grade steel for tool steel. The company is employing at present sixty hands and the prospects for increased business are exceedingly bright.

There have been no additions to existing factories here, and all of them are progressing favorably.

Hamilton's Big String of 32

HAMILTON.—Hamilton has enjoyed a year of unprecedented success in the securing of new industries and may well look forward with confidence to the future prosperity of the city. Since the beginning of 1919 no fewer than 32 industrial concerns have decided to locate their plants here, and while a few of the smaller ones are already in operation, the larger ones have not yet had time to complete their building operations, so that it will be realized that the city has not yet begun to experience the fruits of a year of marked industrial growth.

For the most part, the new industries are Canadian branches of American concerns which are coming to Canada, not only to care for and develop the Canadian market, but also with a view to looking after their export trade from within the Empire, there being a widespread feeling among the manufacturers of the United States that a high preferential tariff within the Empire is sure to come in the immediate future, and that they will then not be in a position to compete with Canadian manufacturers for the coveted British trade unless they have had the foresight to establish Canadian branches. While many American manufacturers have already made the plunge, there is no doubt but that scores of others are deterred only by unsettled labor and other conditions from doing likewise. This condition applies not only to Canada, but to the entire continent, if not the whole world. It is not at all surprising that the manufacturer should adopt this attitude, more particularly when it is a case of making an investment in what is, to him, a foreign field, but there are indications that he is preparing for quick action when conditions generally become more settled. This optimistic prediction is borne out by the fact that never in the history of the city's industrial department have inquiries from American manufacturers been more numerous than during the year 1919, while the number of inquiries from Britain and other overseas countries also show a considerable increase over preceding years.

While most other places have been in almost constant turmoil during the year, Hamilton, although one of Canada's chief manufacturing centres, and fairly strongly unionized, has had no strikes or labor disturbances of any kind, and this has unquestionably been a big factor in the city's industrial success. There are probably many reasons for this comparative labor rest. Some may ascribe it to the fact that labor is largely represented in the Hamilton City Council, thus giving the workingman confidence in the government of the city. Others say it is due to the fact that in Hamilton a majority of the workingmen own their own homes, and, having a stake in the community, they hesitate to do anything that would militate against the welfare of themselves in particular and the community in general; but in my opinion it is because Hamilton manufacturers have shown the good sense to take their employees into their confidence and evince an interest in their welfare, not only in the shops, but also in their hours of rest and recreation.

Among the larger industries that located in Hamilton during the year, but of which the city is not yet feeling the benefit are: Firestone Tire & Rubber Co., Akron, Ohio; Hoover Suction Sweeper Co., Canton, Ohio; Quaker

City Chemical Co., Philadelphia, Pa.; Gerrard Wire Tire Co., New York; Carr Fastener Co., Cambridge, Mass.; Canadian Carbonate Co., Montreal, Que.; Norton Co., Worcester, Mass.; and Porritts & Spencer, Bury, England. When the plants of these companies are completed they will represent an invested capital running into millions, and will give employment to upwards of 4,000 people, so that unless something unforeseen happens there is no cause to worry about Hamilton's prosperity for some time to come.

Sherbrooke Aiming at 50,000

SHERBROOKE.—Sherbrooke, Quebec, records an increase in the industrial line. The Canadian Connecticut Cotton Mills are duplicating their actual plant and the new addition will cost a million; Julius Kayser are erecting a four-storey plant at an expense of $500,000; Cluett-Peabody (shirts and collars) have purchased a plant formerly owned by a shoe factory and will employ at least 300 hands.

Sherbrooke has inaugurated a great paving plan, which will stand for five years, during which period all our main thoroughfares will be permanently paved; a mile and a half of highway is now paved according to the latest modern methods.

Our Street Railway Co. is building a mile and a half of railway and has doubled its tracking system to a certain extent. A company is established to erect a model city; the capital is $500,000, and the construction will begin next spring, 1920. The future of Sherbrooke is a promising one and with its civic developments, our city should attain a population of 50,000 in a few years.

A gang of seven men that took refuge in a compartment of the hold of the Ward Line S. S. Guantanamo in Brooklyn recently to escape from ammonia fumes coming from a tank, the head of which had blown out, were rescued through the quick wit of another gang engaged on a job of welding. The welders were at work on a barge alongside the same pier when the news of the accident reached them. The seven men were part of a crew of twenty-five engaged on the repair of a condenser. Under too great pressure, an ammonia tank in the engine room gave way, flooding the room in which the men were working. All of the men were able to scramble to safety to the hatchways and upper deck.

Cut off from exit, the seven retreated to a compartment far down in the hold, from which they signalled their location by rapping loudly on the plates with their hammers. Their predicament was grave, as the fumes of ammonia, filtering through the crevices, slowly filled the room and made breathing more and more difficult.

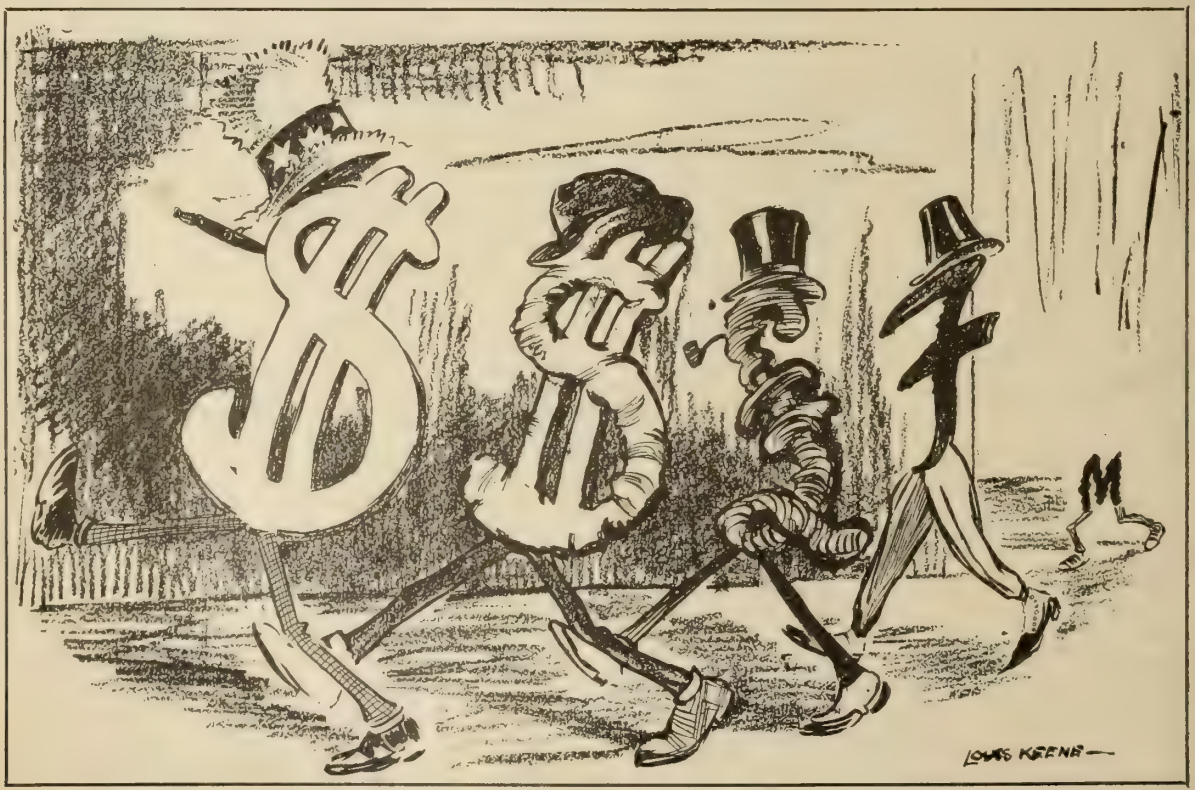
The welders rose to the situation by cutting a hole through the compartment where the men were imprisoned and thrusting down a compressed oxygen pipe line used on their new job. This not only served to blow away the ammonia fumes from the men, but supplied them with comparatively fresh air to breathe for the period of a half hour. Meantime the fire department had been called and Battalion Chief James Heffernan and his chauffeur, Martin J. McNamara, who tied vinegar soaked handkerchiefs over their faces, were lowered into the hold by the welders.

They opened the compartment door and after three trips got all seven men to safety, though the latter were all temporarily blinded from the effects of the fumes and were so weak that they could hardly stand. The heroism of the firemen and the resourcefulness of the welders were the subject of considerable comment in the press.

THEY do tell now that our silver money is getting almost worth more than its face value. That may be so in theory, but when the grocer and the butcher get through with you we can't see wherein the 30-cent standard has been departed from.

THE Ontario Government is advertising for an engineer. Quite a change from the good old days when a man had to be a good Grit or Tory first and some sort of an engineer after that.

THE MARK RUNS RIGHT ALONG BEHIND



The American dollar is still in the lead, and going strong, but the Canadian dollar is second in the race. The pound and the franc are losing more ground. Some financial experts say that the Argentine "lira" and the Spanish "peseta" are really above par, but that doesn't enter very much into Canada's financial calculations.

GENERAL MOTORS GOING INTO BUSINESS IN A VERY LARGE WAY

THE growing importance of the automobile industry in Canada is reflected in the new manufacturing facilities which have become available recently. Many new factories are being rushed to completion, and a number of others are on a production basis.

The plant of Canadian Products Ltd., Division of General Motors–Ltd., Canada, is one of the latest to be built for the Canadian automotive trade, and in attention to general design and detail it displays constructive thought of a very high order.

Provision for expansion has been taken care of in the purchase of about ninety acres of plant site, and the layout of the buildings now erected and their location is such as to permit of extension when necessary.

The present buildings are two in number, each 160 feet wide by 600 feet long and one storey in height. Saw-tooth roof construction is employed, steel roof trusses and gypsum roofing being used. The gypsum roof is pored in situ and makes a very light and durable construction, a material saving in steel resulting from its use.

The two buildings are laid out for a total of about 1,100 separate machines, for the driving of which approximately one thousand motors of varying horsepower will be required. Group drive has been eliminated wherever possible. The electrical equipment for the motors is of the remote control type, and direct-connected motors are used with very few exceptions.

Two lines of track serve the buildings, loading docks having been constructed alongside. These docks are of ample width for trucks and will be largely used for the shop transportation system, done by means of electric shop trucks. For the affording of passage between the two buildings across the tracks lift bridges will be installed. These bridges will lift to sufficient height to permit of the shunting cars underneath them.

Large locker rooms are provided in both buildings for employees, and lavatory accommodation is provided in the saw-tooth roofs, access being given by spiral stairs.

Each building is a complete unit by itself with separate entrances and separate time-recording features. Electrically-operated time clocks will be used.

The first building will be devoted entirely to the manufacture of automobile engines, four different types being made, two types of Chevrolet motors, one Buick and one type of Oakland motor. The front portion of this building is given over to executive offices, accounting and other departments connected with the management of the business.

The motors will be manufactured complete from the machining to the final testing on the test floor. In the other plant, front and rear axles will be made, together with automobile transmissions. The machine-tool equipment installed will be of the character demanded by this work and that of the tool-room which is located immediately in the rear of the engineering offices at the front of the building.

The heat-treating plant is located at the rear of this unit and comprises four double annealing furnaces, one forge furnace, and four lead pot furnaces. An electrical heat-treating furnace will also be installed. All temperature control will be done by means of a complete pyrometer system.

The buildings are heated by an isolated power plant which also serves as a substation for the supply of 550-volt power and lighting circuits. Two Wickes vertical water-tube boilers are installed, each of 300 horsepower. They are equipped with Jones stokers, two being provided for each boiler. Forced draft is employed.

A 10-inch overhead steam main delivers the steam for heating to the various offices and the condensate is returned through a 5-inch underground line to the vacuum pump in the power plant. A 6-inch air compressor line is also carried on the same structural framework, supporting the steam line, and compressed air will be supplied by a 12½, 20 by 14 in. Canadian Ingersoll-Rand compressor.

A Cochrane heater forms part of the power plant equipment.

In all about 45,000 square feet of radiation is installed, not including about 1,600 lineal feet of 2-in. header and about 300 feet of 5-in. header. The radiation is installed along the exterior walls and in the saw-teeth of the roof. The Dunham system is used.

Hydro-electric power will be used for plant operation, the transformers being located outside the building and reducing the voltage from 13,200 down to 550. A Canadian General Electric switchboard forms part of the power plant equipment and controls the various plant feeders.

An extensive landscape scheme will be developed and dormitories are now being built for the accommodation of the employees. Later, other accommodation will be developed. A cafeteria is also being erected.

Difficulty has been encountered in the securing of delivery of equipment, and it is estimated that several months will elapse before production will reach 100 per cent. Production on about a 10 per cent. basis is now being carried on in the motor department, and by the end of February it should reach a figure of 75 per cent.

Personnel

Mr. Howard E. Blood is general manager of the Canadian products; Mr. Davidson is chief designing engineer; Mr. Chas. Rich is master mechanic; Mr. Deets is production manager; Mr. Donovan, comptroller; Mr. T. Miller, axle plant superintendent Mr. Cunningham, motor plant superintendent; John Knapp, purchasing agent; A. H. May, works engineer; J. Gold, assistant works engineer; Mr. Bessie, tool engineer, and Mr. Suttle, standards engineer.

AND SHE'S VERY RESERVED, TOO

A young Brantford school-ma'am boarder was a stout, jolly girl and rather broad from rear view. She had kindly consented to look after nine-year-old Jack, while his mother took a month's holidays. Of course, Jack had to be spanked occasionally, and the teacher was quite equal to the task. Jack didn't mind it when he had his "knickers" on, but sometimes the only pants he was allowed to wear was the pair that Nature gave him.

One day she turned him over the knee, and as she applied the shingle, he remarked: "O-o-h gee! Miss Blank, spank easy, it stings awful on the bare, bare place."

"It will do you good," said the teacher, as she paused a moment; "it will make the bare place grow."

"Gee! Miss Blank," said Jack, "you must a-got a lot of spankins when you was small."

And poor Jack couldn't understand why she smacked him harder.

NEW USE FOR AIRPLANE ENGINE

That the airplane engine is not above ordinary humdrum work is shown by the fact that one has recently been installed in a London factory as a stand-by power unit. It burns gas instead of petrol and the cooling water is circulated through a common cast iron radiator. It is an eight-cylinder engine, surplus from the war, and at the aerial rate of living would develop 200 horsepower, but has been rated at 75 horsepower on earth to give it a reasonable length of life.

One of the curious suggestions made in the Southwest for the saving of wheat at harvest is the use of vacuum cleaners of special size and construction. The idea is that machines of the proper construction could be run over the fields and gather up the loose heads of wheat where grasshappers have eaten the stalks. In some cases 50 per cent. of the heads were lying o nthe ground as the result of this insect's activity. Some farmers used close toothed rakes with more or less succes. Others mowed the wheat and raked it up. It is possible the "vacuum" harvester is on the way.

THE MAKING OF THE *OVERLAND FOUR*

The building of automobiles requires special tools and fixtures, in order to obtain maximum production.

BY

J. H. Moore



A YEAR ago, wondering what to do with a plant equipped specially for the turning out of aeroplane motors—now, production already secured, and working upward to an objective of fifty cars per day. One year ago not a source of employment except for a few factory executives—to-day, a payroll of 1,200, with a fifth of them returned men, and the prospects of many more being taken on.

Such, in brief, is the 1919 history of the Willys-Overland plant on the Weston Road, Toronto. The close of the war left this company, in common with many others, with a big problem to look after. Great organizations had been built up to produce munitions, and they had done it successfully. The Weston Road plant had been tuned up to turn out aeroplane engines—the Sunbeam Arab type—and they had done remarkably well in a job that was perhaps, from a mechanical and engineering point of view, one of the most baffling of the war.

The plant as it stands to-day is a tribute to Canadian courage and initiative to Canadian engineering skill, and to the unbounded faith which our captains of industry have in the future of this country and of the countries to which they hope to export.

The other plant concerned in this company, The Machine and Stamping Company, Limited, has a similar inspiring tale. Stamping work in connection with the munition business of the Russell Motor Car Company, together with the manufacture of bicycle chains and spark plugs, formed the majority of their business.

It was only during the early part of this year that they definitely decided to manufacture the transmission portion of this Model 4 car, yet in that short time they have gathered together the best of equipment and help, and have now reached a production basis. Having mentioned the history of the past performance, let us proceed with pres-



FIG. 1 ASSEMBLING THE CHASSIS.



FIG. 2—A PARTIALLY ASSEMBLED CAR.

ent accomplishments, describing the actual operations in the making of the new car.

To bring before our mind's eye a view of the general appearance of the car, let us refer to the illustration, forming a portion of the heading of this article, which illustrates the first Overland Four produced in Canada. It is worthy of note, that seated in the car are four executives of the concern. Mr. T. A. Russell, president and general manager, is at the wheel; Mr. J. G. Perrin, assistant general manager, sits beside him, while Mr. J. F. Mackay, secretary and treasurer, sits at the left hand side of the car, at the rear; and Mr. W. A. Dover, sales manager, is seated at his side.

The Assembling of the Chassis

No doubt everyone is well aware that the first step in the assembly of an automobile is the assembling of the chassis, so let us study closely Fig. 1, in order that we can discuss one of the car's big features.

Here we see the workman riveting together the various members of the chassis, or framework, as some prefer to call it. If you are at all familiar with cars you will note the peculiar shape of these frames, as this form of chassis is only to be found on such type of car.

It is made in this manner to accommodate the three-point cantilever springs which are perhaps the main feature of the entire car. This innovation is claimed to create a riding buoyancy never possible before with a car of like weight. The springs spoken of will show up clearly in a later view. Referring once more to the photo, it will be noticed that these frames are assembled on a special jig, with levers at the side which tighten the framework by means of cam-shaped bodies. The riveting is accomplished with the aid of a gun manufactured by the Thor Tool Company.

Immediately the framework has been assembled it goes through the following sequence of operations:

The springs are now placed in position on framework. The various braces, front axle, bumper brackets, battery pan and front yoke, are also assembled during the next step in the preparing of the complete chassis.

After this has been accomplished, the rear axle is assembled. Next the engine pans are assembled, also the engine itself is placed on the chassis. The starting crank hole is reamed out, and the starting crank shaft assembled in place.

The Painting Department

The partially completed chassis now passes along rails, on a specially constructed carrying truck to the painting department, where the frame is painted black, and the engine grey, by means of an Aeron spray gun.

They now pass through a long drying oven, coming out at the other end baked sufficiently to allow immediate work on the further stages of assembly. This journey through the ovens takes approximately one hour. The complete drying conveyor is driven from a 5-H.P. Westinghouse motor, the speed of the carrier chain being reduced by means of gears connected direct to the motor.

Further Stages of Assembly

After coming out of the drying ovens the various portions of the chassis are thoroughly oiled and greased. Grease cups are placed in position, wheels with tires attached are assembled, and running boards are attached.

A good idea of how the car looks at this stage is seen from Fig. 2. At this point we wish to call attention once more to the three-point cantilever spring and the rear one showing to splendid advantage.

By the use of these springs, one at the front and one at the rear, the spring base is increased 30 inches, and as the chassis has a wheelbase of 100 inches, this makes the spring base 130 inches, which is a feature of design found only in this type of car.

In order to make clear the class of work being accomplished by the two firms concerned in the manufacture of this car it might be mentioned that the Machine and Stamping Company, Limited, manufactures and assem-



A GENERAL BIRD'S-EYE VIEW OF THE WILLYS-OVERLAND PLANT.

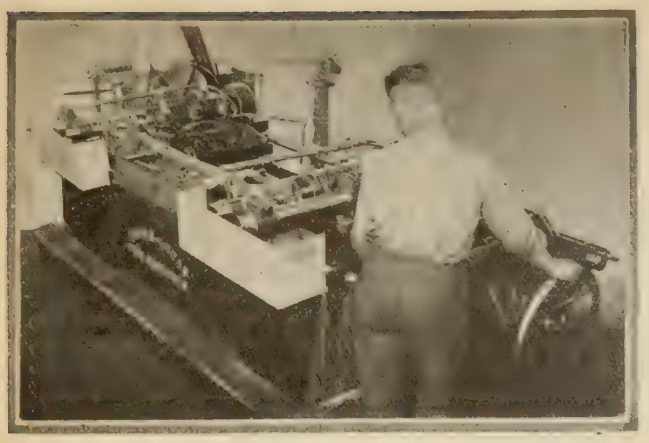


FIG. 3—MILLING BOTH ENDS OF FRONT AXLE AT ONE TIME.

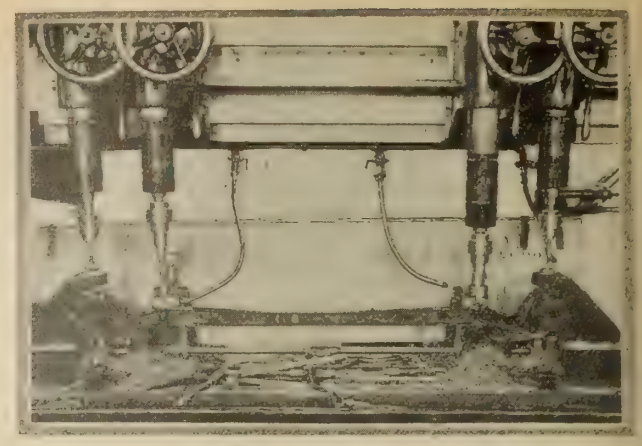


FIG. 4—DRILLING, REAMING AND FACING FRONT AXLE.

bles the transmission, while the Willys-Overland plant make the rest of the power plant—and the remainder of the car, with the exception of about 20 per cent. In other words, at present this is an 80 per cent. made-in-Canada car with 20 per cent. purchased elsewhere. It is, however, the hope of those interested soon to be able to say that it is a 100 per cent. made-in-Canada product. Having pointed out these facts, let us leave the chassis in its partially assembled stage and consider various operations to other portions, individually.

The Front Axle

The front axle is made of I-beam section, drop forged in one piece, and passes through many various interesting operations. Before passing into the machine shop, however, each axle is carefully straightened on a machine for this purpose. As readers will readily understand it is only possible for us to illustrate a few of the different operations on the various parts, so we will show only two of the steps in the manufacture of the axle.

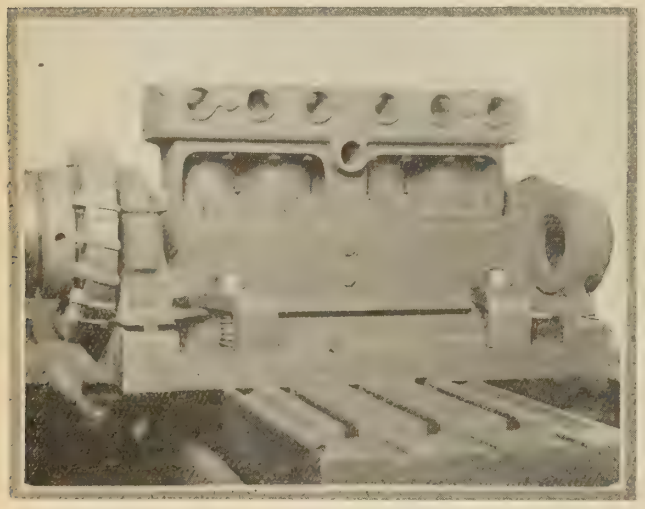


FIG. 5—MILLING THE FLYWHEEL END OF CYLINDER BLOCK.

The first of these operations (see Fig. 3) illustrates a very interesting fixture on an Espen-Lucas horizontal miller. Here we see both ends of the front axle being machined at the same time by means of eight cutters. A machine of this nature equipped as shown means steady production, which is so essential where a certain daily output is absolutely necessary.

The operation shown at Fig. 4 is that of drilling and facing the different holes in the front axle. This operation is performed on a Foote-Burt four-spindle drill. By careful study of this picture the design of the jig can be clearly noted. The axles are gauged from vee blocks, which come in from each end, at a uniform speed, operated from a handle at the end of the jig, but which is not shown on the photograph.

After all operations on the front axle have been performed, they are forwarded to the front axle assembling department, where on special stands made for the purpose the workmen assemble steering knuckles and various other parts to the axle.

The Cylinders

To describe, operation by operation, the work on the cylinder blocks would prove too intricate, and take up too much space to suit the purpose of such an article as this, so again we will consider only certain interesting operations.

At Fig. 5 we illustrate the operation of milling the flywheel end of the block on a Kempsmith Miller. These blocks are placed on a special jig plate and are then clamped in position as shown. Of course, they are gauged from a positive point, as one can readily understand. Other milling operations of like nature are performed on millers of both the vertical and horizontal type. In every case the block is gauged from the same gauge point, so that no error can result and the work is interchangeable, which is a very necessary point to be considered.

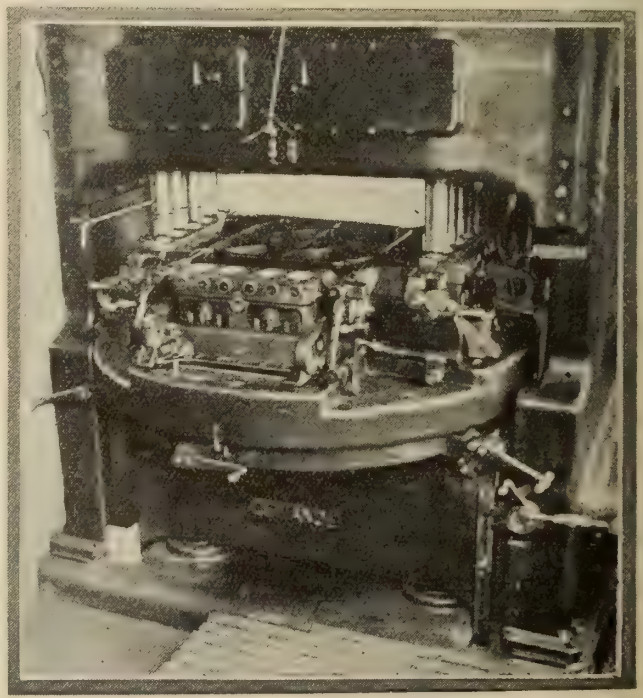


FIG. 6—A SPECIAL EIGHT-SPINDLE CYLINDER BORING MACHINE AT WORK.

Another very interesting operation is that of boring and reaming the four cylinders. This work is accomplished on a special eight-spindle machine made for the purpose by the Defiance Machine Co., and is illustrated in Fig. 6.

This is the only machine of its kind in Canada and is well worth considering in detail. The four spindles to the left of the picture perform the function of rough boring the cylinders, while the four at the right of photo ream out the rough bored surfaces. The main machine of the table revolves, 90 degrees at a time. The reason for this is apparent, viz., that while the machine is rough boring and reaming two cylinder blocks the operator is unloading and loading at the other two stations on the table. It is in installations of this kind that we see the benefit of special machines for special purposes.

Another single purpose machine is illustrated at Fig. 7 and 8. Here we show a Baush three-way horizontal drill

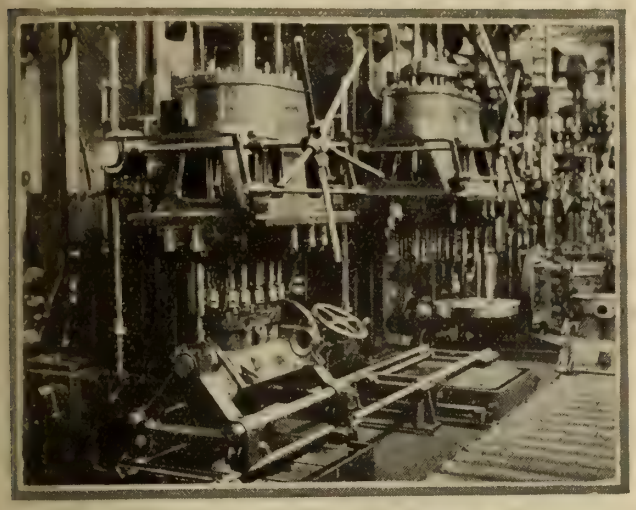


FIG. 9—TAPPING BOTH TOP AND BOTTOM OF CYLINDER BLOCKS. 38 HOLES ARE TAPPED AT THIS OPERATION.

at work on the cylinder block. Forty-seven holes are drilled at one time in this machine. The view, Fig. 7, depicts the back view of the drills about to enter their bushes, while Fig. 8 illustrates the front view of machine showing the drills coming in from either side.

The cylinder block itself is mounted on a jig block which slides out and in on the portion marked A on photograph. It is hardly necessary to state that production, coupled with interchangeability, is a big point in this machine's favor.

Another Interesting Installation

Our next view at Fig. 9 is still another argument in favor of special equipment. In this case we have two

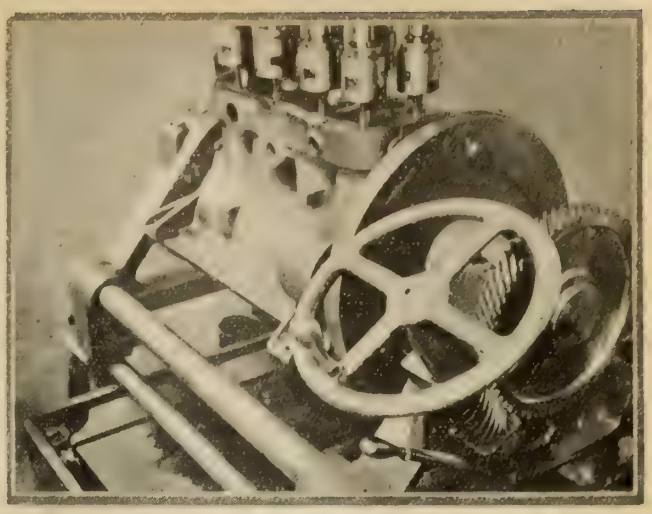


FIG. 10—THE REVOLVING JIG USED IN CONJUNCTION WITH THE MACHINE SHOWN AT FIG. 9.

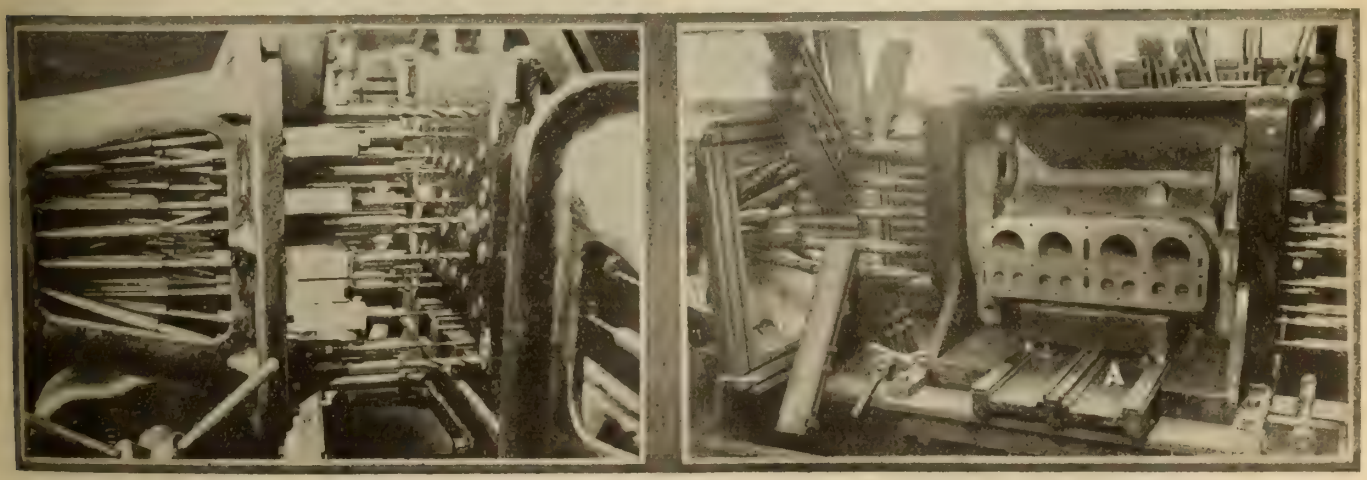
Natco drills, used for tapping in this particular operation, arranged side by side and connected up by means of a set of rails.

At this operation the block is tapped both top and bottom, twenty-four holes in one case and 14 holes in the other. In conjunction with these drills, there is a special revolving jig which we illustrate by itself at Fig. 10. The action of these two operations is self-apparent. One set of holes are first tapped, then the carriage with four grooved wheels, which forms a part of the jig, is pushed along the rails between the two machines. The jig is now revolved 180 degrees by means of the hand-wheel A, shown at Fig. 10. This controls an indexing attachment operated through a worm and worm wheel, that can be clearly noticed on the photograph. The other details are so self-apparent that no further comment on these photographs is necessary.

As stated before, there are other innumerable operations on the cylinder block which we cannot enter into, but at least we have shown some interesting steps in its progress to completion, so, taking it for granted that all the remaining machining parts have been accomplished on this portion, let us consider other parts of the car.

Other Engine Parts

Other operations on various portions of the engine will next be considered. At Fig. 11 is shown the operation known as finish grinding line bearing on the crankshaft. This work is accomplished on a Norton grinding machine, as are other different operations of similar nature. There are quite a few grinding operations on the crankshaft, but the photograph illustrates the average style of accom-



FIGS. 7 AND 8—TWO VIEWS SHOWING THE DRILLING OF CYLINDER BLOCK OF SPECIAL BAUSH THREE-WAY DRILL.

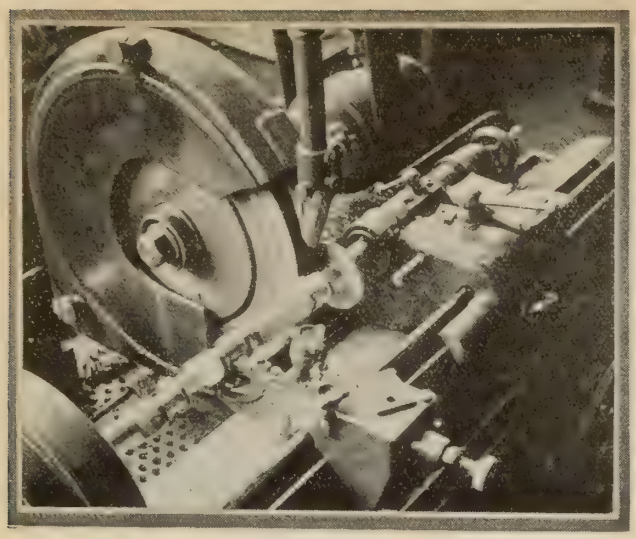


FIG. 11—FINISH GRINDING LINE BEARING ON THE CRANKSHAFT.

plishing such work. The photo, being a close-up view, allows one to see clearly the various details.

We notice at Fig. 12 another case of special equipment used to advantage. This view depicts a Becker double spindle vertical miller, arranged with a revolving, continuous milling fixture. This fixture is designed to take care of 18 connecting rods, the spindles being equipped with cutters of proper design to mill both ends of the rod at once. As stated previously, the fixture is continuous in its action, the operator loading and unloading at the various stations, while the machine keeps on producing. Attention is called to the rack to the extreme right of photograph. This is simply a double-sided stand on four wheels with wooden pins on which the operator places the finished rods, that is, finished as far as his operation is concerned.

It is small details, such as this method of handling the rods after each operation, that help to speed up the work throughout the plant.

Of course, this step is merely a start of the many other stages in the connecting rods' journey; for they must be drilled, reamed, tapped, etc., etc., before arriving at the finished stage. Lack of space prevents us entering into greater detail, but suffice it to say that in every case special jigs and fixtures form a part of each operation.

At Fig. 13 is shown a Foote-Burt four-spindle drill at work on the exhaust manifold, the operation in this case being drilling and facing the four holes shown. This photo shows up the details so clearly that we feel no comment is necessary.



FIG. 13—DRILLING AND FACING FOUR HOLES IN THE EXHAUST MANIFOLD.

Work on the Transmission

We often hear the saying that a change is as good as a rest, so suppose we now consider for a short time the work being performed on the transmission parts at the Machine and Stamping Company, Limited.

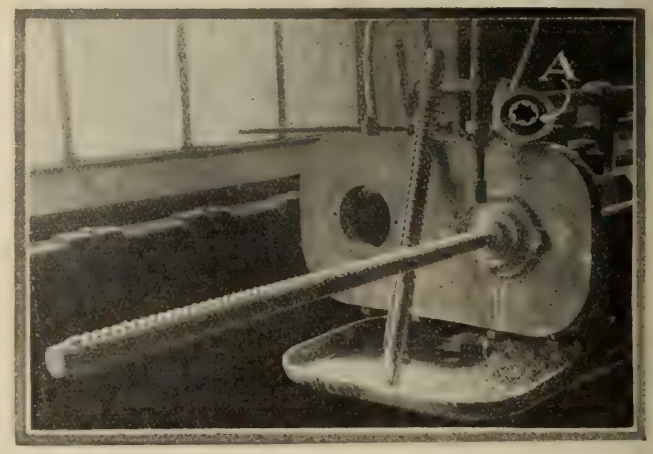


FIG. 15—BROACHING SIX KEYWAYS ON TRANSMISSION GEARS.

Again we must confess that it is impossible to enter into as deep detail as we would like, for one could prepare a regular volume on the making of a car of this nature, but before commenting on any further photographs, we will discuss two operations which are not here illustrated.



FIG. 12—MILLING 18 CONNECTING RODS ON A CONTINUOUS MILLING FIXTURE.

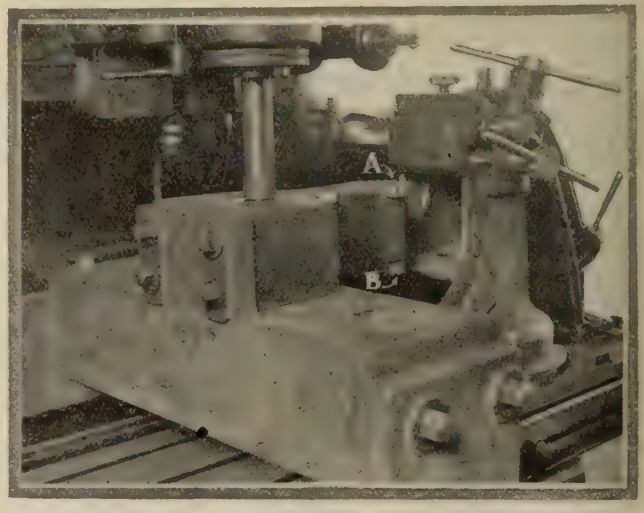


FIG. 14—MILLING INTERNAL BOSSES ON THE TRANSMISSION CASE.

The first of these is the lathe work performed on the case itself. These operations are done on Potter and Johnson automatic lathes, the work being held in special chucks. Another operation of interest is that of milling the pedal shaft boxes on a Garvin duplex miller. Two cutters perform this work, one on each side of the gear case, the result being a quick, accurate job, with all parts interchangeable.

Referring now to Fig. 14, we see a very clever fixture on a Brown & Sharpe vertical miller, designed to mill two bosses inside the transmission case.

This internal milling fixture is driven direct from the main spindle of the machine, being fastened in the manner shown. The two cutters, A and B, accomplish the facing of the interhal bosses, the case being fed up into the fixture.

Broaching six splines, or keyways, on the transmission gears forms the subject of Fig. 15. This work is done on a Lapointe broaching machine and in the photograph shown the broach is just about to enter the work. To further illustrate the type of broach used we have set one at the side of the other where its general proportions can readily be ascertained. The work itself is shown separately on top at A. A good stream of special lubricant is playing on these gears at all times, as the steel is of very high order.



FIG. 16——ROUGHING AND FINISHING UNIVERSAL BALL JOINT.

At Fig. 16 we illustrate the roughing and facing operation of the universal ball joint, the work being performed on a Warner & Swasey turret lathe. This work is accomplished in one operation, and the tooling is shown quite clearly.

Last, but important as any other operation in this plant, we show at Fig. 17 the machining of the universal ball joint socket.

First this piece is bored, then the radius is rough turned, after which it is finished by means of a specially constructed tool and guide. It is this tool that is in operation in the photograph.

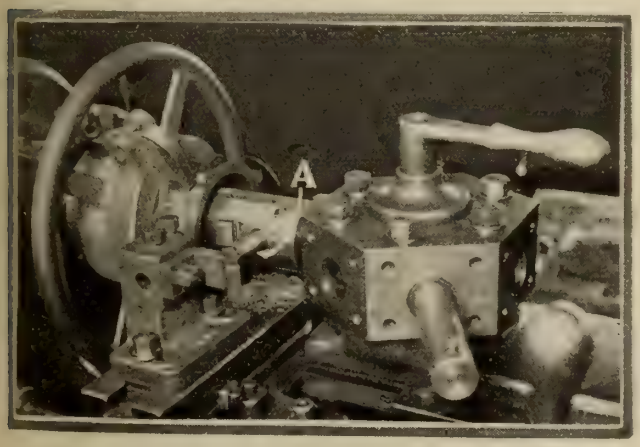


FIG. 17.—MACHINING THE UNIVERSAL BALL JOINT SOCKET.

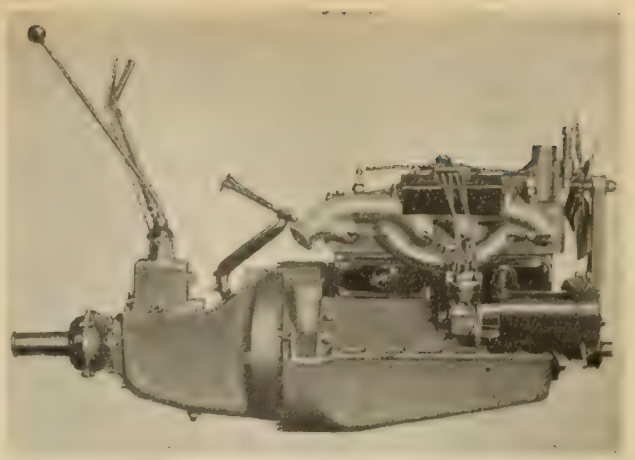


FIG. 18—THE POWER PLANT AS IT LOOKS FROM THE DISTRIBUTOR SIDE.

Briefly its action is as follows: The portion A presses against the guide B. The cross slide operates this guide at the proper speed, which in turn pushes the plunger A in at a predetermined rate. On this plunger are cut a number of teeth which mesh with a quadrant, C, a portion of the teeth being clearly noticed in the photograph. To this quadrant is attached the radius turning tool.

The action is now easily followed out. The plunger moving in rocks the quadrant, which moves the turning tool at the correct radius.

The saddle in the meantime has been feeding in at proper speed, which combination of movements accomplishes the operation.

Before leaving the subject of this plant, it might not be amiss to mention the splendid tool equipment they possess, the well-laid-out tool room and inspection department, in fact, all the vital points which go to make up a successful organization.

We will perhaps, at a later date, go further into the details of the inspection system adopted by this company, enough to say for the present that no jig is allowed to be used in the factory without undergoing a thorough test in this inspection department. We will leave the transmission case at this point, taking it for granted that it has passed through its various stages and finally been assembled and shipped out to the plant of the Willys-Overland, there in turn to be assembled to make up the complete power plant of the car. At this point a glance at Fig. 18 would be a good idea, as we then can figure about how the power plant would appear from the distributor side.

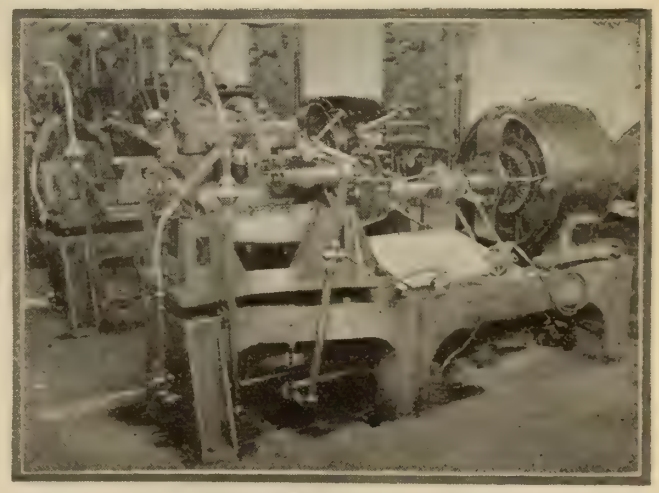


FIG. 19——A VIEW SHOWING THE BLOCK TEST STAND, WITH ENGINE IN POSITION.

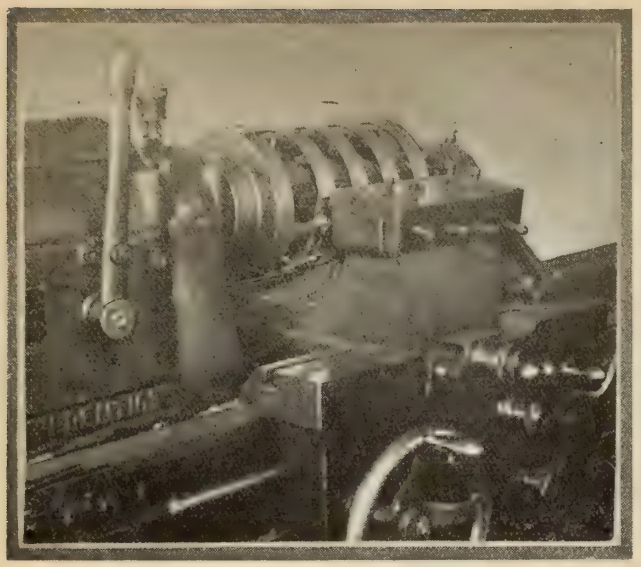


FIG. 21—TURNING FOUR INNER BRAKE BANDS AT A TIME ON A PRENTICE LATHE.

Now that we have arrived back at the plant, let us follow the engine from this point on.

Testing of Engines

After assembly all engines are carefully block tested. To get some idea of these block test stands we illustrate an engine during test at Fig. 19. At the side of each testing stand is a huge switchboard on which is installed all necessary equipment to show just how the engine is performing. The engine is first set in motion by the motor shown to the right of the picture, then the carburetor is properly adjusted until the engine is firing properly, after which the motor switch is shut off. The engine now runs on its own power. The revolutions per minute, mileage, battery, etc., all show clearly on the switchboard.

The main switch is next placed on load position and the control button pressed. The engine is now running on what is known as grid resistance. The load is of course varied to test the engine thoroughly and a record made of its performance.

Should any defect occur, it is taken to a special revolving dis-assembly stand, where the trouble is remedied. This stand is revolved in such a way that the operator is always working in a comfortable position, irrespective of the location of the trouble in the engine.

After leaving the testing department and having been certified as O.K., it is ready for assembly to the chassis.

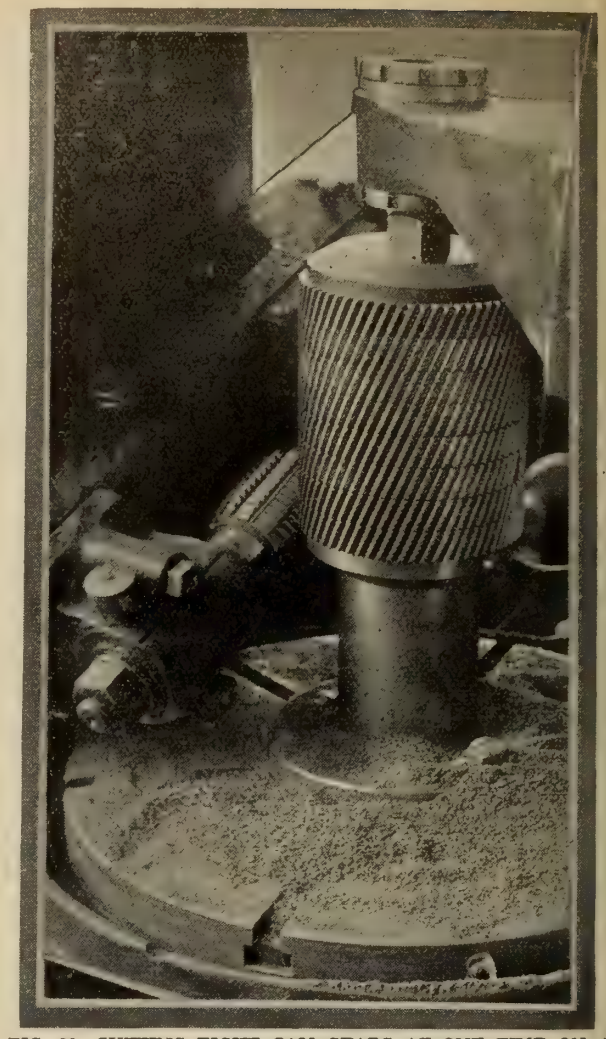


FIG. 20—CUTTING EIGHT CAM GEARS AT ONE TIME ON A GOULD & EBERHARDT GEAR SHAPER.

Other Interesting Operations

We will now consider a few more miscellaneous operations on the car, after which we will proceed with its further stages of manufacture.

Fig. 20 illustrates the cutting of the cam gear on a Gould and Eberhardt gear cutter. Eight blanks are mounted on the spindle at one time as shown, the hob or cutter going right down the line. It is hardly necessary to comment further on this photograph as the details are so clear.

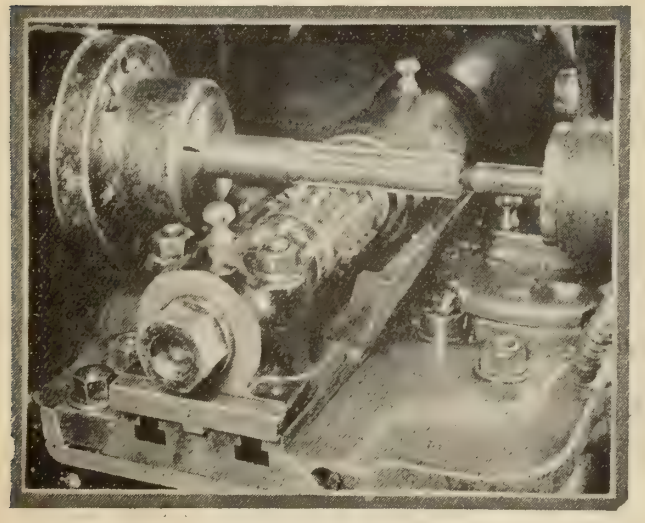


FIG. 22—HOBBING THE SPLINE END OF PROPELLOR SHAFT.

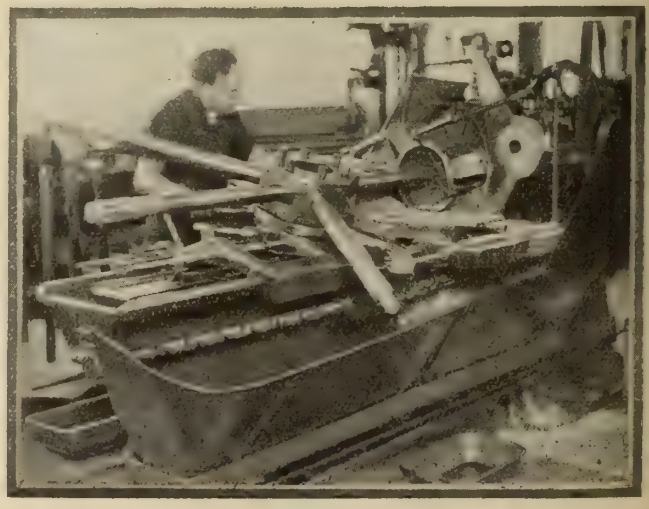


FIG. 23—BORING AND FACING REAR AXLE HOUSING.

Turning four inner brake bands on a Prentice lathe is illustrated at Fig. 21. By means of a special quadruple tool holder, this work is very easily accomplished. The work itself is held on a mandrel made specially for the purpose. Here is a case where by a little ingenuity production was increased to a considerable extent and well repaid the cost of special tooling.

Another hobbing job of a different nature is shown at Fig. 22. This operation is known as hobbing the spline end of propeller shaft, and is accomplished on a Barber & Coleman gear cutter.

The next photograph, Fig. 23, illustrates the boring and facing operations on the rear axle housing, the work being performed on a Gisholt turret lathe. As this style of work is somewhat along the usual line of machine shop practice we leave the reader to study the photograph at his leisure.

The Layout of Operations

It might be interesting to call attention to the system of arranging the various operations. At one portion of the main floor is arranged the different work on the cylinder block and cylinder head. Mathew gravity conveyors run between the various machines engaged on this work, which naturally speeds up the handling of the product. For other methods of handling, various style trucks are used, including the well-known line of Cowan Transveyors.

At another portion on this floor the various operations on the flywheels are performed, Mathew gravity conveyors again being used at the sides of machines to aid in the handling of the work.

Across from this department on the same floor the various operations, on propeller shaft, back axles, crank shafts, cam shafts, etc., etc., are accomplished. On the same floor level, but in another department, the assembling and testing of engines takes place, the various storerooms for these different parts being placed in the very best position for easy access.

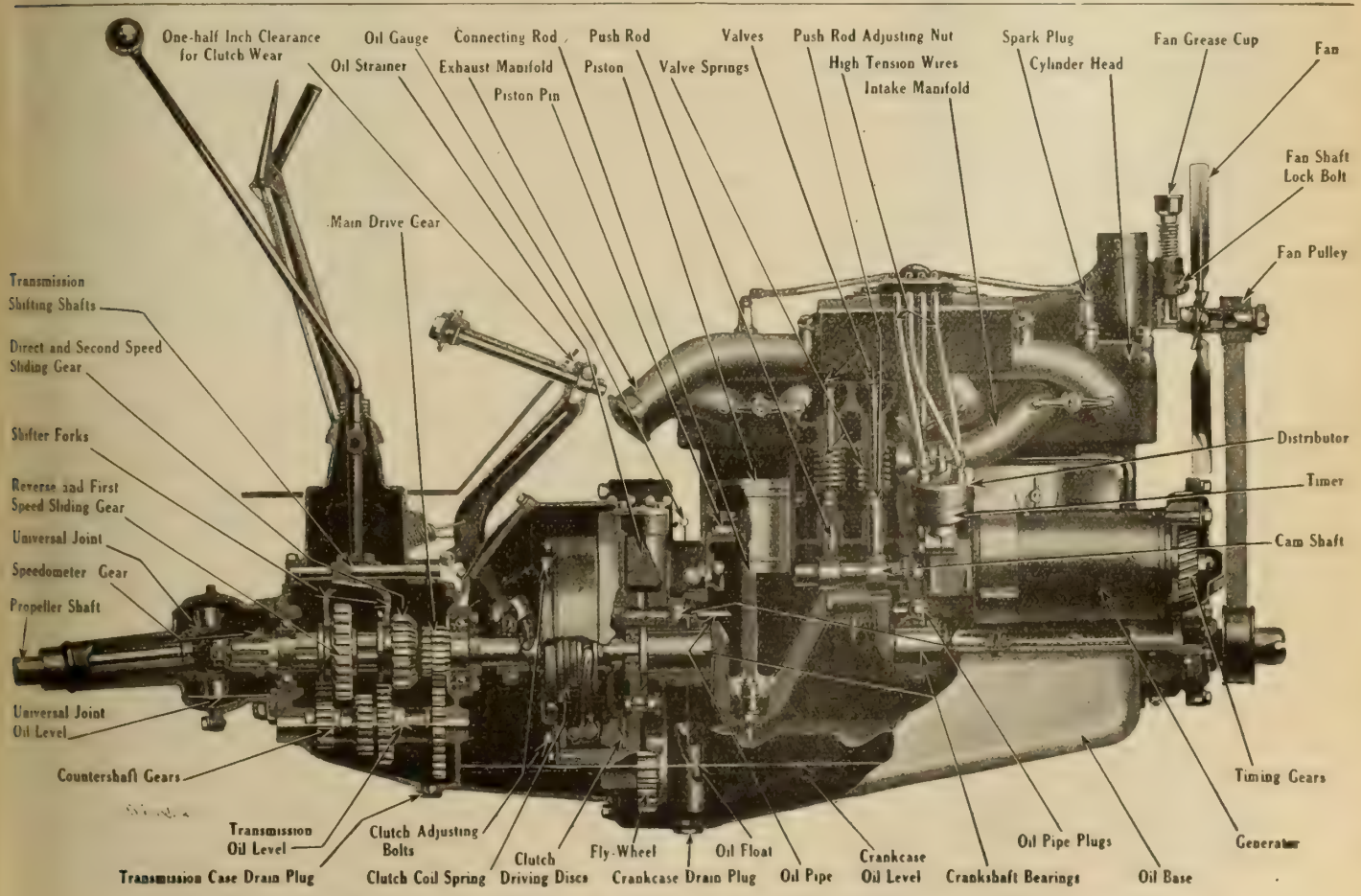


FIG. 24—A SECTION OF TOOL ROOM, SHOWING INSTALLATION OF SMALL LATHES AND MILLER.

The front axle assembly and rear axle assembly are in a different department, but also on the same floor level.

The Heat Treating Department

The heat treating department is also located on this main floor, and more than passing mention should be made regarding this most important portion of the organization. This department is well equipped with American



A SECTION SHOWING CROSS-SECTION OF ENGINE, CLUTCH, TRANSMISSION, AND UNIVERSAL JOINT.

TECHNICAL DESCRIPTION OF THE CAR

For readers familiar with mechanical details we publish this brief description. Our object in thus separating the mechanical data, is in order to allow the general reader to continue the main article without entering into confusing details.

There is one radical departure from general engineering practice which dominates the new Overland. This is the method of spring suspension. Mounted on a wheelbase of 100 inches, the springs are so arranged that the distance between the spring supports is 130 inches. This suspension, which is virtually a cantilever system, projects ahead of the front axle and behind the rear axle, giving an overhang of 15 inches beyond the axles at each end.

This combination of short wheelbase and overhanging springs has enabled the production of a car which weighs less than 2,000 lbs., while giving maximum room for occupants.

Simplicity is an outstanding feature of the chassis. A unit power plant, a propeller shaft enclosed in a torque tube, and a three-quarter floating rear axle enclosed in a two-part malleable iron housing complete the driving parts. The frame has parallel side members with very heavily reinforced end pieces to take care of the strains and stresses imposed by the spring suspension. There are no cross-pieces between the rear end of the frame and the engine support, consequently the result is a flexible structure rather than a rigid one. In fact, the chassis suspension is practically a three-point arrangement. There is but one shackle on the entire car, at the left rear spring. All other points of spring suspension are fixed.

The engine is of L-head type with detachable cylinder head. Cylinders and crankcase are cast integrally. Crankshaft bearings are die-case babbitt, and are reamed to size during the manufacturing process. The bearing caps are shimmed for adjustment.

The flywheel is a semi-steel casting, machined all over and marked for ignition timing. It is drilled for balance after assembly to the crankshaft. The flywheel teeth act as oil carriers for the lubricating system, as well as for the engagement of the starting motor.

Helical timing gears drive the camshaft and generator. The gears are located at the front of the crankcase in a separate housing.

The camshaft is drop-forged with integral cams. It is mounted on three bearings. The front bearing is die-cast, and the other two are out of bronze. The valves are operated through mushroom tappets and cast iron guides which are integral with the crankcase.

Means have been taken to insure the flow of an ample supply of water through the thermo-siphon system. The jackets are large, and the radiator is of cellular type with non-corrosive sheet brass tubes made of an alloy of copper and zinc. The radiator shell is a pressed steel one-piece unit, and a fan shroud on the back of the radiator further assists cooling. The fan is a four-blade, steel stamping, belt driven with an adjustment provided through the fan lock-shaft bolt. The fan-belt is located in front of the fan, thus permitting the bolt to clear the timing gear case readily and the fan to be in approximately the same plane as the timing gear case, reducing the overall length of the engine to a minimum.

Constant circulation of the oil is maintained by the flywheel gear teeth. The oil is taken up to a reservoir and is thrown into a strainer where it is filtered. It is then led to the main feed pipe which runs the full length of the cylinder block and which is connected with the crankshaft bearings through three openings. Scoops on the lower ends of the connecting rods splash the oil to the cylinder walls and to the other bearings. The timing gears are lubricated through a small hole in the end of the main oil feed above the front main bearing. The oil in the crankcase communicates with the clutch, gearset, universal point, speedometer gear, lighting generator and starting motor drive end bearing There is a float oil level indicator on the left side of the engine.

The gasoline tank is located under the cowl, providing a gravity feed for the fuel. The material used for the tank is terne plate (lead coated steel). The carburetor is a Tillotson of special design, equipped with hot air attachment.

The carburetor is on the opposite side from the intake manifold, the gases being drawn through the cylinder blocks. The inlet manifold as well as the exhaust is cast separately and is attached to the cylinder block by three clamps.

Auto-Lite electrical equipment furnishes ignition, starting and lighting, the generator being of four-pole type with third brush regulation. It is mounted on the left front side of the engine. The storage battery is 11-plate, 3-cell, 6-volt type rated at 80 ampere-hours. It is located beneath the driver's seat. No battery cover is needed, as the wooden seat lid affords both protection and ventilation.

The circuit-breaker is of Auto-Lite rectangular type with the cut-out speed of 6 m.p.h. This is 1½ m.p.h. less than the cut-in speed, thereby avoiding frequent cutting-in and cutting-out when travelling at very low engine-speed. The regulator is mounted on the right gasoline tank bracket. A current indicator, reading charge and discharge, is mounted on the instrument board.

The clutch is a single plate unit of semi-steel mounted on a splendid clutch shaft and clamped between the flywheel and another iron ring by means of a spiral spring. Between the flywheel, clutch plate and thrust ring are interposed two moulded asbestos plates. Pressure is applied to the spring for engagement through three toggle levers by a 300-lb. spiral spring. The entire clutch assembly operates in oil, and is constructed in unit with the engine and gearset, thus giving a completely enclosed part.

The gearset is of practically standard construction. Gears are of the stub-teeth type, and the main shaft is supported at the front end by a phosphor bronze bearing and in the rear by an annular ball bearing. The countershaft is carried in two phosphor bronze bearings, and the reverse idler operates on a bearing of similar material. The gears are nickel steel, the countershaft gears being all made in one forging.

Because of the use of a torsion tube, but one universal is needed on the propeller shaft. This is of double-yoked and double ring type, and is drop-forged with the four pins running in oil and enclosed in a ball and socket joint of malleable iron.

The propeller shaft is of nickel steel, and is supported at the front end on a phosphor bronze bearing and at the rear on a double row of ball bearings, taking both radial and thrust loads.

The torsion tube is carbon steel of round tapered seamless tubing. The front end slides in a ball joint, and the rear end is forced into place by hydraulic pressure and riveted to the propeller shaft bearing carrier.

The three-quarter floating rear axle is carried in a two-part iron housing, carrying the differential, two steel axle tubes and two malleable iron brake supports pressed and riveted together. The differential is a four-bevel pinion type, located concentrically with 12 teeth in the pinion and 24 in the gear. The differential is carried on two annular ball bearings, each capable of taking end as well as radial thrust. The drive pinion and gear are nickel steel and are spirally cut. The pinion contains 10 teeth and the ring gear 45 teeth, giving a reduction of 4.5 to 1.

Pressed steel channel section side bars are used in the frame construction. The springs are secured to the frame at the front end by bolts, and to the front axle, close to the wheels, by eye bolts. The radius leaves act as guides for the front axle. The rear left spring is bolted to the frame and shackled to the brake support on the rear axle, and the rear right spring is bolted to the frame and secured to the brake support on the rear axle with an eye bolt, thus providing the solitary spring shackle construction which is a feature of the suspension system. All elongation of spring centres is taken care of by this single shackle. The car is driven through the springs, the reason given for this being that the stresses on the axle are taken directly at the wheel instead of at the centre, thus permitting the use of a lighter axle and less unsprung weight.

The shipping weight of the car is 1,825 lbs., and the weight complete with gasoline, oil, water, tools and side carrier with extra rim is 1,940 lbs.

Four of the Executives Behind the "Four"

T. A. RUSSELL, president and general manager of Willys-Overland Limited, has been in the automobile business for some time in Canada. Not only is he now president of the Willys-Overland Limited, but also of Russell Motor Car Co., Machine & Stamping Co., and Canada Cycle & Motor Co., and when the word president is used, take it as a fact that there is no reference to the easy-chair, carpet-slipper variety.

Besides his many industrial activities and presiding over the destinies of Toronto National Exhibition as president, Mr. Russell's bent is toward farming and stock raising. He goes in for the real thing in stock, and his farm "Downsview" is the home of stock good enough to bring back the first prize from Chicago International last year and second place at the same event this year.

Tractor plowing has also held Mr. Russell's sympathy and interest for some time—so much so in fact that it would have occasioned no surprise had he turned to the making of tractors when war contracts were over.

Just recently he completed a tour of the West, sizing up the situation from the standpoint of disposing of the pro-



MR. T. A. RUSSELL



MR. J. F. MACKAY

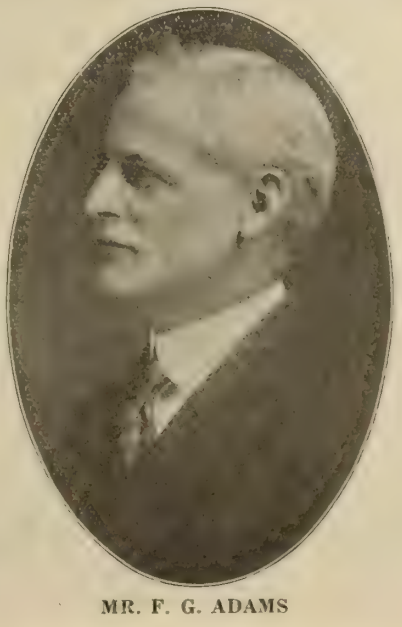
duct of the Toronto plant. He returned and hung out the sign, "Full speed ahead," and that is just what has been happening ever since.

J. F. MACKAY, as business manager of the Toronto "Globe," gave up one of the highest positions in Canadian newspaper work to become associated with the Russell Motor, and later with Willys-Overland Limited, as secretary-treasurer. Whether such a position as "general negotiator" exists in connection with the plant, we do not know, but if such a department were to come into existence, Mr. Mackay would be elected on the first ballot. If there is anyone in the office who has come closer to the men in the shop in a shorter time, we'd like to hear of him.

Speaking of the automobile industry in Canada, and more particularly of the outlook for disposing of the output of the Willys-Overland plant, Mr. Mackay was particularly enthusiastic. The labor troubles at the plant he regarded simply as part of the transition from war to peace lines, and were, he hoped, a thing of the past now. The Canadian market for the Overland Four is very large, and the big problem is not in selling the product of the factory, but in getting the product turned out in large enough quantities.

FRED G. ADAMS, factory superintendent, moved over to the Willys-Overland plant when the war contracts were wound up at the Russell Motor plant. Just now the neat little task facing him is the raising of the production capacity of the plant to fifty cars a day.

Like Mr. Perrin, Mr. Adams came into the automobile business via the bicycle route, in which he had a thorough training. In fact Mr. Adams has had a training covering a broad field, secured largely by individual effort, study, and many worth-while opportunities to observe the best things in machine shop practice and production methods.



MR. F. G. ADAMS

Mr. Adams believes in the Overland Four—he must, because he drives one—a neat Sedan type. He drew attention particularly to the manner in which material is routed in the plant, to the inspection of everything entering the car before and after assembly, and to the efforts that were being made to eliminate "chance."

Mr. Adams had much to do with carrying out the large shell contracts of the Russell Motor Car Co. The appreciation of the munition workers of Mr. Adams' assistance and fairness there was shown in a most tangible way, when they were leaving at the expiration of the contracts. On that occasion he was given a handsome grandfather's clock. It's a fair compliment to be "presented" when you are not leaving, but left, as was the case then with Mr. Adams.

J. G. PERRIN, assistant manager of Willys-Overland Limited, is an automobile man through and through. He knows cars and knows them thoroughly. He has designed cars of the racer type



MR. J. G. PERRIN

that have successfully contested some of the classics of the auto racing world. The U.S. Government was quick to recognize his worth during the war, when he was summoned to Washington as a member of the Aircraft Production Department. It was in this way that he came in touch with the aircraft division of Willys-Overland Limited. Shortly after this, at the suggestion of the Willys-Overland Company, and with permission of the U.S. Government, Mr. Perrin took charge of the making of aircraft motors at the Toronto plant. Before the conclusion of the war the company was turning out five Sunbeam-Arab airplane engines in an eight-hour working day.

The Overland Four is largely a car designed on lines worked out by Mr. Perrin. "There is no doubt," said Mr. Perrin, "about the new model being absolutely certain. The car was thoroughly tested for two years before we adopted the final design, and we are making that car now."

gas furnaces and Rockwell furnaces of various types. It is here that the cam shafts, etc., are decarbonized. Each shaft is placed in separate tube, heated to 1,650 degrees F., then left overnight to cool.

The valve tappets are hardened by the lead bath process, in a special holder, which accommodates five at a time. In this same department is a blacksmith shop for general work of such nature required throughout the plant. A very interesting installation in this portion of the plant is a Beighler pyrometer, controlling, if necessary, twenty furnaces. By this means one can tell at a glance if the different furnaces are up to their proper heat.

Work Accomplished on Various Floors

Pistons, connecting rods, front axles, rear axle housings, brake supports, exhaust manifold, inlet manifolds, water elbows, inner brake bands, and other portions are made on the second floor, while on the third floor between one hundred and fifty to one hundred and seventy-five different parts are made. Each part is followed through in proper sequence, thus eliminating all unnecessary motion.

On the fourth and top floor of the building is situated the tool room where all jigs, fixtures, etc., are made. This is a department well equipped in every respect, even to the smaller machines shown at Fig. 24. These small lathes and miller shown at the right of picture are Pratt and Whitney products and are used on very small pins, etc., which are often necessary for jig and fixture work.

Further Progress of the Car

Having commented on the routine of operations, let us continue to study the partially completed chassis where we left it, and follow it through to its completion. To refresh our memory suppose we once more glance at Fig. 2. We note that up to this stage no radiator has been placed on the car. The placing of this radiator is the next step, after which the car is placed on rails, shown to the right of Fig. 2, and passes gradually along, parts being added as it proceeds.

Fenders, etc., are placed in position, and bodies are lowered through a hole in upper floor onto the chassis. From this stage the progress is very rapid. All connections are tightened up, bolts screwed into position, electrical connections made and other various details too numerous to mention.

On reaching this final stage they appear as shown in Fig. 25.

The car now being completed, the gasoline tank is filled and ready for the road test. In a moment of enthusiasm the writer suggested that he actually go with the driver on this road testing tour, and he did—but—well, at least, he can write from personal experience.

The Road Test

We went eleven miles altogether, and over such roads as, bad as our Canadian roads are, never, in my mind at least, existed before.

In some cases we went into holes and ruts that while they have so far not reached China, have not far to go. Bump, bump, bump, we went on. At last I ventured a remark to my driver, who seemed glued to his seat, so engrossed was he in his task, "Won't you break the car at this rate of going?" I enquired. "Nope," was the reply—"they all get the same treatment." I mentally figured out how this driver's inner works were holding out under these daily tests. One point I noticed, was that in spite of the extreme rough going, the riding was not nearly so unpleasant as might have been expected. Had it not been that my driver seemed to grumble if he did not hit at least 90 per cent. of all the holes and ruts on the road, I might have enjoyed my ride. "See this hill ahead," spoke up the driver. I nodded, and he continued: "Starting at the bottom at 5 miles per hour, we must finish at a speed of 25." Personally, I had my doubts if we would do it, but I felt—that, well—time would tell, so sat tight and waited for the hill, which was really a hill and not a mere mound. We slowed down to 5 miles per hour, then up we went, gaining speed evenly and steadily until



FIG. 25—THIS ILLUSTRATION WILL GIVE READERS A GOOD IDEA OF HOW THE CARS COME DOWN THE ASSEMBLING RAILS.

actually 28 miles per hour registered on the dial when we reached the crest of the hill.

Soon we returned to the plant, none the worse for our drive, and with my mind thoroughly made up that one position I would leave strictly alone was the testing out of these cars. Never has it been my privilege to witness such a thorough test.

During these tests, should any trouble develop, the car is taken back to the factory and the trouble remedied. As a general rule, however, this condition seldom happens. A final road test is always given by the chief road inspector after the preliminary tests have been gone through. Until such time as he places his O.K. on the car, it is not considered as a completed article.

After completion it is shipped in the usual manner, this department being also well equipped with side tracks and other shipping facilities.

As a conclusion to this article we might add that the making of an automobile is a bigger proposition than many imagine. The machine tool equipment must be of the very best, the mechanics employed must be of high standard, and, to obtain uninterrupted production, considerable planning and arranging of operations must be accomplished.

This task requires executives who thoroughly understand the requirements of such a plant, and we feel safe in saying that it is the lucky choice of these various heads which has accounted for such remarkable progress.

CANADIAN MACHINERY asked these gentlemen to state briefly their viewpoint on their pet subject and they have kindly done so.

On one page of this article portraits of these men, with their statements appear, and we cannot do better than say "read and digest," for what they remark is right to the point.

At some future time we hope to show other operations on this car for the perusal of our readers.

Broaching as an Aid to Greater Production

The Third and Last of a Series on the Above-Mentioned Subject. Interesting Examples of Set-Ups Are Given, Which Should be Especially Valuable to Tool Designers

By FRANK H. MAYOH

IN making up this final section on broaching practise mostly examples of set-ups will be shown, and it is in this branch of the subject that a tool designer may display his ingenuity; here he may decide how many parts can be successfully handled at one time, the type of fixture needed, means of locating, and other such points as it is customary for a tool designer to determine. This distinction is made between broaches and fixtures for holding the work, because in designing broaches the designer must be largely governed by what

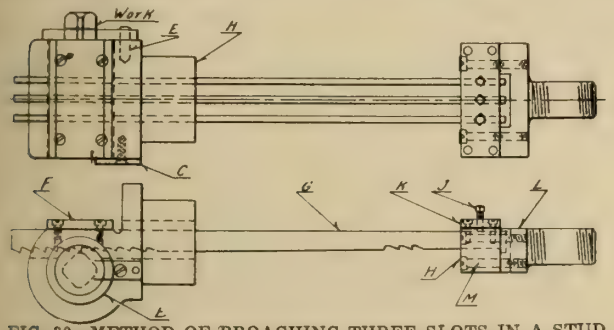


FIG. 30—METHOD OF BROACHING THREE SLOTS IN A STUD.

practical shop experience has proved commercially practical, while fixtures, being a combination of new elements for each job, dependence need not be so completely based on what has gone before.

An example of external broaching three slots in a stud is shown by Fig. 30. This consists of a fixture for holding the work, and a special broach holder to grip three broaches. Referring to the illustration, the work holder A is made of cast iron, and it has a hole B bored through it; in this hole the work is placed, the end coming against the plate C to locate it endwise; a plate D having a square hole cut through it fits over the square on the work; this plate also has a hole in it which fits over pin E, thereby locating the same radially. A hardened steel plate F backs up the broaches G as they are drawn across the work in the position shown, while at the opposite end the broaches are held by the block H and screws J contained in the cap K, all of which are attached to the threaded shank of the holder L by screws M. In this instance, advantage is taken of the square on the work, to prevent it from turning

This makes a very substantial broaching arrangement, and the result is very smooth, accurate work.

Mention having been made of enlarging holes in hardened parts by the use of broaching machines, an example showing this class of work is illustrated by Fig. 31. The work is a sliding gear, and when hardened it naturally closes in unequally, owing to the uneven distribution of metal in its construction. To correct the hole and remove these inequalities, a broach similar to that shown below the work is drawn through it. This

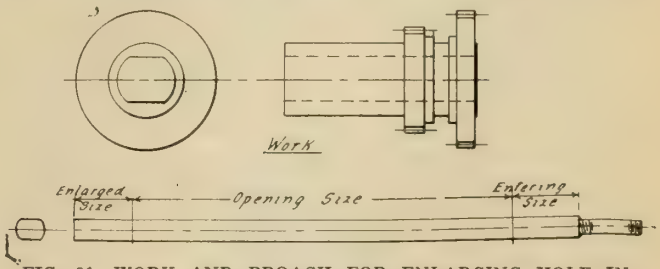


FIG. 31—WORK AND BROACH FOR ENLARGING HOLE IN HARDENED GEAR.

is simply a smooth bar having the entering end small enough to pass through the smallest part of the hole, and a gradually increasing portion which opens the hole to a size a few thousandths larger than the hole desired, so that after the broach has passed through it will spring back to the size required.

For broaching spiral holes having a long lead, a suitable arrangement can be made by locating a ball

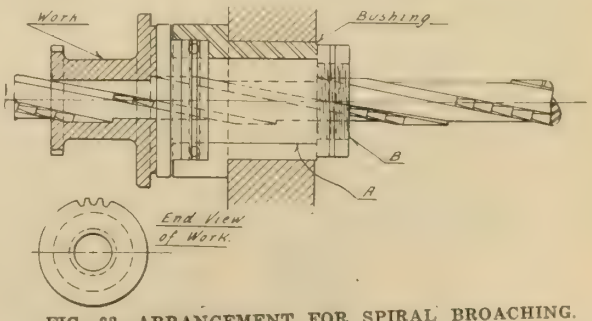


FIG. 32—ARRANGEMENT FOR SPIRAL BROACHING.

bearing thrust washer in a work-bushing similar to that shown by Fig. 32. This is so arranged that the work will revolve as the broach is drawn through it, and consists of a revolving pad A against which the work comes; check nuts B keep this revolving pad in the bushing, and the ball bearing takes the thrust of the cut in the usual manner. This makes a bearing which easily revolves under the cut, thus allowing the work to follow the angle of the spiral.

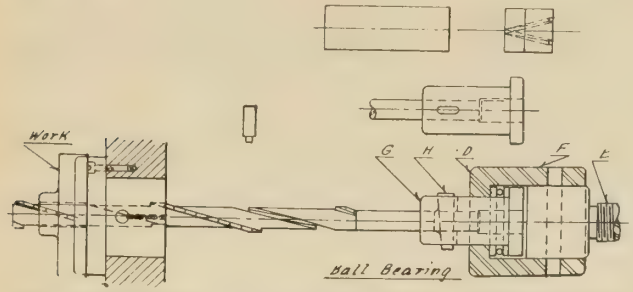


FIG. 33—METHOD OF SPIRAL BROACHING WHERE BROACH REVOLVES.

Another spiral broaching arrangement where the broach revolves instead of the work is illustrated in Fig. 33, and consists of the following parts: A work-holder A is held to the face-plate of the machine by screws B; this work-holder has a slot cut across its face, and the work being rectangular in shape is prevented from turning thereby. Two pins C are held in place by screws D, and these are flatted to fit slots cut in the broach, which pins are set to conform to the angle of spiral of the broach when they are in place in the

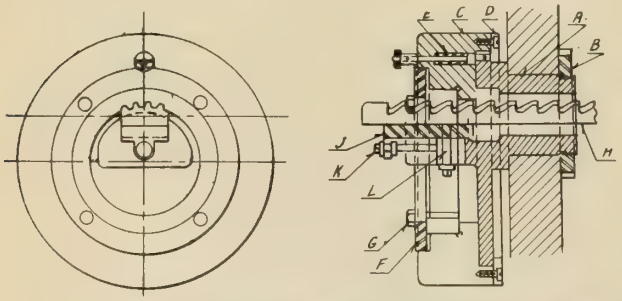


FIG. 34—METHOD OF BROACHING AN INTERNAL GEAR.

holder. The broach-holder shank E has a sleeve F over it, and this contains a ball-bearing thrust washer D in it; a broach-holding portion G having a head on it comes against the ball bearing, and thus the thrust of the cut is taken directly by this ball bearing. To hold the broaches in position, a key H passing through a slot in the broach is used. In operation, as the broach is pulled through the work, the guide pins C in the slots of the broach cause the broach to revolve as it is drawn through the work, and as the ball-bearing construction at the pulling end allows it to do so, spiral keyways are broached very nicely. At the lower left-hand corner of

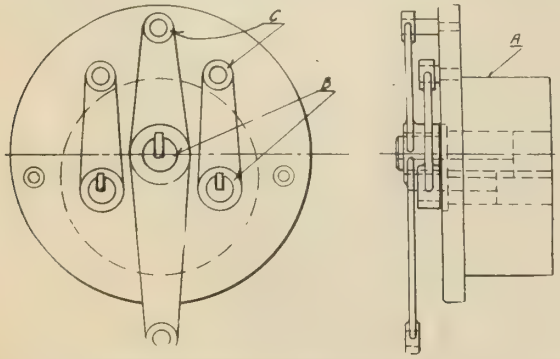


FIG. 35—FIXTURE ON WHICH THREE LEVERS ARE BROACHED.

this illustration, two views of the work broached are shown.

An indexing fixture used for broaching teeth in an internal gear is shown by Fig. 34. This is held to the face-plate of the machine, and is set off centre so the broach will pass through the centre hole of the machine. Referring to the illustration, the body of the fixture A is securely held in the face-plate of the machine by a collar B. This has a work-holding member C held to it by a strap D. A spring pin arrangement E locates this member C at ten different points about the centre. The work is held in place by a strap F and four bolts G. In operation, the broach H is passed through the work once and then returned to its starting point, following which the work is indexed in the fixture to the next locating holes successively until the broaching is completed. In this fixture a wedge J backs up the broach, and this has a slight adjustment for wear, by means of the screw K, while it is locked in position by a screw L.

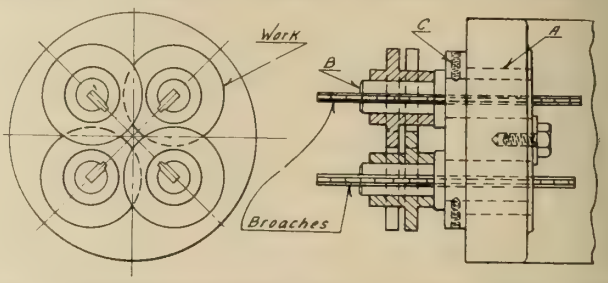


FIG. 36—EXAMPLE OF BROACHING FOUR OVERLAPPING PARTS AT ONE TIME.

For broaching large gears, a number of keyways and other parts which would require an extra-large broach, this method will often prove the most economical and sometimes the only practical method of machining.

The next two illustrations, Figs. 35 and 36, show examples of group broaching, both of which are keyway-broaching fixtures, one for levers and one for gears.

Referring to Fig. 35, this fixture A fits into the face-plate of the machine, and the levers are located on work bushings B and pins C, while three broaches are pulled through the levers.

In Fig. 36, the large bushing A contains four work bushings B, which are held in position by the screws C, and the broaches operate in the usual manner to cut the

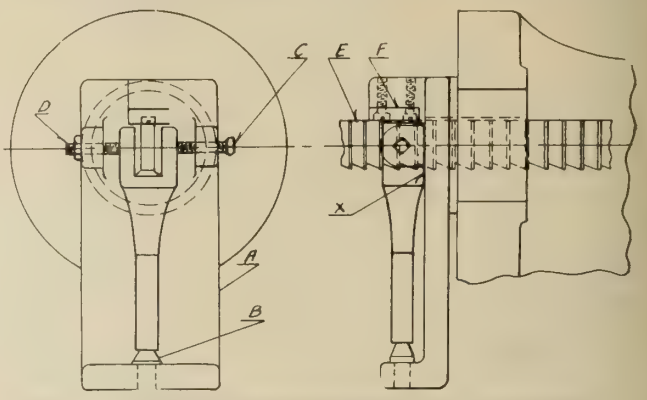


FIG. 37—FIXTURE FOR BROACHING LINK CONNECTION.

keyways. The gears held on this fixture are staggered, the short hub on one being arranged with the long hub on another so the gear portions will clear each other.

A fixture, in which a link connection has the slot broached in it, is illustrated by Fig. 37. This link has the centre hole drilled in it at the lower end before broaching, it otherwise being rough; this centre hole is used for locating purposes, as the body of the fixture A, which is attached to the machine in the usual manner, has a centre B in it, while a screw C holds the upper end lightly in position against the locating screw D; the work rests against the body of the fixture at X while

the broach E is pulled through it. A hardened steel plate F backs up the broach during this operation.

Broaching a slot in the outside of a ring is accomplished very neatly by using the fixture shown by Fig. 38, where a cast-iron body A has suitable provisions made for holding a large ring while a broach B, supported in a guide-bushing C, cuts the slot. This guide bushing has a groove machined in it to support the work while a slide block D, operated by the screw E, clamps the work. This screw has a head on it which fits a counter-bored hole, while a plate F keeps this screw in place. The stud G has a tapped hole through it, and the screw E, operating in this hole, moves the slide in and out to bind the ring while, at the opposite side of the ring, a hook bolt H, with a hand knob on it, clamps the work against a finished seat on the arm of the body of the fixture. At the upper right hand corner of this

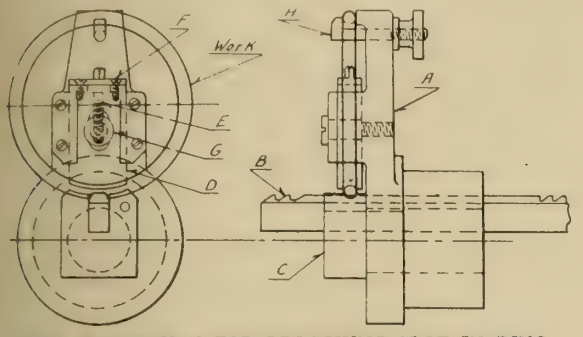


FIG. 38—FIXTURE FOR BROACHING SLOT IN RING.

illustration, a section showing the broached slot in the work has been drawn. It will be readily apparent that this fixture makes a very simple and effective method of holding the ring for this operation.

The purpose of the broach shown in Fig. 40 is to enlarge the holes in soft material and, by compressing the metal, give the holes a glazed finish, thus producing a harder surface than would be possible by reaming.

The two illustrations below this broach show typical examples of work handled in this manner, these being bronze bushings. The finishing teeth for this purpose are made slightly larger than the finished size of the

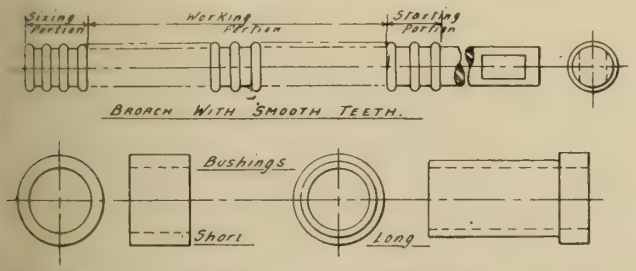


FIG. 40—COMPRESSION BROACH AND EXAMPLES OF WORK.

hole, to allow for spring in the metal, while the amount compressed is usually about the same amount as is allowed for reaming.

For broaching the two slots in the open end of a yoke, a fixture similar to that shown by Fig. 41 was used. The body of the fixture A is made of cast iron, and has a stem turned on it to fit the hole in the faceplate of a draw broaching machine; there is also a pin B for locating the work, while two screws C and two locating screws D, one against each arm, hold the open ends in position. The plate E slips between these open ends and into slots at both sides of the fixture, while two wedges, F and G, when driven into position, form a solid backing for taking the thrust of the cut as the broach H is drawn across the work. Two plates, J and K, back up and help to guide the broach, which forms the sides and radius at the same time.

This fixture is one of many which form a class for locating from finished surfaces to bring broached surfaces in line with them; they vary but slightly from the general run of work holding fixtures, the most important feature, in addition to proper locating points, being to hold the work rigidly at the broached points to counteract the severe stresses of straight line cutting.

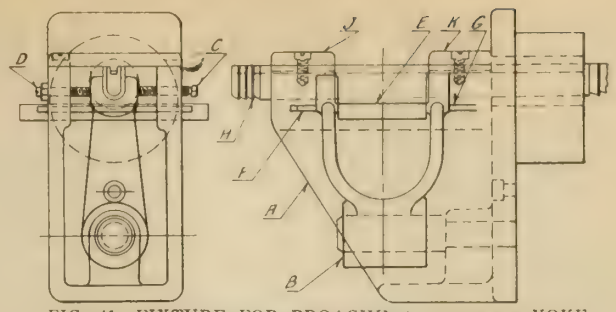


FIG. 41—FIXTURE FOR BROACHING SLOTS IN YOKE.

During the repairs on a 1,900-ton drawbridge, located where the Lincoln Highway crosses the Passaic River near Newark, N.J., it was found necessary to remove the centre casting and pin, the latter being so tightly wedged that it was impossible to pull it from the casting.

After several unsuccessful attempts to draw the pin from the casting, below which it projected down 3 inches into the masonry, it was found necessary to cut a trench in the hard granite so that the casting might be shifted laterally to one side for removal and replacement by a new and larger centre casting. This trench was 4 feet long, 9 inches wide and 3 inches deep, extending under the old casting.

The cutting of the trench would have been an endless task had it not been discovered that an oxy-acetylene flame chipped the granite quite readily and could be used under the old casting without damaging the balance of the masonry. The desired channel was thus quickly obtained. The flame was also used for cutting away the abutment back of the fixed span bottom chord to provide expansion clearance. This work was under the supervision of T. J Wasser, county engineer of Hudson County, N.J., and was done by the Bethlehem Steel Bridge Corporation, with Thomas D. Fulton as erection engineer.



Why Do We Stand For This?

The Day of the *Apprentice* Has Not Vanished

The Stratford Shops of the Grand Trunk Maintain a Merry Army of Young Men Who Are Thoroughly Schooled in the Working of a Locomotive

By A. R. K.

THE world moves, and the apprentice moves along with it. At least he does as far as the Grand Trunk shops are concerned. Apprentices used to start at 3.4 cents per hour, while now they begin to learn the why and why not of the mechanical world at the sum of 29 cents per hour.

The Stratford classes of the Grand Trunk shop have always held a premier position in the organization. It is interesting to notice the way in which apprentices line up and wait for a chance to get in there. In fact, it is somewhat of a relief to see the size of the classes and the calibre of the boys in them. It is not unusual to hear a manufacturer sigh and say: "We have no apprentices in our shop." In such a case one can almost with certainty put it down that apprentice training is not seriously considered in that shop. The shop that trains apprentices, that teaches them and uses them fairly is going to have a good supply of apprentices. The shop that wants an apprentice as a chore boy, or to get a day's work out of him after he has been around the premises for a week or so, is going to have a poor and a hard time trying to interest the apprentice. Such a shop has nothing to offer the boy, and the reputation of the place travels quickly and acts, as it should, as a signal and a warning.

In the first place the Grand Trunk apprentice must have a certain training before he is taken on. That eliminates right at the start the lad who has no particular interest in his work, and it gives the apprentice instructor, both in the shop and schoolroom, something to work on.

The Five-Year Term Again

The Grand Trunk are reverting to the old term of five years for apprentices. For some time they were put through in four years, but the change has come into effect within the last few weeks, and in the future the five-year period will be in force. The McAdoo schedule for railway employees is probably behind the scale that is paid now. Here are the amounts paid to apprentices per hour under the new scale. Along with it is given the scale for four years, which has just been abandoned:—

	Old Scale	New Scale
First six months	25	29
Second six months	27½	31½
2nd year, first 6 months	30	34
2nd year, second 6 months	32½	36½
3rd year, first 6 months	35	39
3rd year, second 6 months.....	37½	41½
4th year, first 6 months.....	42½	46½
4th year, second 6 months.....	50	54
5th year, first 6 months	..	60
5th year, second 6 months	..	69

The apprentice in the Grand Trunk shops has an option of the following trades:—

Blacksmithing.
Boiler Making.
Tinsmith and Pipe Fitting.
Pattern Maker.
Machinist.

It is hard to state with accuracy what percentage of apprentices go through for the various courses, but the last class named, viz., machinists, would embrace by far the most.

The Grand Trunk aprentice is looked after in the shop and in the class room. The shop instructor sees to it that the apprentice is moved on, that he becomes the master of every operation in the shop, and even though there are a large number of apprentices going through, there is no stinting with individual instruction. The day the writer was in the shops this was clearly demonstrated. One lad was on a lathe for the first time. He was not getting along—in fact, he was getting tied up. The instructor saw where the boy had gone wrong. He did not shout at him or "bawl him out." He simply did the thing that would help the boy most, viz., start right at the beginning, show him exactly how to put his work in and true it up and then set the tool, etc. The boy was not long before he was gaining, but the instructor was in no hurry to leave, and before he was done that lad understood that operation coming, going, upside down or sideways. I thought at the time that that might offer the explanation as to why there was always a waiting list of apprentices at the Grand Trunk shops in Stratford.

The putting of an apprentice along from one rate of pay to the next is accomplished by certain attainments on the part of the apprentice himself. The Grand Trunk shops are not run on any hit and miss basis, neither are the apprentices lost sight of after they are indentured. The full time must be made up in each period. That is, if an apprentice is out for a couple of weeks in his first six months, he must make up that time before passing along to the pay of the next six months.

In the Classes

The Stratford shops have class rooms that are ideal for all the purposes of apprentice instruction. The rooms can be thrown into one large assembly hall, and social gatherings are frequently held for the boys.

In a general way the first year's instruction in arithmetic takes in addition, subtraction, multiplication, division, and the same work applied to decimals, vulgar fractions, etc. Percentage is also included in the first year apprentice work.

The second year takes them into involution and evolution, mensuration, triangles, circles, rings, cylinders, solids, cubes, ratio and proportion, while in third year work the apprentice passes to the more advanced forms, such as equations and formulae, transmission of motion, pulleys, gears, lathe gearing, uniform motion, horse power, steam engine, friction, etc.

What a Difference

Do the Stratford shops turn out good mechanics? Well the Stratford shops have a reputation for turning out a tremendous lot of good work, and good work and good mechanics generally travel along together. Mr. Robb, vice-president of the Grand Trunk, is a graduate of Stratford, so was Mr. Maver, late superintendent of the Montreal shops, as well as Mr. George Wilson, the present holder of that position. Mr. Battley, superintendent of the Eastern lines, was also trained at Stratford, and Mr. McDonald, assistant superintendent of the Montreal shops, is another. And Mr. Jos. Chidley, general superintendent of the Lake Shore Road, comes on the same list. Mr. Robert Patterson, now retired, but for many years master mechanic at Stratford, also came up through the Stratford shops.

J. C. Garden, now superintendent of Motive Power at Stratford, was a Stratford apprentice. "It's quite a bit different learning a trade now to what it was when I first came here," remarked Mr. Garden to CANADIAN MACHINERY. Mr. Garden, by the way, talks to the in-

terviewer, gives instructions to clerks, answers the phone and pushes buttons all at the same time. In other words he's a busy man and the Stratford shop is a busy place. Mr. Garden has "growed up" with the Grand Trunk—in fact he was a foreman at the age of 21, and he's been going ever since.

But to get back to the brand of days that existed when Mr. Garden started to find out the mechanical wherefore of the Grand Trunk shops. "Let's see, we used to get in those days a scale that ran something like this—First year, 3.4c per hour; second year 4.5c; third year, 5.6c; fourth year 6.7c., and fifth year 7.8c. After that, if the apprentice turned out to be a very good mechanic he got 15 cents per hour, but if he didn't the chances are that he was let out. That's quite a difference to the scale as it stands to-day. Starting now at 29c against 3.4 and ending at 69c against 7.8. It's hard to say if the apprentice is any better off on account of the higher wages. It works differently in different cases. An apprentice on the present scale can really become self-supporting and more or less independent of home influence or restraint. This does not often happen, but it can.

"Of course there were no classes for mechanical drawing or arithmetic in my apprenticeship days," continued Mr. Garden. "I can remember when about a dozen or so of us decided to study drawing. We bought our own material and drawing supplies, and then paid for our teacher. That cost as near as I can remember about $1 per month. Not much, you say. Well, when you consider that apprentices then were earning about $6 a month, it was quite a sum. But for all that they always had an apprentice waiting list about a mile long.

"Then there was a class organized by some of the apprentice boys who wanted to study arithmetic. No classes then on the company's time. We hired a room down town and engaged one of the school teachers to come there at night. Then there was something else to consider," remarked Mr. Garden, "the place had to be heated. We used to put our own fires on, and after the room had become sufficiently warm the class would commence. The woodpile that we had in connection with our school was a mark for someone in the neighborhood and we had a merry time of it trying to keep track of our supply of fuel."

But the apprentices of the day when Mr. Garden went through were going to master shop arithmetic and mechanical drawing, and they did. Speaking of drawing brings to mind an incident told me at the Stratford shops. It shows the interest Mr. Garden still feels in the boy who wants to get along. An apprentice, a returned man by the way, had been working studiously at home trying to get a drawing in shape for the Exhibition, when word came placing the closing date at a time that would make it quite impossible for the boy to get his drawing in shape, as it was an extensive affair, with a very large amount of detail involved. Mr. Garden heard of the incident, called the apprentice to his office, and inquired about the drawing. The apprentice informed him that it would not be possible for him to get it done in time.

Asked as to how long it would take, the answer was that a couple of days "if laid off," would see it done.

Whereupon Mr. Garden informed the ambitious draftsman that he was to use the drawing room at the shops, and stay with it until he was finished, and that no time would be lost.

Time was when Mr. Garden looked in directions quite separate and apart from the railroad shops. If one were to go back far enough it would probably be found that the parents had a Scotch Presbyterian pulpit picked out for him, while not many years after Mr. Garden had a law career mapped out for himself. As a matter of fact he read law and studied shorthand at nights, preparatory to studying with one of the Toronto firms. The law was a poor trade just then, however, and a number of very capable lawyers were seriously and anxiously looking for something to do that had a real meal ticket hitched to it. So it was that Mr. Garden was lost to the pulpit and the bench, but he found his element in the railway world.

The Days of Shop Secrets

"A boy going through our training," remarked Mr. Garden, "learns a real trade. If he applies himself and

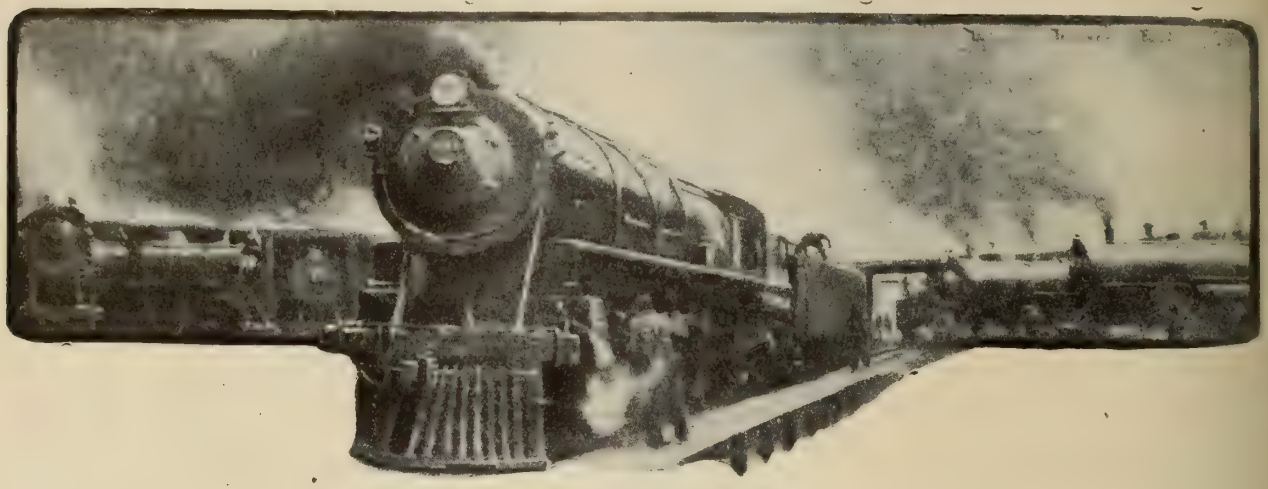
WHO SAID THE DAY OF THE APPRENTICE HAD PASSED?



THE 1919 APPRENTICE CLASS AT STRATFORD SHOPS OF G.T.R.

takes advantage of all the opportunities here, he can go out nothing short of a mechanical engineer. There is a great difference in what the apprentice can learn now, and the ease with which he can learn it. The day of the trade secret has passed away. For instance, the setting of valves on the locomotives used to be a real secret. It was so much so in years gone by—and remember, I am speaking of a number of years ago—that one of the foremen wanted to watch an old hand setting valves, and so informed him. He was greeted by something like this:—'You get to —— out of here. If I'm going to set valves you're not going to watch me. I paid well to learn that trick and I'm not handing it out free.' The upshot of the thing was," laughed Mr. Garden, "that the foreman had to get out while the old man set the valves."

The apprentice in the Grand Trunk shops does not have to work long now before he has a chance to become familiar with slide valves. It is not the policy of the shop to have any secrets. They want men who know the locomotive, valves and all, and nothing is held back from the boy who wants to go ahead and learn.



More Attention Needed for the Average Boy

IF one were to ask Robert Patterson, formerly master mechanic at the Stratford shops of the G.T.R., what part of his life work had had the strongest appeal to him, my guess would be that he would say "The apprentice classes." Mr. Patterson is now superannuated, but has not lost any of his interest in the work to which he gave the best years of his life.

Although Mr. Patterson did not start his apprenticeship at Stratford, he completed it there. After going through the Model School at Toronto, he entered the Grand Trunk shops at Montreal in 1874, but went to Stratford three years later. Becoming a journeyman, Mr. Patterson went to the big Baldwin works, returning in 1882 as foreman of the machine shop at Stratford. He was made general foreman of the Midland Railway at Port Hope the same year, and from 1883 to 1887, was locomotive foreman at Montreal. It was in 1888 that Mr. Patterson was made general foreman of the shops at Toronto when the G.T.R. got possession of the Northern and North Western Railway. Acting assistant master mechanic at Gorham from October to December, 1896, and in 1897 general foreman of the Port Huron shops. The same year Mr. Patterson was made master mechanic of the lines west of St. Clair River. In February of 1899, the Grand Trunk made Mr. Patterson master mechanic of the Stratford shops. He retired, on the advice of physicians, almost two years ago.

Such, in brief, is where Robert Patterson has been, but it does not record what he has done. You hear much of the latter from the apprentices—now mechanics, and good ones—who came through the shops under his direction. To all these he was not merely "the boss," but more. He was their friend—their ideal of what a real railroad man should be.

I spent an afternoon with Robert Patterson in his pleasant home at Stratford a few weeks past. We talked of many things, but no matter how far astray we went, it was not long before the drift was back to the question of a real chance for the average boy. Not the boy whose parents could school him to the limit by their wealth and position, but the average boy, the lad who had, sooner or later, to get out and make good off his own bat.

"The ordinary man is the one we have to deal with," is Mr. Patterson's starting point. "I have my doubts if we have ever done enough in our schools for the ordinary



ROBERT PATTERSON
For 20 years master mechanic of G.T.R. at Stratford—now retired.

boy. We are making it possible for the best technical schools to be cornered in the cities, and it becomes almost as great an undertaking for a father to send his boy there as it does to give him a university education. Sooner or later we must realize the necessity of looking after the boys who live in the smaller centres. We must prevent them as much as possible from drifting out and growing up as laborers."

"Well, how would you go about it?" I asked.

"Schools right in the shops," was the answer of Mr. Patterson. "Have trade schools with travelling teachers who are specialists in their lines. Let shops in similar lines of work in a district come together for this purpose. The apprentice who goes into a shop has a right to know what he is going to get there. That shop has the boy in those important years which are going to determine largely what sort of a man or mechanic he is going to be in after years. Every apprentice should be educated along the lines that he is going to work on in after years. If this is done what happens? The boy becomes an intelligent apprentice, he turns out to be a first-class mechanic, with sufficient knowledge to enable him to go to be a foreman, a master mechanic or superintendent. What do the shops and factories get out of it? A better class of mechanics, a better output and a satisfactory supply of skilled men. Give the boys the very best teaching of the things they are going to need in shop practice, and be careful to cut out the things they will not need. Make a drive on the subjects that men have had to work nights to learn."

Mr. Patterson holds firmly to the belief that we have no right to shape our schooling so that the advantages will be for those who are able to go to our higher schools of education. "The average boy is the lad we have to deal with in nearly every case," is his idea, and it's hard to see where one is going to find good reason or ground to dispute this claim.

But what of the apprentice who enters a shop where he is going to get a training worth while? Mr. Patterson does not by any means favor the building up of any jug-handled arrangement by which the apprentice would have nothing to do but come in and take advantage of the training.

"Keep up the standard of the shop. Keep up the standard of what the boys must know before that shop will take them in, and you will find you are doing a lot to raise the standard of the whole community. Boys should not be allowed to have a period in between the time when they leave school and when they begin to learn their trade. Any man who has dealt with apprentices has seen this work out. A boy leaves school as soon as the school age allows him to do it. He starts out to look for a job—commendable, no doubt. But what happens? He spends a year or so driving a grocery or a butcher rig before he realizes that he has made a mistake, and wants to learn his trade. In that year he has had little chance to use what he learned at school. His asset has been his knowledge of the streets and houses in the town or city and his ability to drive a horse. When he starts in a machine shop, he really knows less, from that point, than when he left school. A good examination, fairly stiff, based on the essentials, should be the starting point of the apprentice. Make your training worth while, but let the boys understand that they have got to come up to the scratch in order to qualify, and they will come."

CENTERING LARGE SHAFTS WITH A PNEUMATIC DRILL

By F. A. McLean.

In many shops it is sometimes necessary to centre shaft or other pieces of machinery which are too large to be readily handled on an ordinary centering machine or in the lathe, and where machines of sufficient size are in use, the time consumed in lifting the pieces to and from the machines is often an objectionable features. To anyone who is confronted with this problem, the following description of a pneumatic centering rig used by a large manufacturer in the eastern part of the United States to centre large shafts may be of some interest.

The size and weight of the shafts made handling costly, and in view of this fact it was thought that some form of portable centering equipment would be of value. A number of methods of doing the work were tried out and abandoned for one reason or another, until the pneumatic centering device shown in the accompanying illustration was worked out by the company's engineers.

From a little study of the photo, it will be seen that this centering fixture consists essentially of a pneumatic drill supported in a cradle formed by screwing steel rods into the back of a three-jawed universal chuck. The rods were placed in such a way as to prevent the drill from turning, and were fastened at the free ends to a round steel plate. The star feed wheel which is usually fitted to air drills was removed, and a round hand wheel with a rolled edge used in its place. In operation the chuck end of the device is slipped over the end of the shaft to be centered, the jaws are tightened sufficiently to resist the thrust and the drill is started. After drilling to the required depth with a combination drill and centering tool, it is only the work of a few moments to loosen the chuck and go on to the next shaft which may be of the same or another diameter, as the universal chuck readily permits shafts of various diameters to be centered without the use of bushings, etc., and with full assurance as to the ultimate concentricity of the hole. The entire device being light in weight, easily handled, and speedy in operation has proved of great value for this work.



USING THE CENTERING OUTFIT DESCRIBED.

According to the "Engineering News Record, a superintendent was annoyed to find that a crew of carpenters did not attend to their work properly, while a derrick was periodically swinging its load over their heads. The men invariably stopped work to watch the loads pass by. A canvas awning was stretched over the carpenters' benches. This was obviously no protection at all against a falling object; nevertheless, it served its purpose, because the carpenters were unable to see the work of the derrick, and although they knew that the loads were passing over them, they did not stop and stand ready to dodge if the derrick should let go. This device resulted in the saving of 10 per cent. of carpenters' lost time.

Reed Small Tool Works, Cherry Street, Worcester, Mass., are sending out their new catalogue, No. 4, in which a revision of list prices is noted. This booklet, consisting of forty pages and twenty half-tones, covers the Reed line of micrometers much more fully than any of their descriptive matter heretofore issued, and shows a greatly broadened line.



JOHN PATTERSON

Mr. Patterson came with the company at the age of 46, and spent 29 years in the lumber yard and Saw Department.



GEO. IRWIN

He retired at 77 years of age, with 19 years' service to his credit, most of which he spent as an expert.



HARRY PAYNE

For nearly 32 years in the No. 1 Machine Shop. Now 70 years of age, with the Massey-Harris Co. for 32 years.



JOHN VALENTINE.

Of the Knife Department, retir with 22 years' service to his cred at the age of 71 years.



WM. LOWRY

Ten years at Brantford shops, then in Toronto. He has served 38 years here, making 48 years in all.



HARRY FRICKER

For 32 years employed in No. 1 Machine Shop, retires on the Pension Fund. Harry wears medals for Fenian Raid and long service in militia.

After They Have Done Their Bi

ALTHOUGH there are no actual figures prepared yet, showing on what basis the pension scheme will be operated, about thirty of the employees of the Massey-Harris Company have gone on the pension list, provision for them being made temporarily out of the capital of the company. It was in April of 1919 that the directors approved of the idea, and, although there has been a lot of investigation carried on, the plan to be ultimately adopted has not been completed. The matter is now in the hands of a firm of actuaries, and on their report, if it is feasible, will be based much of the machinery for putting into effect the pension fund of the Massey-Harris Company.

So far the pensions are running from $25 to $40 per month, depending largely on the length of service. In time, when the whole plan is worked out, there will be a definite statement, put down in black and white, and the man entering the employment of the firm will know exactly what he can expect in the way of pension.

The Ideal System

Mr. J. N. Shenstone, first vice-president of the Massey-Harris Co., discussed the matter at some length with a representative of CANADIAN MACHINERY. "The ideal pension system," said Mr. Shenstone, "is not one that provides for the man in his old age only, but goes on and provides for his dependents. "I'll grant that such a thing takes a long time to work up to, but it is coming. We want the men here, when they come to the point where th are entitled to a pension, to feel that th are not getting anything in the shape charity. We want them to realize th they have, through their years of servic earned the pension which they are startin to receive, and that they have a perfe right to it."

Where It Does Not Work

Mr. Shenstone went on to speak of th experiences of other places that had worke along these lines. One instance came u where not long ago an employee of a certai shop was urged to go on the pension list He did not like the idea of quitting work Like many another man he still held to th belief that he could still hold up his end in a day's work as well as when he was twenty-five years of age. The result was that one day, after walking home and feeling very much exhausted by an extra effort on account of the failure of transportation facilities, he dropped dead shortly after reaching his home that evening. Now, the pension, had he taken it, would have helped him very little. The persons needing help are those who are left without the earning power of the bread winner.

"So far," stated Mr. Shenstone, "we are simply making provision for pensions out of a lump sum set aside by the shareholders for that purpose, but we intend to have a fund invested for the purpose, and use the interest to sustain the pension fund. That is the only way to put it on a substantial basis.



PATRICK HARDING

For 21 years in employ of Massey-Harris, lately on elevator in Cream Separator Department, retires on the Pension Fund at age of 73.



ARTHUR WALL

Retired under the Pension Scheme, at the age of 68, after 30 years' service, mostly in the Malleable Department.



LEVI DAY

Retired under the Pension Scheme, at the age of 75, after 20 years' service, mostly in the Malleable Department.



JAS. RICHARDSON.

As repair man in the machine shop, Mr. Richardson was 32 years with the firm. He is now 70 years of age.



HENRY DUNSFORD.

low 77 years of age, was in the onstruction Department at Toronto for 17 years.



WM. WATSON

Sixty-three years of age, 36 of which he spent as an expert, starting in with A. Harris & Son at Brantford. Mr. Watson was taken ill with paralysis last March, but recovered.



FRANK PALSER

He retires under the Pension Scheme at 67 years of age. His record is 36 years' service in Nos. 2 and 3 Machine Shops.



THOS. BUXTON

Retires on pension. Owing to Mr. Buxton becoming blind through cataracts he was only able to give us 13 years' service in the No. 3 Machine Shop and on the elevators.

"Will the men have anything to do with t?" asked CANADIAN MACHINERY, that is, will they be asked to pay anything into a pension fund?

"Not at all?" replied Mr. Shenstone. We are not going to ask the employees o pay. We consider that the best form f pension is one that is provided by the ompany out of its earnings."

THE INDUSTRIAL COUNCIL

Some time ago the Massey-Harris Co. ntroduced the industrial council idea, an ccount of which was given in the July 31 ssue of CANADIAN MACHINERY. At hat time it was in its experimental stages, nd only actual experience could show its worth or weakness. An official of Massey-Harris Co. stated just a few days ago that hey were well pleased with the way in which it was working out. "The chief hing is this—the members of the council, while at work in the shop, can head off good many disturbances that might go further, and that is a great consideration. When you can get the men in the shop to believe that they have recourse to an independent body, and that no shop prejudice s working against them, you have something worth while. Just a few days ago mechanic applied to his foreman, stating that he considered he was entitled to an increase in wages. The foreman could not see it that way, claiming that the next raise in that department should be coming o the assistant foreman. The man was, of course, disappointed, and went to the shop representative of that department on the industrial council, who in turn got in touch with the superintendent. The result was that the three, the shop representative, the foreman, and superintendent settled the matter in a few minutes. It is splendid work to get these things attended to at one, because no man, either in the office or the factory, can do his best work if he considers that his application for wages or for the readjustment of any grievance has simply been side-tracked.

Stock Selling to Employees

Progress is also being made in regard to selling stock in the company to employees. There seems to be a very fair way in vogue. For instance, if a person subscribes for an allotment of five shares, he is credited with one share paid-up just as soon as 20 per cent. in paid, whereas in many stock propositions it is withheld until fully paid up. Glancing over the stock list of the Massey-Harris Co., one is impressed with the number of names that can be checked off as being actively in the employ of the company.

The Victory Loan has interfered to some extent with the work, but now that is over it is anticipated that stock buying in the Massey-Harris Co. by the employees will be gone on with more aggressively than ever. The number of shareholders is increasing, now being not far removed from the five hundred mark.

The Massey-Harris Co., in common with other large industrial concerns, have had a great deal of valuable time taken up in the last few months with securing sufficient steel and iron, and more recently coal for the operations of their plants.



WM. SHERRIF.

Retired at the age of 69 with a record of 35 years to his credit. Most of this time has been spent in the Shipping Department.



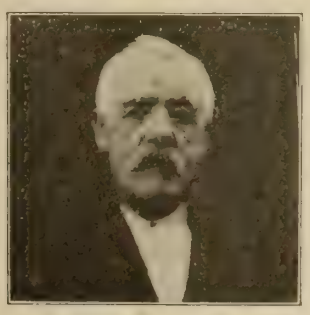
JOHN D. HENTIG

He is now 74 years of age, for 15 years with the company, in the Scratch Iron Department.



BENJAMIN FINNIE

Here's a record, 48 years, almost half a century—mostly in the Paint Department. Mr. Finnie has retired at the age of 75.



THOS. BARNETT

He is 78 years of age, for 24 year in employ of Massey-Harris as a painter. Mr. Barnett has been sick and unable to be at work since 1913.



ADAM MURRAY

Retires under the Pension Scheme. He is 72 years of age and has served 26 years in the Shipping Department and on various elevators.



J. H. MASON

He has 37 years' service to his credit. Mr. Mason was a genial deaf mute—a familiar figure in No. 1 Machine Shop—respected and liked by all.

The *Personal Touch* Worth Cultivating

How the Jeffrey Mfg. Co., With Their 4,000 Employees, Get Along Without Strikes—Aim to Make Man Get the Work He Likes and is Fitted For, and Find It Pays

By S. S. MOORE, Canadian Machinery

IN these days of industrial unrest, the question that pushes itself to the front is, "What is the solution?"—and out of the desperation of it all there seems to be developing on the part of the employer and the employee the recognition that each possesses all of the elements of heart and head—and soul—that go to make up a human being. There is a call for confidence, for interresponsibility which must resolve itself into co-operation on a common sense, business-like basis.

The Jeffrey Manufacturing Co., of Columbus, O., have investigated, experimented, developed and applied the personal touch among their 4,000 employees. That little phrase "the personal touch," is not a stranger; it has been recognized in many changes of raiment, has been camouflaged, overworked and misunderstood, but still it represents factors that contribute to good business and that can be applied thereto in a practical way. The Jeffrey Co. are applying it, not by any means as a cure-all, nor do they claim that its adoption in different lines of co-operative interest will cast aside human frailities and misunderstandings, as apparent in the industrial world. Still, it is evident that the personal touch works effectively toward ironing out the problems that are everywhere retarding good business—that is, good business for the employee as well as for the employer.

New Sphere for Woman

Sweeping aside the altruistic bung that so often hedges around the so-called welfare work of the present day, the Jeffrey people recognize that, in dealing with men, there are three fundamentals that must claim first consideration. These are, wages, working conditions and the square deal.

By paying better wages, they secure the better class of workmen, and this in turn leads up to higher standards of efficiency, superior workmanship, more satisfactory production.

By the way, a man applying for a position with the Jeffrey people, does so to a young woman, pleasing, tactful, but with an intention which seldom errs in an estimate of the applicant. The reason is plain but seldom appreciated by employers of labor. Inquiry proves that when an applicant first meets a man, and is asked for certain particulars as to his record, skill, etc., there is almost invariably set up a sense of resistance, a prejudice which damages confidence, if it does not induce deception. On the other hand, it is seldom that an applicant will be anything but truthful when confronted by a young lady; he will not hold back any useful information, and his confidence is obtained to a degree that would hardly be possible under other circumstances.

Having been successful in his application, some attention is paid to the man's adaptability. The Jeffrey Company are manufacturers of mining machinery and the assignment of men throughout the different departments is not done in a hap-hazard way. The newcomer is placed wherever he feels he can best make good. He is not driven into a location for which he is little fitted and for which he has little heart. The idea is that from the outset, he is made to feel that he has a position in which there is scope for his ambition and in an atmosphere that is friendly, helpful, rather than antagonistic. The efficiency system of the organization is such that the man's wages are advanced according to improvement in his work.

Every Liberty to the Worker

There is no paternalism about the Jeffrey plant. It is one that helps the employee help himself, thereby setting up a co-operation that works for the benefit of the entire organization. Should an employee feel that he has a grievance it is his recognized right to appeal—to his foreman, to the works superintendent, to the general superintendent and so on up to the general manager, if he so desires—and certainly no impediment is put in his way. His reasons for withdrawing from the service, if it comes to this, are very finely sifted and given sympathetic consideration. Of course, some withdrawals are unavoidable —rank insubordination, domestic troubles, climate conditions, etc.—but this matter of eliminating the floater in labor turnover has its merits from the viewpoint of good business.

It has been established by actual investigation that the labor turnover in industrial plants throughout the United States is something like 250 per cent., that every withdrawal from the force means an average cost to the concern of about $80. That is to say, some 3,500 men are hired during the year to maintain a permanent force of one thousand men—and that every withdrawal means a loss of $80. When this fact is brought home to the average employer of labor, he is dubious. He has never looked at the labor turnover from that point of view. The going and coming of men is all in the day's work. He fails to realize that a temporary employee is by no means a producer, that permanence is the one factor that makes him a paying investment. By careful selection, by the most agreeable working conditions, by the application of the square deal—in short, by setting up the elements of contentment and confidence the Jeffrey people have reduced their labor turnover from 250 to 40 per cent. The saving thus affected certainly is good business. In the forty years of their history there has been one strike—about twenty years ago—but this was due somewhat to a misunderstanding and at a time when the personal touch had not been developed.

How to Go About It

In a recent address on "The handling of men," Mr. W. A. Grieves, assistant secretary of the Jeffrey Manufacturing Company, stated: "Our work has been from the men to the company, and not from the company to the men. We have avoided, as far as we could, all evidences of suggestion that we might have paternalistic motives. The average man is at once more or less suspicious of any attempt to hand him something for which he is not looking. He assumes the attitude of one who has to be shown—shown that you are dead in earnest—and this requires time and patient effort on the part of the employer. If anything new is to be introduced, get hold of the leaders—those fellows whose intelligence is most developed. Having gained their favor, the less thoughtful will fall in line."

In the Jeffrey organization particular attention has been paid to the situation of foremen, for as the foreman so will be his men. Big, broad-minded workmen will not be content to work for a department head whom they cannot respect. Men unconsciously gather about them

men of their own viewpoint and disposition. The elimination of the policy of hiring and firing and the adoption of a policy of education is, from the standpoint of good business, the approved procedure for modern industry.

The Mutual Aid Association

In the various plans adopted by the company by way of encouraging employees to work out their own problems, there is again seen the principle of mutuality. In the beginning, of course, there was placed at the service of the men someone fitted to lead men and to help them in helping themselves. In all activities fostered and encouraged by the company, the management and organization has been carried on entirely by committees of shop men. They have their Mutual Aid Association, a $20,000 employees' restaurant, an employees' grocery and bakery, the latter with a capacity of four thousand loaves per day. There are clothing, dry goods and boot and shoe departments. In connection with the meat department, butchering has been successfully initiated, and lard rendering, sausage making and the killing of poultry have been the means of considerable saving to the men, and needless to say, there is no profiteering in connection with this co-operative store, in which the business amounts to about $25,000 each month. Agricultural products are handled in a large way, and there is a regular auto truck and wagon delivery service.

How They Solve Housing

Some ten years ago a building and loan association was formed. The result is the erection of over four hundred houses—modern, comfortable, homelike houses—owned by employees. The Association's operations last year were to the extent of a million and a half dollars. It has paid a dividend of 6 per cent. and has loaned the money for a lower rate than is paid elsewhere. The company advanced the money to start the Association, but it has all been paid back—a matter of helping the employees help themselves.

"Jeffrey Service," a monthly publication in the interests of the entire organization has done much to weld together various elements of factory, shop and office life. Its columns are made up of the main events of human interest to all of the organization. Pictures of the beautiful homes, the winsome children and babies, Jeffrey salesman, branch offices, records of parties, editorials and special articles go to make up a most interesting periodical. The paper has its regular staff and as the bulk of the material is contributed by the men themselves, there is never a dearth of copy. The paper reflects Jeffrey shop and home life vividly.

Insuring the Employees Now

Recently there was inaugurated by the company a plan of insurance to cover all those who have been in their employ over a year or more. A very extensive study was given to the subject before its adoption. The ideal plan would be for each employee to pay his own insurance, but the fact remains that they do not do this and as a result their dependents do not have the protection they should. One good feature about the group insurance plan is that it gives protection to all employees whether they can pass a physical examination for ordinary insurance or not. Moreover, such a large quantity of insurance, based entirely on the law of averages, can be bought at a very low rate—an average of about $13 per thousand.

All those who have been in the employ of the company for one year, are insured for $500; this insurance increases $100 each year for the next four years, at the end of which time, the completion of five years' service, the amount is automatically raised to $2,000. It continues to increase $100 per year for the next 20 years until a total amount of $4,000 is reached. This plan is based on the idea that there is at least a certain consideration in length of service which justifies the company, in paying for it the way the plan provides. The inauguration of group insurance as described is not looked upon by the employers as any great panacea for stability within their organization, but they believe it will be an important factor. It will tend, as other activities have, toward a better understanding between management and co-workers as well as providing a very helpful agency toward security in the family relationship.

In all of these undertakings—the Building and Loan Association, co-operative grocery, restaurant, hospital, dairy farm, etc.—the same idea is in mind, that it is profitable to encourage and help men to help themselves and their ability to do things other than the mere routine of the daily work for which they are paid in money.

Commenting upon the insurance plan, as described, the Christmas number of "Jeffrey Service" had this to say: "The insurance is provided without cost and no medical examination is required. Further, it does not interfere with any payments under the Workmens' Compensation. Since the plan was announced there has been a constant expression of approval and appreciation on the part of all co-workers. We see in this insurance another evidence of the willingness of all of us who work here together to make it a safer, more secure and better place to work. We know that the expense involved will be more than accounted for by the increased service of every one of us. It is purely a business proposition and we know that it will pay. Those of us who know anything of the spirit behind everything that we have undertaken here together, know that our interests must always be that of mutuality —none of us can truly and permanently succeed unless we strive for the success and welfare of all. It is this attitude that has made Jeffrey what it is; and it is going to be the perpetuation of this idea that will make secure our future."

Confidence is the Keyword

Mr. W. A. Grieves, assistant secretary of the company, is a former Canadian. His boyhood home was near Meaford. He has made a careful study of conditions surrounding and created by modern industry, and is a strong believer in the application of common sense and sincerity in working toward workable solutions in industrial problems. "Confidence," he declares, "is the last word. The biggest wages, the best working conditions and an honest effort to divide the profits fifty-fifty won't even satisfy The whole question has a more fundamental element. It goes deeper than any one or a thousand methods. It has as its rock bed, confidence. It has as its superstructure a combination of all those factors that make for good will. And these cannot be catalogued. They are found in the hearts of men who have learned to play the game fairly. They are nurtured in the atmosphere of harmony, which, in turn, is nothing but the culture bed of efficiency."

A device has been constructed by an automobile manufacturing firm in its own shop for testing the properties of lubricants. The machine is built on the following lines: The chief part is a pendulum hung on a bearing which is supported on a shaft rotated by means of a pulley. The bearing is composed of two brasses to which pressure can be applied by a spiral spring inside of the pendulum. The pressure regulation is effected by a milled-head screw. When the shaft is rotated the friction between it and the brasses causes the pendulum to set itself a certain number of degrees out of the vertical and this distance together with the pressure on the journal give an indication of the friction, from which the friction-reducing value of the lubricant between the shaft and bearing can be determined by consulting a calibrated scale.—"Scientific American."

WHEN one reads of the plight of Austria—in need of credits, of grain and almost everything—it is not hard to see that one word "production" sticking up in Canada as the slogan for 1920.

Business of *Selling* an Interesting One

The Ideal Time to Start is Around 16—Get Bright Boys and Train Them Thoroughly—How Does the Outside Man See the Inside Organization at the Head Office?

By A. R. K.

IS there an opening for the young men of to-day to go in and study seriously the business of selling machine tools? How many successful, high-class machine tool men do you know? Not many. Do you see many of them out of employment? Or do you ever hear the remark, "Do you know where I can get a good salesman?" The latter many times more than the former.

CANADIAN MACHINERY discussed the matter at some length with Fred. W. Evans, Toronto manager of the Canadian Fairbanks-Morse Co.

"The best time to get a salesman," said Mr. Evans, "is when he is a boy of 15 or 16. Get the chap that has come from a good, thrifty home, where the value of money and time is known. Get a boy who is not too smart or too much advanced to go to Sunday School—get that boy and make your start with him. When the boy is ready to sell for you some years later, he will know your business thoroughly. He will have been brought up with it. He will know definitely and intimately the ways and methods of your firm. You have a chance to work with him during the years when he is willing to receive impression, because, unfortunately the time comes for many people when that period has passed.

The Man Who is "Just" Too Old

"THEN there is the young man of twenty who comes in and applies for a position. He has had some experience in selling, perhaps in a store, and he is quite certain that inside of two weeks or so he could get out and sell machine tools. Imagine a company putting a two-weeks man up against the average superintendent in the larger factory. He would stand a great chance, but still they come in that way. They have passed the stage where they are willing, or where they can afford to work for a small wage. They cannot start where you want them to start. They cannot work in the warehouse, from which they should naturally come on to the sample floor. We do not encourage the young man to come on with the idea of getting out on the road as a salesman in a short time.

"Then in the third class, and quite a large one, too, is the man of 35 or 40 who begins to realize that he has not had enough direct drive in his life—that he has wandered around too much, and has failed by not concentrating his effort. He realizes that he has got to make his stake pretty soon, and very often he is most persistent when asking for a chance. Some of these men, especially if they have experience in certain lines that the firm can commercialize, make good salesmen, but that is not the rule, it is rather the exception to the rule. You will find in nine times out of ten that a man at forty is set in his ways. He has his own ideas as to how things should be done, and he has his own ideas as to how machinery should be sold. The average firm does not want to take a man on with a view of training him after he has gone past the period where he is susceptible to training.

The Real View of the Salesman

"THERE used to be a belief that the successful salesman would have to be a mechanic himself, and that he would have to be the mechanical master of the line he sold. A general knowledge is necessary, but it does not follow that a man has to be a high-class mechanic in order to sell successfully. If he runs into problems that are too deep for him he can always draw on the company he is selling for, and experts can be quickly secured. The biggest thing a salesman has to think about is this:

"'What does my customer think of me?'

"The customer may be in a centre away from your head office. He may never have seen your head office, your factories, or any of your plants. For the time being all he sees is your salesman. The salesman who is going to succeed must get that idea behind him and ahead of him all the time. He has got to measure up to the size of the company. His big job is not selling a machine, or some other article, not simply taking an order or chasing up a prospect. His real worth-while work is to sell the company to the man, and that is a big enough job for any man to tackle, and the man who can do it successfully and consistently is going to succeed, and it will be difficult to keep him back."

"And do you think," CANADIAN MACHINERY asked Mr. Evans, "that there is future enough in the machinery business to warrant a boy going into the business as a life work, expecting from it as good a chance at advancement as he could gain by investing his time elsewhere?"

"I certainly do," was the reply. "The business of selling in the mechanical field is a big proposition, and the field is not crowded. There is room for competent men, and there will be more room in the future as the industrial developments in this country become more marked."

How the Outside Man Sees the Home Office

HOW does the outside man view the home office? Here's a pretty fair view from R. V. Donaldson, London representative of the Canadian Fairbanks-Morse Co.:

It seems to me that a great deal of misunderstanding occurs owing to the fact that salesmen are inclined to feel that the inside organization does not give sufficient attention to each order he sends in and forgets that the inside staff have a duty to perform to a large number of salesmen, and that it is impossible for those on the inside to devote all their time to one particular order, but the best possible service must be rendered to all.

On the other hand, those on the inside sometimes seem to think that a salesman is just a fellow who travels around the country in a first-class train or drives a flivver around, picking up orders here and there, living on the fat of the land, and getting well paid for it. Needless to say both viewpoints are wrong.

There are many people who have a responsibility in connection with the execution of every order. In this responsibility there are no exceptions, from the manager to the office boy, each must assume his share and must never forget that a moment's carelessness may cost the company a good account.

A curt answer on the telephone, a little sarcasm in a letter, a wire overlooked, or worst of all, a promise of shipment made and broken; a hundred and one little things which seem of no consequence, but which at a critical moment may prove vital to the customer.

Service is the keynote of business to-day. The quality

of service given by us to our customers will determine the volume of our business in the years to come. If we are prepared to give our customer the right article to serve his needs in the most efficient manner, and to see that we not only make the sale but also that the article leaves our warehouse in good condition at the earliest possible moment, and be prepared, if necessary, to follow the shipment up and see that no unnecessary delay occurs in its reaching the proper destination, then we can, to a great extent, forget price. I do not mean by this that we can soak a man, but that we can secure business at a price showing us a reasonable profit, and competitors can cut prices if they like, but in the long run we are going to get the business.

Remember the Customer Always

THE point I am trying to impress on the minds of the inside staff is that no salesman can continue to do business unless he has the support and co-operation of the entire inside organization. Every man has got to do his share in the most efficient manner possible, and the only suggestion I have to offer is that the department managers and their assistants endeavor to keep in closer touch with the shipment of orders after the salesman has sent them in. For instance, a big concern gives an order for an article which, unfortunately, is not in stock. This party happens to be a good customer of ours, and the department head or assistant immediately endeavors to pick up the article. Failing to find it in the city, he may wire the factory and have the goods shipped by express. In doing these things he is using all the means in his power to serve the customer, but meantime Mr. Black, superintendent or engineer of the concern requiring the goods, only knows that he gave a salesman the order, and that his work is tied up, and the goods should have arrived three days ago if those fellows in Toronto were on the job. Result—he gets Mr. Salesman, and gives him a dressing down. Mr. Salesman calls Toronto on the long distance telephone, and learns the facts and communicates them to his customer. Mr. Blank says: "All right, but why in 'Sam Hill' did not they let me know that? I would have borrowed a tool from someone else, or done some other work, but now I have lost three, four or five days, as the case may be, waiting on every express to bring the goods." Result—Mr. Salesman spends an hour smoothing up the rough spot. He is generally unreasonable if a delay hits his pocket, or inconvenienced him, and Mr. Salesman has spent an hour's time, and a whole bunch of energy which could have been used in procuring more business, and don't forget, he also spent 60 or 70 cents on a long distance phone call, and used up some of the phone operator's time, the department's time, and the time of the purchasing department.

Advise About Any Delays

NOW, if those on the inside made a practice, in a case of this nature of dropping Mr. Superintendent or manager a little note advising that we had endeavored to get the goods locally, failing which we had been interested enough in giving service to pay for a wire to the factory, and that we were after his shipment, all this soreness and unnecessary friction and expense would have been avoided. Customer would feel better disposed to us, the salesman's temper would have been unruffled, and considerable energy saved to be used in productive effort, instead of reselling the company all over again.

This is the most vital thing I can think of in connection with our "Inside organization," the keeping of the customer advised without his asking for information, as he generally allows the delay to run along until he is good and sore before asking, and then time and money must be spent to remove the sore spot, whereas if we had forestalled his soreness by assuring him we were after his interests he would have felt better disposed towards us.

Selling in a Broad Way

IT seems to me that those on the inside sometimes lose sight of the fact that a salesman does not only sell the article to the customer; that kind of business may be all right, in dealing with a specialty which a man buys about once in his lifetime, but the man who represents us has got to sell himself, his article and also the class of service which the company stands for, because we want, not only the order to-day but the account during the years to come. The time I feel best is when weeks or months after I call on a customer, and open an account, to receive from this office a salesman's copy of a shipping ticket, covering some different line of goods to that which was first sold. Then I know that not only did I sell him one order, but that the manner in which the inside organization handled that order sold him the service of the company, and that I have another solid customer in my territory; and the next time I go back and send my name in to that man he immediately begins to think, "Now, what do we need that I can buy from this man?"

A special dispatch from Rome to the Chicago "Tribune" states that negotiations are being concluded between a representative of a French syndicate and the Italian Government for the construction of a tunnel through Mount Blanc, which will be one of the greatest projects to pass through the Alps. Studies for the project have been going on for about fifteen years. It is now proposed to build an electric railway from Chamonix in Savoy to Amsta in the province of Turin, a length of 50 miles, whereof 10 will be under Mount Blanc. The new railway will join two of the most celebrated valleys with magnificent scenery and perhaps the most renowned among all picturesque cities of the Alps.

NOW that they are going to have an examination for graded certificates for engineers in Ontario power plants, how about an examination for the men appointed to do the examining? Is there any good reason why they should not demonstrate their ability before some disinterested, yet capable, body?



Darling in Des Moines "Register."

The innocent little game of crack the whip.

The Status of the World's Mercantile Fleet

by T. H. Fenner
Editor "Marine Engineering"



WITH more tonnage under construction than at any previous time, the centre of gravity of the world's merchant fleets shows a considerable movement from pre-war days. The chief cause of this is, of course, the heavy losses sustained by Great Britain, and the heavy gains made in the United States. Other nations have also come into the field, but the distribution of tonnage between the two great Anglo-Saxon nations is the dominating feature of the situation.

If we look at the relative positions at the outbreak of war, and that of the present day, we will see what a radical change has taken place. The question that is uppermost in the minds of those interested in shipbuilding on both sides of the Atlantic is "How will we stand two years hence?" The latest available figures show that Great Britain, emerging from her sacrificial labors of the war, and her more recent labor difficulties at home, is beginning to catch up. On the other hand, construction in the United States is declining. The general losses in the world's fleet are being made up, and ere very long ocean freights will be governed by normal competitive rules. The day when anything capable of carrying a cargo can be operated at a profit will be past, and the vessel that can keep out of dock for the longest time, and take the least amount of maintenance and operating cost will be the survivor. Again, if two competing vessels are on an equality as regards these prime essentials, the prize will go to that one which enjoys the greatest skill in management. In that day years of successful experience in ship operation will be a big factor against competition from comparative newcomers, however brilliant they may be. But those days are yet in the future, and in the lap of the gods. Let us turn to concrete facts and see where the nations stand.

The Tonnage in 1914

IN August, 1914, the tonnage of the world's fleet was approximately 40,000,000 tons gross. This is equal to about 60,000,000 tons deadweight carrying capacity. Of this, Great Britain possessed approximately 20,000,000 tons, or about one-half the total tonnage of the world. The United States at the same date had 2,700,000 gross tons of ocean-going shipping. France possessed 2,325,000 gross tons, Italy about 1,700,000, Japan about the same, Swden, 1,222,000; Norway, 2,500,000; Denmark, 737,500. Spain had 864,395 tons, Greece about the same, Holland, 1,500,000; Belgium, 400,000, and Brazil, 3,000,000 gross tons. Of the enemy nations' fleets, Germany owned by far the largest. Her fleet was ,in fact, second only to that of Great Britain. She had a total of 5,291,000 gross tons, while Austria had only 1,000,000.

During the war the losses to the allied and neutral nations amounted to about 15,000,000 tons. Here, again, Great Britain was by far the largest loser. This was, of course, inevitable. Her ships kept the seas and carried her troops and supplies from every corner of the world, besides carrying supplies to other nations. Her total losses were 9,000,000 tons, or about 45% of her fleet as it was in August, 1914. During the war, in spite of her enormous production of naval vessels, and repairs to damaged ships, she built 4,342,000 tons. Captured vessels and ships bought from other countries amounted to 1,247,000 tons, a total of 5,589,000 tons. Her net losses were, therefore, 3,443,000 tons. This left her at the end of the war with a tonnage of 15,814,000. Her losses were in some respects greater than appears on the surface. This is because she lost a large number of her first-class passenger liners, which are hard to replace, as well as the larger size of cargo carriers, which carried on trade as regular liners on established routes. Now she is getting down to cases, and her yards are busy on the production of both cargo and passenger ships, the naval construction having been dropped. The comparative construction figures further on in this article will show just what is being done in this direction.

The Position of United States

THE record of the United States shipping during the war is, of course, one of pure gain. By new construction alone she added to her fleet 875 vessels of 2,941,845 tons. In addition to this she purchased 233 vessels of 833,854 gross tons, and brought down from the lakes 66 steamers of 140,000 gross tons. Her losses by enemy action amounted to only 322,214 gross tons, and this was offset by the seizure of 81 enemy steamers of 546,000 tons. The U. S. shipping profit and loss account shows a good credit balance



A MODERN OIL TANKER—ISHERWOOD CONSTRUCTION.

through the war. Her sea-going merchant marine of 2,706,317 gross tons in 1914 had grown at the end of the war to 5,515,180 gross tons. Including lake and coastwise shipping, she has 12,000,000 tons.

France lost about 40% of her pre-war shipping and has no new construction in her own country to take its place. She is getting some ships built in Canada at present, and a large number of wooden steamers were built here during the war. These vessels were of 1,500 to 3,500 tons deadweight, and their value to France is, with all due deference, problematical. France demanded that the enemy merchant ships seized at surrender should be turned over to her in the proportion of ton for ton, and that she be allowed to buy 1,000,000 tons each from Great Britain and the United States. These plans have not yet been realized, but it shows her ambition to become a maritime nation. This ambition is shared by others.

Italy, who lost about 51% of her merchant fleet during the war, is also taking steps to rehabilitate herself, and a bit more. She has now about 36 shipyards in operation, and still more are planned. She hopes to obtain an annual output of 400,000 tons, if she can obtain the raw material. This has in the past been obtained chiefly from Great Britain, and during the war that source was, of course, shut off. She is looking now to develop her own resources, chiefly on the island of Elba.

Japan was another nation that came out of the war exceedingly well as far as her ships and shipbuilding capacity are concerned. She lost through enemy action only 132,000 gross tons. She sold to other countries about another 125,000 and purchased 130,000 tons. During the war she built for herself 768,325 gross tons, the net result of her activities being an increase of 25% on her pre-war fleet. She also built for the U.S. about 130,000 tons, and had under construction at the end of the war about thirty more steamers for the U.S. Japan has expanded her shipbuilding facilities enormously, and has now an annual capacity of over 1,000,000 tons. However, despite the low cost of labor, the difficulties of securing plates, etc., has resulted in Japanese costs going up till they are in the neighborhood of $185 per ton.

The Scandinavian nations also suffered during the war, and their efforts at new construction were hampered by the lack of raw materials. Norway was the heaviest neutral sufferer among the nations. Out of a tonnage of roughly 2,500,000 she lost no less than 1,178,000 gross tons. To counteract this, she had under construction at the end of 1918 about 200,000 tons. This was made up of steamers and motorships, fifty of which were of wooden construction and eight of concrete. It is interesting to note that the Norwegians were among the first to undertake the construction of concrete vessels, and they adopted methods which have been widely copied by other builders. Sweden lost about 18% of her merchant fleet by enemy action, amounting to 202,000 tons. She had under construction at the end of last year about 60,000 tons. The Swedish yards are very busy, but have suffered from the difficulty of obtaining ship plate, which were in pre-war days imported from England. Denmark also suffered from the submarine activities, her losses being 219,000 gross tons out of 739,532, leaving her in June, 1918, with 600,000 tons. The difference was made up by new construction which amounted to 100,000 tons, and sale to and purchase from other nations about equalized themselves. Spain had a merchant navy of approximately 864,000 tons before the war. She came out of it with about 650,000 tons. She lost by enemy action 166,000 tons, while marine risks and sales accounted for 133,000 tons. New construction amounted to 35,000 tons and purchases 47,000 tons. Greece, Holland, Belgium and Brazil all suffered heavy losses, the totals being 662,000 tons out of a tonnage of 2,900,000 tons belonging to the four nations.



H.M.S. "WITHERINGTON," 28,000 H.P. GEARED TURBINE.



H.M.S. "RENOWN," 100,000 H.P. GEARED TURBINES.

What Canada is Doing

THE total tonnage under construction in the Dominion of Canada in June, 1914, was 14,184 tons gross. In 1915 the necessity for more ships had become apparent

and the Imperial Munitions Board took up the question of building ships in Canada. Contracts were given out amounting to $70,000,000, including both steel and wooden ships. There were 43 steel and 58 wooden ships. This started shipbuilding in Canada in good earnest, and it has kept up so far in very good shape. At the end of 1918 there were 45 berths for steel vessels ranging from 3,500 to 10,500 tons in the various yards. The Canadian Government Merchant Marine programme came along when the I.M.B. ships were being finished, and is still keeping the majority of the yards going.

In addition to this, some firms built ships to their own account, for sale, and at least one firm is doing so at present. Other yards have contracts for European tons, were being built. The great preponderance of tonnage compared with the slight difference in numbers building, is accounted for by the larger size of the vessels built in the deep-water yards. These vessels are all steel. Besides these, 49 wooden ships of approximately 49,000 tons were under construction. All the other British Dominions had between them only 24 steel vessels of 77,000 tons, and 9 wooden vessels of 6,443 tons.

The cost of building a ship in Canada is now but little different from the English prices. Taking into consideration the fact that English yards are not in a position to take outside orders for some time, and that European nations are clamoring for ships, there should be lots of business for Canadian shipyards. The exchange

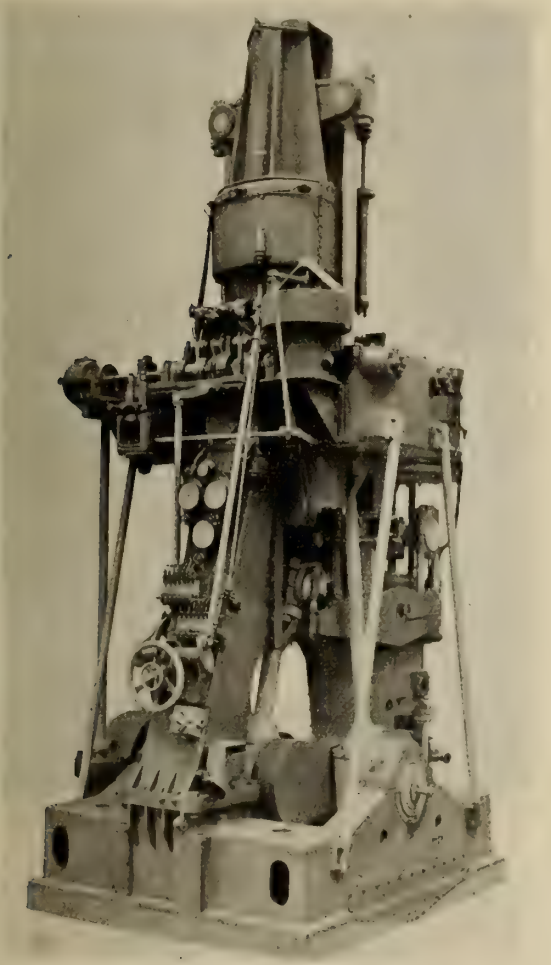


AUXILIARY MOTOR SCHOONER.

owners, and there are at present negotiations being carried on for the securing of a large order from France. This would cover contracts for over 100 ships. It is supposed that the Canadian Government would finance the building of these vessels, the stumbling block at present being the low French exchange rate. The growth of the Canadian shipbuilding business can be seen by a comparison of the tonnage under construction in 1914 with that in the present year. The figures for June, 1914, as already stated, were 14,184 tons gross, while those at September, 1919, were 210,800 tons gross. This was divided as follows: Great Lakes shipbuilding yards had 23 vessels of 53,833 gross tons under way, while on the Atlantic and Pacific coast 29 vessels, of 108,020 gross rate is, of course, a very adverse factor, but this could probably be overcome. Canada's deep-water yards can construct any type of cargo ship, and there are at present oil tank vessels being built on the St. Lawrence. The Canadian Government Merchant Marine have had 24 ships delivered this year, and the remainder, comprising 30 vessels, will be delivered during 1920. These ships are being built at fourteen different yards, situated on the Atlantic coast, River St. Lawrence, Great Lakes, and Pacific coast. They range in size from 3,500 tons deadweight to 10,500 tons deadweight, and will make a very useful fleet when completed. Already a goodly number of them are sailing the seas, bearing Canadian goods to different countries, and bringing their products in return.

Another phase of the marine business more particularly connected with upkeep and repair is the establishment of large drydocks of the floating type in Canadian harbors. Sydney and St. John on the Atlantic coast, and Victoria and Vancouver on the Pacific coast, will all have these docks in the near future. An adequate drydock, of the floating or permanent type, is a source of income to the vicinity it is situated in, as well as a splendid investment to the owners. It is also of indirect benefit to the shipowner in that its presence in certain localities exerts a favorable influence on insurance rates. These drydocks should bring many millions of dollars to Canadian pockets that formerly went to our Southern neighbors. Canada has built a large number of motor and auxiliary craft in the last few years, but no Canadian firm has yet tackled the making of the marine oil engine. However, that may come before very long, and be attended with as much success as the building of the marine steam engine.

The great expansion in shipbuilding called for a large number of auxiliary appliances for ship use, and Can-



OPPOSED PISTON TWO-CYCLE OIL ENGINE.

adian firms went into this business with as much energy as they displayed in the main effort. The manufacture of steam winches, windlasses, steering gears, pumps, etc., has been so successful that in some cases these machines have been sold to U.S. purchasers in direct competition with American builders.

In far-away Australia 12,000 miles from the heart of the Empire, the shipping shortage was felt acutely. There were thousands of bushels of wheat waiting for shipment, a lot of which was spoiled. It was piled along the wharves in many cases under temporary covering. Faced with the knowledge that ships could not be obtained, the Commonwealth Government resolved to build for themselves. They, therefore, gave contracts to several firms in the Commonwealth for twin-screw cargo steamers built on the Isherwood system. The first to be completed was the Dromana," and eight more are be completed was the "Dromana," and eight more are Government have decided on a programme of fifteen more to be built during the next two years. They have also ordered six 12,000-ton steamers in Great Britain.

The Losses of Germany

OF Germany's fleet of 2,159 vessels, aggregating 5,291,000 tons, which she owned at the beginning of the war, but little remains. At the time of the armistice probably 2,500,000 tons remained in her lands, and a considerable amount of this has been transferred to Allied nations. The actual tonnage remaining to her is not very clear. She built during the war about 740,000 tons. The ships so far divided among the Allies include the cream of her passenger fleets, which cost so much time and money to create. It is only poetic justice that the nation which started out to wipe all other flags from the seas should only succeed in nearly eliminating her own. There will be few tears of sympathy shed over the spectacle.

The quarterly returns issued by Lloyd's Register of Shipping make interesting reading, and the latest available statement is up to September 30th of this year.

There was on March 31st of this year a total tonnage under construction of 7,796,266 tons gross. This only includes vessels of 100 tons and over. Of this total the United Kingdom was building 2,254,845 tons, and the United States 4,185,523 tons. Canada had at this date 61 steel vessels of 168,935 tons, and 42 wooden vessels of 49,452 tons on the ways. The total of the other British Dominions was ten steel vessels, 46,866 tons gross, and 18 wooden ships of 16,987 tons. The remainder were divided over the European nations. These figures relate only to steam and motor vessels. There were in addition 165 wooden and 3 steel sailing vessels being built in various parts of the world, but their total tonnage was only 151,500.

On June 30th there were under construction 1,744 vessels of all types, the tonnage being 5,493,717. These included 1,155 steam and motor vessels of steel, 356 wooden steam and motor vessels, 5 steel sailing vessels and 228 wooden sailing vessels. Great Britain had in hand, 2,524,050 gross tons, the United States at the same time having 3,874,143. This shows an increase for Great Britain of 269,155 tons, and a decrease for the United States of 311,380 tons. Canada had under construction 55 steam and motor vessels of steel, totalling 163,493 tons, and 70 wooden vessels of 81,000 tons, 244,493 tons altogether. The other British Dominions were building 26 steel vessels of 70,256 tons and 13 wooden vessels of 11,647 tons. European nations accounted for the rest.

The British Show Gains

THE latest figures show the position at September 30th, and are interesting as showing the relative activities of Great Britain and the United States. The total for the United Kingdom is 781 vessels of 2,816,773 tons, while that of the United States is only 3,470,748. The increase in Great Britain over the previous quarter is 293,000 tons, and the decrease in the United States about 400,000 tons. Canada had 52 steel vessels of 161,853 tons and 49 wooden vessels of 48,950 tons. This is a slight decrease from the previous quarter, and shows that ships are being delivered with no new orders taking their place. The other Dominions have 33 vessels altogether, 24 steel and nine wood, but the tonnage is about the same as the last quarter.

That Great Britain is getting her large cargo liners back on the seas is evident from the size of the ships under construction. There are 157 vessels of 6,000 tons and over on the stocks, and 18 of these are between 15,000 and 25,000 tons. It is confidently predicted that the output for the full year will amount to 3,000,000 tons. The United States may be going to capture the seagoing trade of the world, but they will know they have been in a

race. There are no figures available for Germany or Austria as yet. Holland, Italy and Japan are the only other nations with over 200,000 tons under construction, beside Canada. France has about 180,000 tons.

The ferro-concrete vessel has practically gone out of existence, the only vessels of this type under construction being barges of small size. Wooden shipbuilding is also being relegated to the limbo of forgotten things, as far as large-sized ships are concerned. Both wooden and concrete ships are practically possible as far as being ships is concerned, but they have the fatal drawback of costing as much as a steel ship, with less deadweight capacity. This is a point that cannot be got around, and effectually disposes of their claims to recognition.

New Features of Ship Design

IF the concrete ship, which was to revolutionize all future marine construction, according to the enthusiasts, has slid quietly into oblivion, there have been other developments which are more permanent. Another feature of war-time shipbuilding which was introduced with a great flourish of trumpets, was the standard fabricated ship. This was particularly in evidence in the United States, where it was entered into on a large scale. Briefly, the idea was to introduce repetition production into the science of shipbuilding, and turn it into manufacture. A standard design of ship was decided on, and the making of the scantlings was given out to different contractors all over the country. These firms would cut, bend, and drill the various members to the drawings or templates furnished, and the manufactured shape would be shipped to any yard to be assembled. In Great Britain a number of vessels were built under this plan, but on the conclusion of the armistice, those not completed were sold to private owners in their uncompleted state. These private owners made the necessary alterations to fit them for the particular trade they were going in. Fabricated shipbuilding, as far as the United Kingdom is concerned, has been abandoned. In the States the experiment did not work out with the complete success expected, but there are a considerable number of these ships still under construction.

The greatest departure from old established practice was the introduction of the Isherwood system of construction. From time immemorial boat builders have built their craft with vertical rigs or frames attached to a longitudinal keel. These frames are spaced from 2′ 6″ to 4′ apart, according to the size of vessel, and the shell plating is riveted on to the skeleton thus formed.

The Isherwood system, so named after its originator, departed completely from this practice. The main scantlings of the vessel are laid fore and aft, or longitudinally, the vertical framing consisting of deep frames at considerable distances apart. This method allows for greater strength with considerably less weight of steel. It is being adopted more and more every day, and especially in the construction of oil tank vessels.

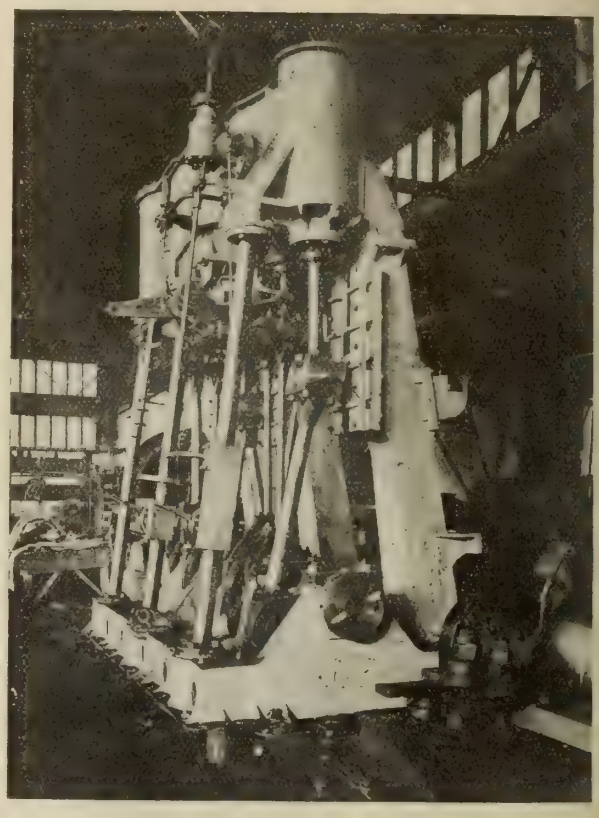
Electric welding, while for many years employed in the repairing of vessels, has only since the war been suggested as a means of construction. A vessel of 150 feet in length has been laid down, in the construction of which riveting will be entirely eliminated. She may be completed by the time this article will appear, and her performance will be watched with interest. Lloyd's Register Committee have also approved a design for a vessel on the Isherwood system, in which the plates will be attached to the longitudinal framing by this method.

Development in Marine Engines

WHEN we turn to the propelling end of marine design, the great advances made are apparent. After long years of successful and reliable operation, the triple and compound inverted vertical reciprocating engine seems doomed to pass away, and its place taken by the geared turbine and internal combustion engine.

From the inception of steam navigation on the ocean, development was comparatively slow. The first great revolution was the introduction of the screw propeller to take the place of the paddle wheel. Following this came the introduction of the compound expansion engine, the first trans-Atlantic steamer to be fitted with this type being the "Holland" in 1870. From the two stage expansion developed the three and four stage, and it was felt that the last word had been said in this direction. From 1881 to 1896 the only improvement made was in the direction of higher pressures, and slight gains in economy. Then in 1896 the engineering world was startled by the advent of the "Turbinia," a little vessel of 45 tons displacement, 100 feet long, 45 feet beam, which tore through the water at the speed of 34 knots an hour. This was achieved by the use of Sir Charles Parson's turbine. The British Admiralty immediately started experimenting with the new motor with the result that about 1905 this method was finally adopted for all the vessels of H.M. Navy.

The turbine was introduced into the merchant service in 1907, by the "King Edward," a Clyde pleasure boat. The



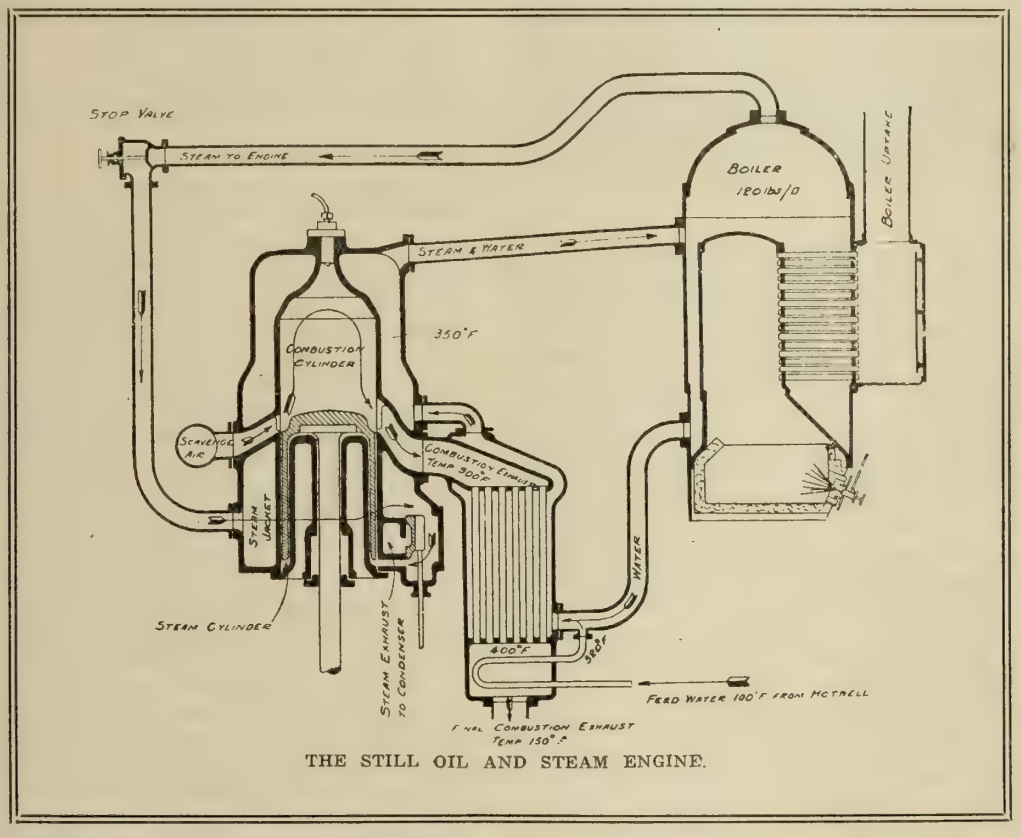
TRIPLE EXPANSION RECIPROCATING ENGINE.

Allan Line steamer "Victorian" was the first trans-Atlantic steamer to adopt it in 1905, and then came the two sister queens of the seas, the "Lusitania" and "Mauretania." Thus was the turbine definitely placed in supremacy for all high speed, high-class liners. The great bulk of the merchant marine still held fast to the reciprocating engine, the reason being that for speeds under fifteen knots the turbine was not efficient. This was because of the high speed, of rotation necessary for efficiency, which was only practicable on high speed ships. However, ingenuity in the engineering world was not to be stopped by this obstacle, and in 1910 the "Vespasian" was fitted with a reducing gear between the turbine and propeller, which allowed both to be run at their most efficient speed. The single reduction gear was so successful that it was developed further, and a double reduction gear introduced. The success of this may be estimated by the fact that in June, 1917, Lloyd's classed 23 vessels of 153,000 tons fitted with either single or double reduction turbines, and in the following twelve months 72 vessels

of 367,960 tons, while in the year ending June 30, 1919, they classed 183 vessels of over 1,000,000 tons. The largest of these vessels was the oil carrier "San Florentino" of 12,842 tons. This does not take into account war vessels, of which the "Renown" is an outstanding example.

Another development has been the combination of steam turbines direct connected to electric generators, which drive motors connected to the propeller shaft. The best example of this style of equipment is the U.S. battleship "New Mexico," while in England the "Wulsty Castle," a vessel of 3,566 tons, has been so fitted.

The adoption of the internal combustion engine for sea-going vessels dates from 1910. In this year the "Vulcanus," of 1,179 tons, was fitted with a Diesel engine of six cylinders, 15¾ inches diameter by 23⅝ inches stroke. The development in this type of engine may be seen by the fact that the latest and largest vessel of this type is the "Glenapp," fitted with two sets of engines driving twin screws. Each set consists of eight cylinders 29½ inches diameter by 43 5-16 inches stroke, the horse-power of the two being 6,400. The "Glenapp" is 7,374 tons gross, about 11,000 tons deadweight.



THE STILL OIL AND STEAM ENGINE.

The Engine of the Future

IT will be seen by the foregoing that there are rivals a-plenty for our old friend the triple expansion engine. Which of them will eventually gain the palm, and occupy the position so long and honorably held by it in the marine world? To answer that we must look into the question a little deeper than we have up to the present.

In deciding on the type of power plant to be adopted in a ship, several factors must be considered, all of which have an important bearing on the final decision.

The most important is reliability, or freedom from danger of breakdown. The great bulk of the world's trading is carried on by ships that have to be away from their home ports for months at a time, sometimes even years. It is absolutely necessary that the motive power must be capable of long sustained running with only minor adjustments. A major repair carried out in a foreign port may easily devour the profits of several voyages.

The second consideration is weight and space occupied. These must be a minimum as every cubic foot occupied by the power plant, and every ton displacement, is obtained by sacrifice of earning, or cargo carrying space.

Fuel economy comes next. Not only in the actual fuel used per horse power is economy beneficial, but greater economy in fuel consumption means less fuel carried for a certain length of voyage. This enables more cargo to be carried. If the voyage is a long one, it means less calls for replenishing fuel stores, saving money in pilot and harbor dues. It also enables the fuelling to be done where that commodity is cheapest, or at least leaves some alternatives.

Maintenance and operating costs come next. The prime mover which requires the minimum of attendance, and consumes the least supplies, may be more desirable than one which is cheaper in first cost, or slightly more economical in coal.

Regarding the question of reliability, there is nothing to choose between the reciprocating engine and the geared turbine. The triple expansion engine has moved the world's fleets around the oceans, with a remarkable absence of breakdowns. The only thing that made them a total breakdown was the breaking of a tail end shaft, and these accidents were few in proportion to the number of vessels engaged. In the early days of turbine operation, some trouble was encountered, due to the stripping of blades, but this has long since been eliminated. Turbines with and without reduction gears are now giving as reliable service as the older reciprocating engines.

Taking up the subject of weight, the geared turbine installation has the advantage of the reciprocator. In figuring on the total displacement for each type of engine, the fuel consumption must be taken into account. The installation which uses the least fuel allows for a greater amount of cargo being carried. The consumption of fuel for all purposes with a good triple expansion engine may be taken as 1.6 lbs. per I.H.P. per hour, while that of the geared turbine will be about 1.3 lbs. per S.H.P. per hour. I.H.P. means indicated horse power, while S.H.P. means shaft horse power. The shaft horse power will be in the turbine installation about 96 per cent. of the I.H.P., so

that consumption per I.H.P. will be about 1.2 lbs. This is taking the fuel used to be coal. If steam is generated by oil, the consumption will be less in both cases, but the real factor is that the steam consumption of the turbine is least. The consumption of fuel figured on here includes that necessary for driving the auxiliaries, which must be taken into account. We see, therefore, that the geared turbine is equal in reliability to the reciprocating engine, and is the better as far as weight and fuel consumption are concerned. In first cost the geared turbine installation is from 3 to 4 per cent. dearer than the reciprocator. This disadvantage is more than outweighed by the other advantages.

The turbo-electric drive, while slightly more economical in steam consumption, is much heavier than the geared turbine, and is also higher in first cost. The complicated electrical connections call for much more skilled attendance than is required for the geared turbine, and we may safely say that for the general cargo carrying steamer its adoption is unlikely. For naval vessels it may have a field.

A further combination which has proved very successful in a certain class of vessel is the reciprocating engine exhausting into a low pressure turbine. This is the arrangement adopted in the famous "Olympic," and gives economy of operation with flexibility in manoeuvring. However, it is with the typical cargo carrier of 6,000 to 10,000 tons that we are more immediately concerned. This type is the backbone of the merchant marine.

The Oil Engine's Future

WE will now consider the latest type of marine engine, and the one which many people believe will be the standard type in a few years. The internal combustion engine has a good many points in its favor with but few against it, and the latter are gradually being eliminated.

In the first place, the use of the internal combustion engine eliminates at once, boilers, coal and boiler room crew. Instead of large spaces being occupied to store coal, the oil is carried in the ballast tanks. This, of course, is true of an installation using oil fired boilers, but the difference is that the internal combustion engine uses only about one-half the fuel consumed by the most economical steam motors. In a steam engine the heat losses start at the furnace, and go on to the condensor. The result is that in a reciprocating engine the overall efficiency is about 12 per cent. In a turbine it is about 16 per cent., while in the oil engine it is about 30 per cent. The thermal efficiency of the oil engine is higher by far than any steam engine or turbine can ever reach.

The first cost of an oil engine is probably 20 per cent. higher than the geared turbine type, but the crew necessary is only about two-thirds that of the latter. This coupled with the much lower fuel consumption places it far ahead as an economic factor. While the saving of weight in the engine itself is not great compared to the turbine installation, the increased cruising radius, or the smaller quantity of reserve fuel required, is much more important than the actual engine weight.

It has had several disadvantages to fight against. The first, and one of the greatest, is the limitation of power that could be developed in each cylinder. This limitation precludes its use in very high-powered vessels. About 500 H.P. per cylinder would seem to be the limit at present, but a further adoption of the two-cycle type may increase this considerably. Difficulty of reserving and starting were also a drawback, but these may be said not to figure in the latest types. Difficulty of finding oil stations militated against both oil fuel and the oil engine for some years, but is practically overcome now. The great drawback seems to have been the liability to irreparable breakdown and the difficulty of finding highly trained attendance. With improvement in design, and greater experience the first difficulty should gradually vanish. With the more general adoption of this engine the men will be trained. British engine builders are developing their own designs, and improvements are taking place frequently. One of the most promising of these is the Still engine, in which the exhaust gases are utilized to evaporate the water in the cylinder jacket, the resulting steam being used on the opposite side of the piston. By this method a still greater efficiency reaching as high as 40 per cent. has been obtained. The development of the two-cycle opposed piston type will result in reducing the weight per horse power, allowing of larger units, and decreasing the number of cylinders required for a given power. Taking it all round, the oil engine promises a reduction in weight, space, attendance, and fuel, a combination which should result in its general adoption for all medium speed cargo vessels of 6,000 to 10,000 tons.

The first-class express steamer and the warship will no doubt be propelled by the geared turbine for some time to come, while the mixed cargo and passenger liner of 17 to 20 knote will no doubt use the combined reciprocating and turbine installation in many cases. With the growing need of economy in both coal and oil, and the steady increase in wages, marine engineers must keep on their investigations to determine the most efficient motor. Special trades require specialized treatment, but the outlook for the internal combustion engine is good. Some day the practicable internal combustion turbine will be discovered, marking another great stride in the science of marine propulsion.

The Outlook in Canada

CANADA has a large number of well-equipped ya to-day, with efficient managing and operating staffs. There are between the actual building and the contributory trades probably 40,000 men employed. The pay roll amounts to something like $40,000,000 a year. Every British yard is booked up for two years to come. That means that the most dangerous competitor is removed. All Europe wants ships, and must get them built outside of their own countries. The exchange rate operates just as much against the U.S. as it does against Canada, putting them on an equality. Canadian yards can build as well and as cheaply as United States yards. It is up to them to go after the foreign orders and keep their yards going. If they can be kept in successful operation for the next three or four years, they should be in a position to face the future with every confidence. Make shipbuilding a permanent industry of the country.

According to "Der Schweizerische Eisenwarenhandel," a file when new, if viewed under a strong magnifying glass, will be found to consist of fine points or teeth, so far as the cutting surface is concerned, and if passed over a piece of hard steel or other hard resistant metal, it will be found that the majority of these teeth have splintered off, leaving a very indifferent set of cutting points. For this reason, it is best always to use files first on brass and copper alloys, as this saves the teeth from breaking away, while the heat engendered by the working friction somewhat anneals them, and makes them fit to follow on with wrought iron and mild steel, harder steel and cast iron taking the last place, and after these the files want re-cutting, if they be thick enough.

A gas stove is now available for housekeepers that has a heat measuring device for the oven. A thermostat is made use of, which automatically maintains oven heat at a constant temperature, and also enables the cook to select at will any pre-determined temperature. The regulator will automatically maintain it for any definite period.

Fitted with flanged steel wheels, a motor truck was recently used to reclaim an abandoned railroad spur line extending to a deserted lumber camp in Montana, thus saving a large amount of money for the company. A small flat car served as a trailer on which were hauled the rails. The truck used was standard make, one-half ton, and in the first month travelled 3,300 miles, or about 108 miles daily.

The Making of Nickel-Chromium Products

By W. F. Sutherland



NOT so very long ago the engineer's handbook contained a few well-known facts regarding the physical properties of the more common industrial metals. Reference information of this character was somewhat limited and the engineer was also handicapped by the paucity of the materials at his command. The handbook of to-day must contain a fund of data relative not only to iron, copper, brass and other well-known alloys, but must also embrace the subject of nonferrous alloys to a much greater extent than has been the practice heretofore.

Metals, which for many years had been of interest only to the scientist and to the laboratory investigator, are now used with signal success in the making of articles of high value in the industrial arts. Chromium is one such metal, and, alloyed with nickel, it forms the basis of many alloys used where high temperature conditions are encountered. Carbonizing boxes, annealing pots, lead pots and similar articles are subjected to the action of external heat, and it is desirable that the materials from which they are made should possess a number of characteristics, such as the power to resist the action of either oxidizing or reducing flames; resistance to the action of metals and salts and toughness under high temperature conditions, even as great as 2,500 degrees F. It is also desirable that the material should be soft enough for machining.



VOLTA FURNACE AND REGULATORS.

Hiram Walker and Sons Metal Products, Ltd., Walkerville, Ont., are the manufacturers of "Nichroloy," an alloy possessing the desirable qualities enumerated above. It is composed of low carbon steel, chromium, silicon, manganese, aluminum and nickel, together with two other metals, forming a very hard and clear surface when cast.

The physical qualities of the alloy closely resemble those of steel even when heated. The metal machines similar to a medium high carbon cast steel, yet, when machined, does not oxidize or rust, but maintains for a considerable time its grey steel appearance. Unlike steel, too, it does not become porous when heated, and when used for carbonizing boxes this property tends to the conservation of the carbonizing compound. The life of the boxes depends, of course, upon their size and thickness, as well as the temperature to which they are subjected. Life runs of about 3,500 hours are common.

The life of nickel content alloys when used for containers of molten metals or salts to some extent depends upon the percentage of nickel. In this alloy the nickel content is low and a scale is formed when heated in the air. By producing the scale artificially in the interior of the pots it is possible to prolong the life very materially.

Manufacture of Nichroloy Products

Naturally enough, when the product has to withstand high temperatures in the performance of its duties, its manufacture involves the use of higher temperatures to secure fusion and in the electric furnace is found the most suitable means of melting. In the present plant a one-ton electric furnace, made by the Volta Manufacturing Co., Welland, is installed. This furnace is of the three-phase type, using six-inch Acheson graphite electrodes and is fitted with a Thury regulator made by the same firm. The usual rheostats and hand control, together with ammeters for indicating the current input, are also installed. Low tension current for furnace operation is supplied by three single-phase Packard transformers, which step down the 13,200 volt, 25 cycle



GROUP OF DRAW BENCHES IN WIRE DRAWING DEPARTMENT.

supply to 100-95 or 90 volts, depending on the tap employed. The high tension is connected star, while the low tension is connected up in delta, the delta being placed at the transformers.

A switchboard forms part of the equipment, two Condit oil switches being mounted, together with a graphic wattmeter and an integrating wattmeter, both of Canadian Westinghouse make. The furnace lining is of magnesite brick for the hearth, with silica brick lining above and a silica brick roof.

In the making of nichroloy, the nickel is charged into the furnace in shot form and the chromium as ferro-chrome. No slags are needed for refining as in steel making, the only additional agents needed being ferro-silicon and ferro-manganese. These ferro-alloys serve to eliminate any oxides formed in the metal.

Monel Metal

In the making of alloys which resist corrosion, there is a broad field for a metal which will withstand acids, high temperatures and the erosive action of hot gases and super-heated steam. Monel metal meets these severe requirements, and as the Canadian distributors, Hiram Walker and Sons Metal Products, convert this metal into the form of the finished casting or wire for the Canadian market.

Monel metal is not a synthetic alloy, but is a natural combination of nickel and copper, which is refined without changing the relation of the important elements, i.e., nickel and copper. These two metals bear the same relation to each other when the alloy is refined and fabricated as in the ore taken from the mines. The alloy contains approximately 67 per cent. nickel, 28 per cent. copper and 5 per cent. other metals.

In making castings, the natural alloy, either in shot or ingot form, is charged into the furnace and melted down. Metallic magnesium is added for deoxidation near the end of the heat before the metal is poured.

Moulding Practice

Pouring temperatures encountered are much higher than those prevailing in the iron foundry and accordingly the foundry practice adopted is, to a large extent, that of the steel foundry. Exceptional care is taken to ensure good moulds since the metals cast are of comparatively high intrinsic worth and spoiled castings come high. Dry sand moulds are used, the binder being molasses. A silica wash is also employed when particularly smooth castings are desired. The baking of the moulds is very thoroughly done since moisture detrimental to the proper casting of either nicholoy or monel metal.

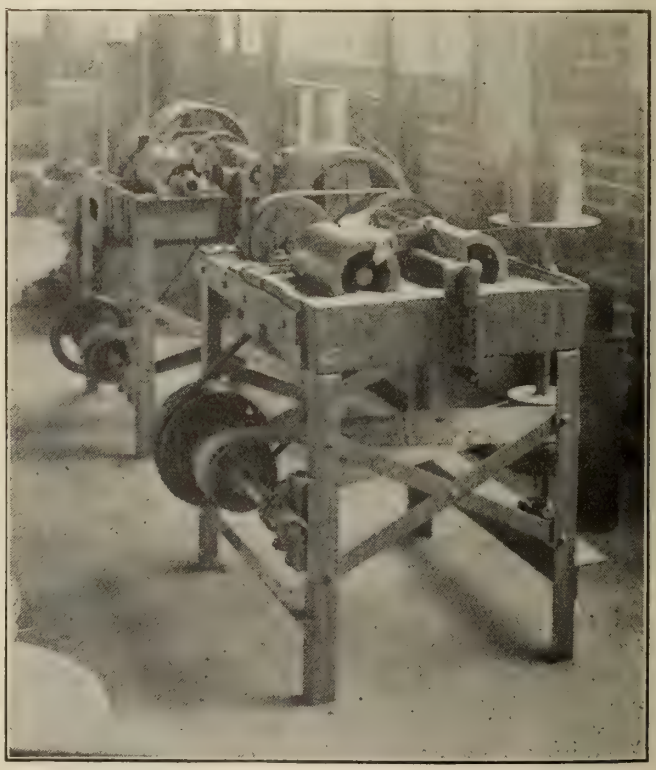
Wire Drawing

Nickel-chromium alloys possess valuable properties when used for resistance wire in electrical apparatus. Their specific resistance is high, varying with the different grades; their melting point is high and their immunity from oxidation makes them particularly adapted for use in heating appliances, both industrial and domestic.

This company manufactures "Chromel" resistor alloys in three different classes, each having its own electrical characteristics. Chromel "A" contains approximately 80 per cent. nickel and 20 per cent. chromium. It is especially useful in electrically-heated devices operating at temperatures above 1,600 degrees F. and up to 2,000 degrees F. Its resistance to oxidation and corrosion makes it very useful for electric stoves, furnaces, hot plates, etc., Compared with copper, its electrical resistance is 60 times as great at 75 deg. F. Chromel "B" has a lower chromium content since its composition is approximately 85 per cent. nickel and 15 per cent. chromium. It has a slightly lower electrical resistance, running about 51 times that of copper at 75 deg. F.

Chromel "C" is a nickel-chromium-iron alloy containing about 25 per cent. iron and 11 per cent. chromium. It finds considerable use in sadirons, toasters and other devices of a similar nature.

The Canadian demand for these various types of re-



FINISH DRAWING BY MEANS OF DIAMOND DIES.

sistance wire is met by the product of this factory and in addition to chromel wire, monel metal wire is also drawn. Aside from tungsten the chromel alloy "A" is the hardest wire drawn commercially, and since tungsten wire is drawn for lamp purposes only, the drawing of chromel alloy is no small achievement.

Various factors enter into the successful drawing of the metal. The drawing must proceed at a uniform rate, the wire must be supplied with the proper lubricant and the annealing and cleaning of the wire between operations must be carefully done.

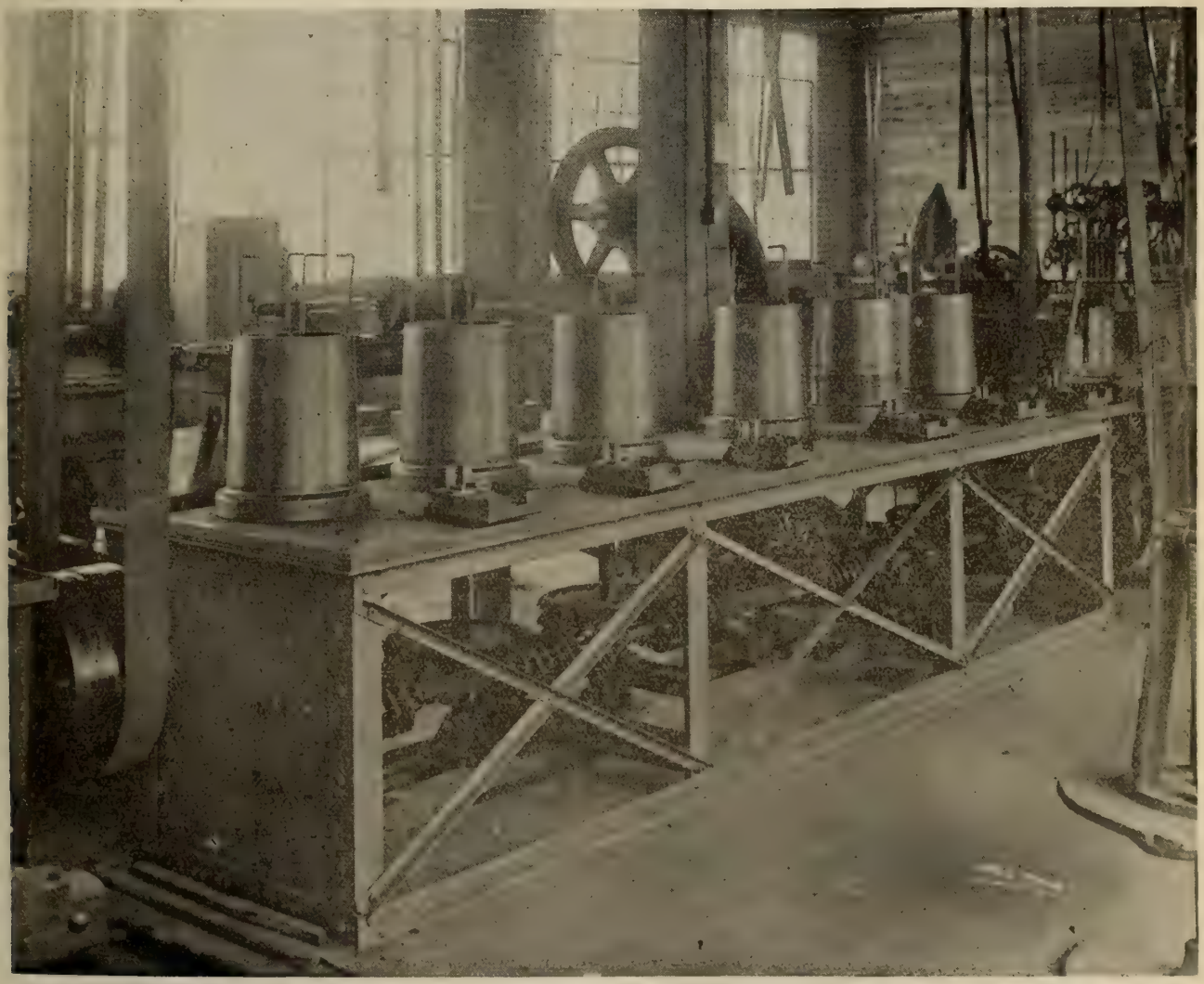
From the accompanying illustrations a good idea of the drawing operation may be gained. A number of draw benches are provided and are fitted with rotating heads upon which the wire is coiled and by means of which it is pulled through the dies. Two kinds of dies are used, chilled cast iron and the diamond. Since the latter is used on a somewhat special machine it will be considered later.

A word as to the mechanical details of the drawing benches: They consist of an angle-iron framework supporting a flat iron top. Through this top each vertical shaft projects and is provided with bearings and a worm gear meshing with a worm on a horizontal shaft running the length of the bench. This shaft is belted to the line shaft in the usual manner and is fitted with a friction clutch, by means of which it may be started or stopped.

Five stands or benches are used in drawing with cast iron dies. The first of these is a single drum machine with a 24 in. drum. The second stand is of similar construction to the first, mounting three drums of the same size. The third stand has six 14 in. drums arranged in two sets of three each. Two more stands of two drums each complete the equipment for using cast iron dies.

The drums on each stand can be used singly or in multiple, that is, the wire being drawn can be taken from the reel, passed through the die and wound upon the drum, or it can be reeled off, passed through the die, given a loop around the drum and through another die to the next drum in line, and so on until it reaches the last one, where it is coiled. By this means it is possible to effect several reductions in the one reeling with considerable economy.

The character of the metal being drawn determines the number of passes advisable; with monel, six are possible, but with chromel, three are about the limit, the greater hardness of the latter metal making the drawing operation more difficult and necessitating more frequent annealing. The wire, of course, elongates in being drawn through the dies, owing to the reduction in diameter, and at first sight it might be supposed that difficulty would be encountered from this source in multiple drawing, since the drums on each bench rotate at the same speed. This fact is of no importance, for the wire looped about the first and intermediate drums slips sufficiently to compensate for its growing length. The dies are of cast iron, chilled, and are cast in rectangular shape with rounded off cone-shaped depressions. The wire hole is drilled to the smallest size and carefully reamed to the correct taper. On being worn oversize the hole is then reamed to the next size larger, and as this is repeated until the opening is worn too large for the largest pass, a considerable life is thus obtained. The multiplicity of



DETAIL VIEW OF ONE OF THE LATEST TYPES OF DRAW BENCHES.

holes in each block also tends towards economical use of the die blocks.

The benches above described are made by the firm for its own use and are of interest in that the worm drive is contrary to usual practice. The extra expense is justified in the securing of more uniform tension in the wire. This is of considerable importance in the drawing of a difficult metal, such as chromel.

Diamond dies are used for the reduction of the wire to the finished sizes for the market. These dies are set in brass holders and the machine shown in one of our illustrations is of much smaller dimensions than those just described. While this is the case, these last machines, of which there are two, are capable of drawing monel wire through ten passes with the one reeling. Six passes are the limit on chromel wire.

Starting from the reel the wire passes through the first die and then over a drum beyond, from which it passes through the bath of lubricant and up over another drum on the original side of the die. From this it passes through the second die and repeats its course until all dies have been passed. From the late die it is wound on a receiving drum. Both horizontal cylinders and the receiving drum are power-driven. The elongation of the wire here as in former drawings is taken care of by slip. The dies are supported by an iron bar through slots in which the wire passes.

The lubricant here used is of a liquid type, a special soap being one of the ingredients. Wire is drawn from 5-16 in. rod down to standard gauges, as required by customers. The smallest size usually drawn is .009 in. in diameter; this corresponds to about No. 31 B. & S. gauge. The draft in each pass varies with the material and with the diameter of the wire; it varies from .025 in. down to about .0005 in. for the smaller sizes. The wire is annealed at various stages of the drawing. The annealing is done in a separate building with two oil-fired pot furnaces and fitted with quenching and pickling tanks. A special coating is also given the wire to assist in the lubricating of the dies used.

After a final annealing the wire is reeled on spools and is then ready for the market.

Making Turbo Blowers and Alternators

A Line Now Being Made in Canada—Many Interesting Features in Connection With This Type of Equipment—Work at Dominion Bridge Company Plant

By C. O. THOMAS, Asst. Chief Engineer of Turbine Dept., Dominion Bridge Co.

THE construction of steam turbines of any considerable size in Canada has not, until recently, been considered a commercial proposition. Yet it seems unreasonable to suupose that this country, which has developed so many different lines of engineering manufacture, should continue longer to stop short at the steam turbine. The principal prime mover of the age is now, however, a product of Canadian industry in the form of steam turbines, manufactured by the Dominion Bridge Company under license from the Rateau-Battu-Smoot Company of New York. Two of these units are each of 2,150 h.p. and drive blowers, also built by former company, for the conversion of nickel material at the plant of the British American Nickel Corporation of Nickelton, near Sudbury, Ont.

The blower unit, illustrated in outline by Figure 1, is a direct connected set, consisting of the turbine and a multistage blwoer, delivering 36,000 cu. ft. of air per minute at a pressure of 12 lbs. sq. inch above atmosphere. The turbine takes superheated steam at a pressure of 180 lbs. and exhausts into a surface condenser at 28 in. vacuum relatively to a 30 in. barometer.

The turbine is of the Rateau impulse type, with characteristically large clearances between the bucket, and stationary parts, and the normal running speed of 3,600 r.p.m., is well below the critical speed of the shaft. Although the end thrust with this type of turbine is almost negligible, a trust bearing of the now well-known Kingsbury type is provided to retain the motor in its proper endwise position. These bearings have given perfect satisfaction on the steam trials. The packing boxes consist of a series of self-centreing carbon rings, the leakage from the first two or three at the high pressure end being led back into the turbine casing where the steam is utilized by the nozzles which receive it. Some of this steam is also conducted to the exhausts end packing box to seal the vacuum against air leakage. High pressure steam can also be supplied for the same purpose when starting up or at very light loads.

An interesting feature of this turbine is the air fan governor. As the pressure of air delivered varies with the speed, this pressure regulates the position of the steam actuated admission valve. Very close regulation is attained. The fan is directly mounted upon the turbine shaft beyond the outer bearing and the air pressure is also used to operate an emergency shut-off valve in the case. An advantage of the fan governor is its extreme simplicity, no lubrication being required owing to the absence of sleeves, links, etc. The impeller blades of the blower, shown in Fig. 1A, which is connected to the turbine by a flexible coupling, consist of high-grade forging machined all over and have a section tapering to the periphery in such a manner that the stress is nearly uniform along

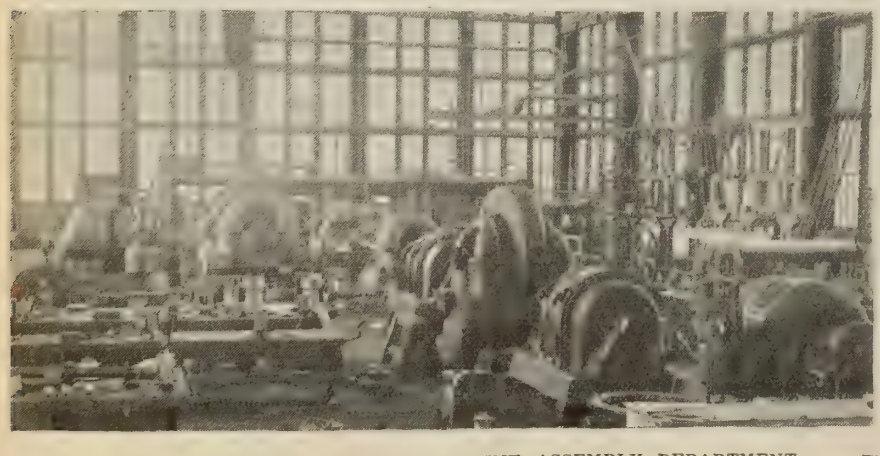


FIG. 4—GENERAL VIEW OF TURBINE ASSEMBLY DEPARTMENT.

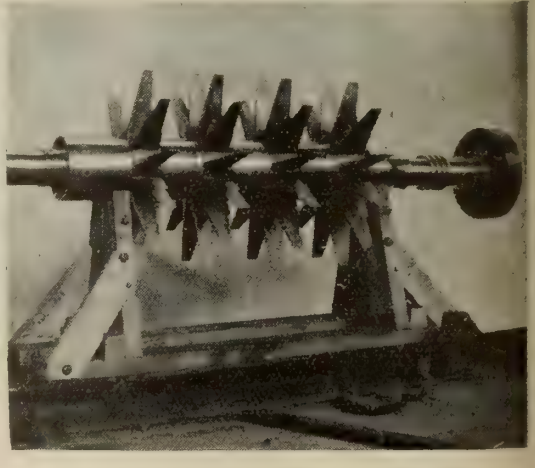


FIG. 3—2100 H.P. TURBO BLOWER ON TEST BLOCK.

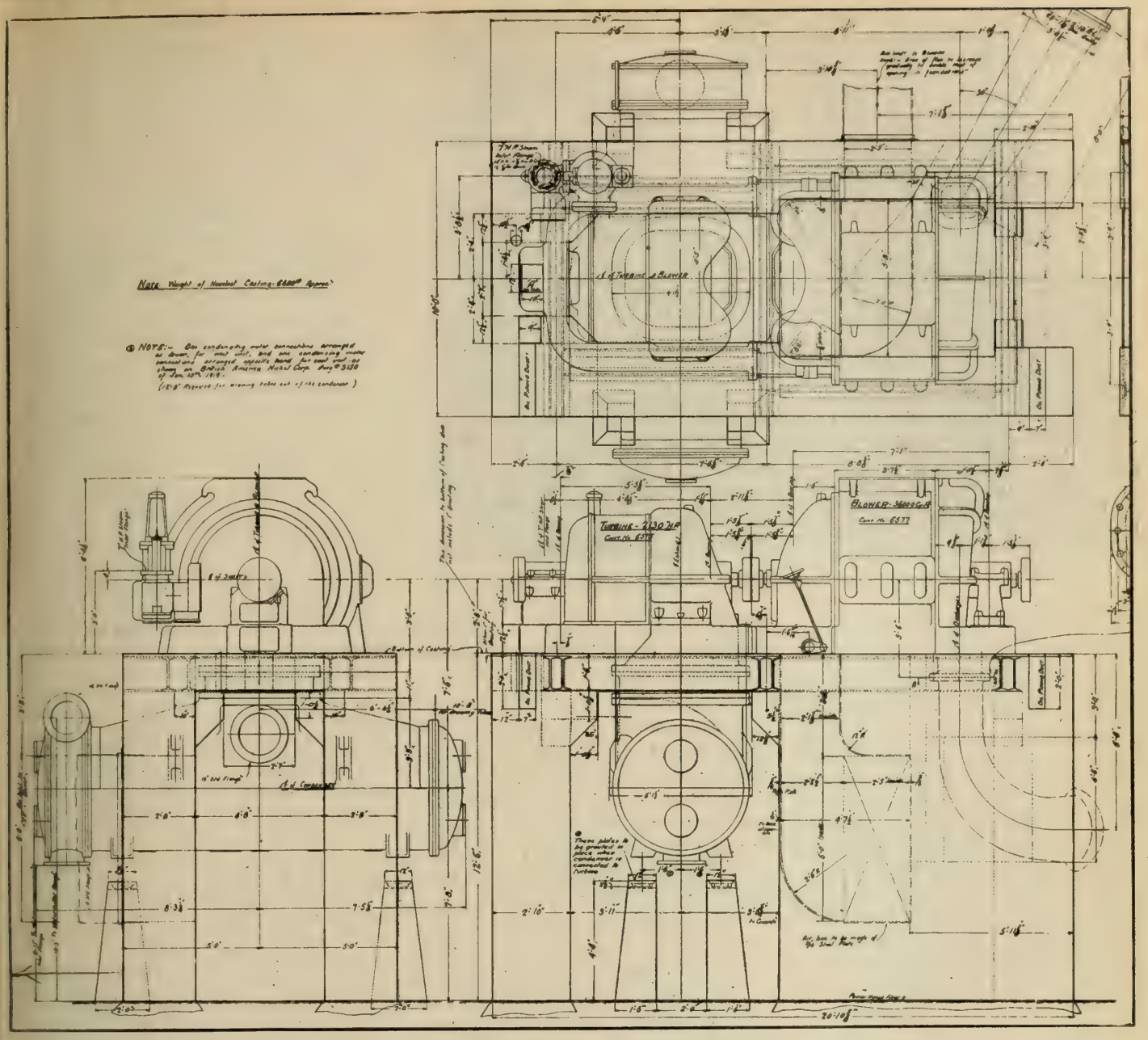

Note Weight of Nominal Casing 6000# Approx.
NOTE:- Circulating water connections arranged as shown, for one unit, and are interchangeable when arranged opposite hand for second unit as shown on British Aluminium Nickel Corp. Dwg. No 3328 of Jan 19th 1919.
(12"0" Reserve for drawing holes out of the condenser)
Turbine - 2250 H.P.
Blower - 36000 C.F.
Cast No. 6577
Cast No. 6577
Cast No. 6577



FIG. 3—2100 H.P. TURBO BLOWER ON TEST BLOCK.

valve in the air discharge line, in accordance with the usual practice, prevents any back flow occurring at light loads. On test at the manufacturer's works, the guaranteed steam consumption and output were fully met, the unit running with marked absence of vibration. The machine mounted on the test bed with its surface condenser is shown in figure 3.

Figure 4 is a view of the Dominion Bridge Company's assembly shop with five turbines, three blowers, and two A.C. generators in course of construction. On the right of the picture, paper-making machinery is seen in course of erection. Turbines and blowers in earlier stages of construction are shown in figure 5, where a blower impeller is also to be seen as described above.

In summing up the merits of pulverized coal as a fuel for open-hearth furnaces, Mr. N. C. Harrison, the general superintendent of the Atlantic Steel Company, says that in the case of the pulverized fuel, all the heat units in the coal are consumed in the furnace, while in the case of the gas producer some 18 to 25 per cent. of the heat units are lost in the producer itself when converting the coal into gas. Coal can be pulverized in plants of about 100 tons daily capacity and delivered to the furnace for about 50 cents (2s. 1d.) per ton, which is about the same as the costs for gasifying coal in gas producers. When using the same coal as in gas producers, the flame is hotter, which allows the use of a greater percentage of scrap per ton of steel. On the other hand, however, the refractory costs have been very much greater in the furnace using pulverized coal than in the gas producer furnaces, and were almost twice as great a year or so ago, although Mr. Harrison believes that refractory costs will steadily decrease.

Some information on the system of steaming gas retorts was given at a recent meeting of the Midland Institute of Mining, Civil and Mechanical Engineers by Mr. Riley, the coke-oven manager at Tinsley Park. Mr. Riley explained that the steam connection was made about 18 in. up from the oven level in the centre of the door; a hole was drilled to receive a 1⅛ in. coupling. The steam pipe ran along each side of the oven, with branches at every oven, and the steam was introduced by a flexible hose with a nozzle. When about to start steaming a rod was rammed into the coke and the nozzle inserted, which tapered from 1 in. to ⅜ in. This was inserted and the steam turned on for four or six hours; at the present time they steamed for hours at each end. Of course, the steam had to be turned on very slowly, owing to the fact that the pressure might blow off the roofing and the charging hole caps. The system had been in operation for four or five months, and he had not noticed any damage whatever to the oven walls.

In a paper read before the American Electro-Chemical Society, Chicago, Mr. G. M. Clark states that two American concerns have developed methods of heating rivets electrically. The American Car and Foundry Company employs a method whereby the rivet itself forms a short-circuit connection across the secondary of a transformer. A spring device holds the rivet in the desired position across the ends of the transformer whilst the operator holds the rivet with a pair of tongs and brings the spring holding device into operation by means of a foot lever. The consumption of electrical energy is about 20 units per 100 lb. of rivets, and the time taken to heat the rivet naturally varies with the size of the rivet. In another type of heater, employed by the Electric Furnace Company, a granulated carbon block forms the short-circuiting device across the transformed secondary, and in turn radiates heat to the rivets. The consumption of electrical energy for this type is about 18 units per 100 lb. of rivets.

According to Mr. F. B. Silsbe, the cracking of the rubber insulation on the high-tension cables connecting the spark plugs of petrol motors to the distributor is due to ozone. The ozone produced by electrical discharges in the neighborhood of such cables attacks unstressed rubber uniformly and very slowly. The presence of a very little mechanical tension in the insulation, however, is sufficient to localize the corrosion to a few deep cracks, which rapidly extend to the core of the cable and render it useless.

THINGS TO REMEMBER

By Proverbious

A single fact is worth a shipload of argument.
A poor workman quarrels with his tools.
A good action is never thrown away.
Be slow to promise and quick to perform.
Better do it, than wish it done.
Conceit may puff a man up, but never prop him up.
Do not throw your opinions in everybody's teeth.
He that stays in the valley never gets over the hill.
Sloth, like rust, consumes faster than labor wears.

Plans of the Canadian Steel Corporation

Plant Now Under Way at Ojibway Indicates That This Company Looks for Big Developments in Canada—Planning for a Steel City There of 25,000 People

THE Windsor district of Ontario, to which the name Border Cities has been given, is one of the most flourishing industrial centres in Canada at the present time. With the influx of automobile manufacturers and other industries of like nature, a rapid growth is taking place. It also bids fair to become one of the bigger steel centres in Canada, for when the Canadian Steel Corporation complete their plant at Ojibway, not only will the steel now imported into the country by the U.S. Steel Corporation, the parent company, be supplied by a home industry, but export trade may also be developed.

In the establishing of this steel plant a departure in design has been made from one of the practices of the U. S. Steel Corporation. The mills of the company in the United States specialize in particular products, that is, the whole output of individual mills is devoted to one particular class of steel product. Here, on the contrary, the whole steel industry will be represented in the products turned out; structural shapes, rails, rod, sheet and plate, together with tinplate and wire will be manufactured, the different plant units being added as need arises.

Several million dollars have already been spent in actual construction work and drawings and plans have been finished for the whole development.

A Steel City of 25,000?

A site of some two thousand acres has been purchased which will accommodate both the steel plant proper and the company's industrial town of Ojibway. This latter has been laid out for the accommodation of a community of 25,000 persons. The steel plant site has a frontage on the Detroit River of two miles, and the town development is located behind that portion reserved for the plant.

The ultimate size of the plant will be on a generous scale. As laid out at present twelve blast furnaces are provided for, with a possible two additional. These will be of 500 to 550 tons daily capacity each. At the present time four only of these will be installed, the remainder being left for future requirements.

In addition to these open hearth furnaces will be erected. Present plans call for two or three groups of fourteen open hearth furnaces of the stationary type, each of 75 tons capacity. The capacity of each group will be in the neighborhood of 750,000 tons per annum. As an alternative to the above it is possible that duplex process of the type used at the Gary mills may be used, and in this case two 250-ton open hearths will be erected together with two 25-ton converters. This plant would have a capacity of 50,000 tons a month.

The Talbot process, by which these open hearths would be operated, does not require the use of any scrap for the making of steel, but is able to use the molten iron from the blast furnace as the sole raw material. The iron is first partially blown for the removal of the silicon and a varying proportion of carbon and is then transferred to the open hearth. About one-quarter to one-third of the finished steel is tapped at one time, the remaining portion of it being left in the furnace to dilute the impurities contained in the pig iron and to supply the heat necessary for the keeping of the slag very fluid. Addition of lime and iron ore or oxide are made as slug-making materials, and after the slag has formed the molten iron is run in and a violent reaction takes place, most of the phosphorus and silicon being removed in the first few minutes.

With the four blast furnaces considered as present equipment and with sixteen 75-ton open hearths, approximately 1,000,000 tons of ingots will be made per annum.

Blooming mills will be installed to take care of the product of the open hearth plants and the rolling mills also contemplated will manufacture nearly every line of rolled steel products. A combination structural and rail mill, a plate mill, a bar mill, rod mills and wire mills will be erected, together with finishing mills for wire products. Tube mills and mills for the manufacture of sheet and tin plate are also among the future possibilities.

Present Status of the Development

While considerable development work has already been done, the magnitude of the work is not apparent at first sight to the casual observer. This is so for the reason that most of it is underground and the substructure of any building or work of this nature, while inconspicuous, when finished is exceedingly important and costly.

The ore dock and blast furnace foundations consist of concrete work of considerable magnitude. The blast furnaces will be erected in a line at right angles to the river frontage, and for the accommodation of the ore vessels a slip has been partially completed. This slip for the present is 2,400 feet long by 202 feet between dock walls, and will be completely dredged out to a depth of 23 feet. The method of making the dock walls is of much interest. Excavation was made to the bottom of the concrete walls and pile foundations were driven to solid rock some seventy feet below. On top of these the concrete was poured and the dock walls finished in dry land. When the concrete had set and when the work had advanced sufficiently, a sand dredge was employed to remove the earth intervening between the walls. The sand thus removed served admirably as a fill for some low land on the plant site; 600,000 cu. yards of earth will be removed from the slip. At the present time this concrete work is completed and a considerable portion of the slip dredged out.

As mentioned before, the section completed at the present time is 2,400 feet in length. Later, when expansion is necessary, a further 2,000 feet will be finished, making the total length 4,400 feet. The width of 202 feet is sufficient for two boats to tie up at opposite sides and a third to pass between them.

The snubbing posts are of special design, constructed so far as is humanly possible to avoid accidents in mooring. Hand chains are also provided at water level for the saving of any workman unfortunate to tumble off the docks, and ladders are provided at intervals for his gaining access to the level above.

The portal is 400 feet wide, the convergence to the width of the channel inside all being made on the down stream wall. The end of each dock wall makes a right-angled turn and these portions of the walls are securely braced back by heavy reinforced concrete beams, all converging to a common centre. Later, slag will be used as a filling material.

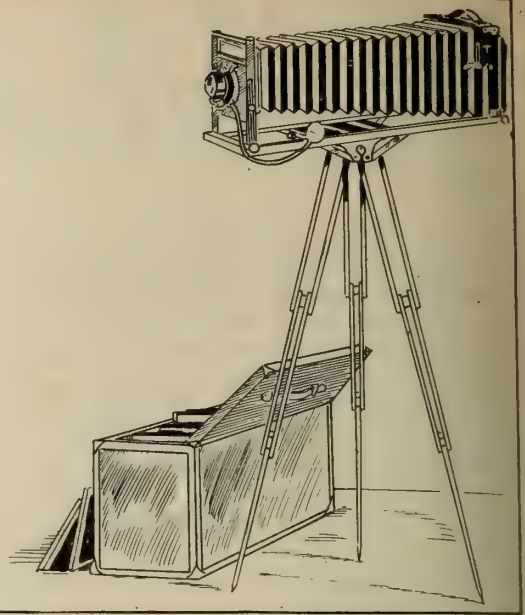
Some movement was naturally to be expected when the slip was dredged out, and this was provided for. About two inches lateral movement was found. About forty feet back from one dock wall is placed a reinforced concrete structure which serves as a runway for the boat unloader and also as a retaining wall for the stock pile; beyond this wall is tied in to the dock wall with heavy reinforced concrete beams every forty feet or so, and in turn it is tied in to the stock pile wall some 600 feet beyond. Conduits are provided in it for power supply to the unloader, and a tunnel runs its full length. This latter serves to lighten the wall and at the same time provides a place for racking pipes, etc.

Excavation has been made for the foundations of four blast furnaces together with their stoves, and foundations have practically been completed for two of them; 12,000 yards of concrete will be used in these foundations. In building them piles are driven to rock bearing as thickly as possible, and on these is laid 15 feet of limestone concrete. This is followed by five feet of gravel or silica concrete, and on top of this 12 feet of firebrick will be laid before the blast furnace is erected.

Two stacks together with their stoves are now in the course of fabrication as well as the steel for a machine shop.

Copper by-product coke ovens will be erected, and their capacity will keep pace with the demands of the blast furnaces.

Shop Photography



THE need of a special department of this nature is coming to be recognized as an important adjunct to the selling and advertising end of the business.

by *E. F. Hetherington and J. A. Moore†

TO anyone in the manufacturing business the value of good photographic reproductions of their product can hardly be over-estimated.

It is becoming a more established fact as time goes on, that good photographs are of the greatest assistance to the sales department, securing orders in many cases where the prospect was doubtful. Another advantage of using the photographic method of showing your product is in such cases where the carrying of samples is impossible. Take, for example, a large marine or power plant installation. A series of photographs forwarded to a prospect showing similar installations to that which he requires cannot fail to carry considerable weight.

Manufacturers who depend on outside photographers to supply their work are very often disappointed at the results obtained. This is due to the fact that the local photographer rarely pays any attention to commercial work, and is, therefore, unfitted for such work, having neither the equipment or experience, not to speak of technical knowledge.

Because of this fact, and other important reasons, many manufacturers are installing their own photographic department to work in conjunction with their advertising and sales departments. The advantages of such a movement are ovious, chief among them being the quality of the work obtained.

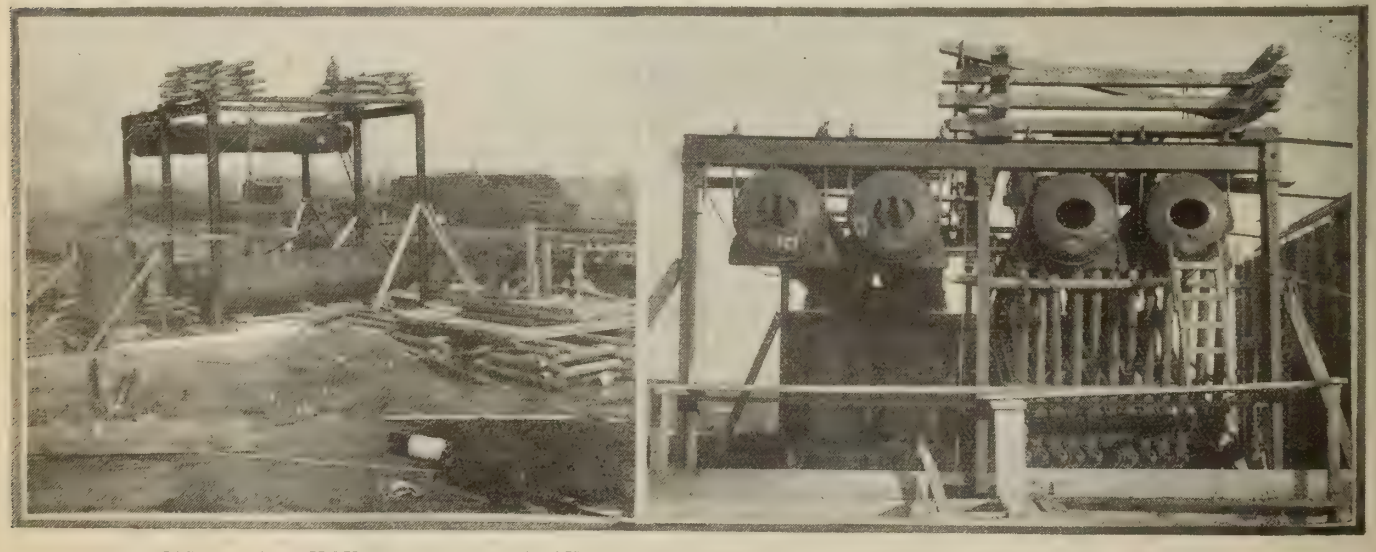
*Advertising Manager, Goldie & McCulloch Co., Ltd.
†Associate Editor, Canadian Machinery.

Quality of Work

Having your own photographer, he naturally becomes familiar with your product and develops a sense of mechanical values, which is most important in order that the greatest possible value as a selling aid may be found in the photograph. By specializing on any one line of product the photographer is enabled to bring into prominence the important details that have real sales and educational value, as well as additional artistic merit.

When a photographer realizes that success to a great extent depends on his efforts, it is his best work only which you procure. His subjects are always arranged to make retouching as small an expense as possible, the plates are exposed and developed with greatest care, while the prints he delivers are of the best quality he can obtain from his negatives. In other words, he takes a personal pride in his work. This is especially true if his efforts are commented on and appreciated.

The efficient service obtainable proves a most important advantage over the usual outside method. Perhaps you wish some prints in a hurry. With the outside photographer this becomes quite a problem, as three or four days is not an uncommon time to wait for prints ordered from outside sources. In many cases the print becomes of no value through arriving too late for its sales pur-



FIGS. 1 AND 2, ILLUSTRATING THE VALUE OF PHOTOGRAPHS IN SHOWING CONSTRUCTON PROGRESS.



FIG. 3.- RECORD PHOTOGRAPH SHOWING STYLE OF WRENCH BOARD SUPPLIED WITH CERTAIN INSTALLATIONS

pose, proving once more that it pays to conduct your own photographic department.

With your own studio, finished prints from existing negatives can be delivered to the sales department at an hour or two's notice, an advantage not to be overlooked.

Another strong point in favor of one's own photographic department is the question of expense. It will be found that considerable money can be saved through conducting a studio at the plant. In place of the usual three to four dollars per exposure, you will find the expense cut to a considerable extent, not to speak of the advantage of getting the exposure just when you want it. A commercial photographer does not answer one's beck and call, for he has other lines to attend to, and often you must wait his pleasure before obtaining the desired picture. The advantages of having your own photographer have been clearly pointed out and the reader, no doubt, convinced. We will now state what has proved to be a successful equipment for average conditions.

What Equipment Is Necessary

As the great majority of work will necessitate the taking of the complete kit to where the work is, we should secure an outfit which is easily portable, yet not lacking in utility. Any of the modern type of view cameras which has a focal length equal to at least twice the diagonal of the plate used, will do nicely. This focal length is necessary in order to obtain good perspective in our subject.

In photographing machinery we should get far enough away from the subject in order that our perspective and proportions are good, filling our plate by using a long focus lens. The extension bed on a view camera admits of this long draw of bellows. Another desirable feature is the sliding block under the bed of the camera, which is so arranged that the weight is well balanced over the tripod, and not all in front as would otherwise be the case. This is a great convenience in wide angle work, or when working on a slippery floor, for one can balance the camera with less danger of upsetting. For illustrative purposes, we will mention the photographic outfit as used by the Goldie & McCulloch Co. of Galt.

Starting from the ground up, we first come to the tripod. This is of the regular wooden type, which folds up and goes into the camera case. It should be sufficiently heavy to form a solid foundation for camera. The camera used is of the Premo view type, fitted with a series 7A Ziess-Protar anastigmat double lens, working at F 6.3. This lens is made by the well-known firm of Bausch & Lomb. It is so arranged as to give two focal lengths. With both lens in position, a focus of 9¼ in. is procured, but with either the front or rear combination used separately, it gives a focus of 16⅛ in. The advantages of such latitude are self-apparent.

The Work Room

The lens works in a volute shutter which varies from one one-hundredth second exposure to three seconds, in addition to the usual bulb, and time exposure points.

Entering their room, we find the following equipment: First, the regular developing tanks, fixing tanks, print washer, plate washer, etc., etc., which require no detailed mention. Next comes the contact printing apparatus which we will dwell on for a few moments. This printing box is equipped with a 500-watt nitrogen lamp, which gives ample light for the purpose.

In front of the printing light is a flashed opal glass for evenly diffusing the light, but installed in front of this again and operated from a foot treadle is a pair of sliding wings in which is placed a safe light color for printing purpose. The object is obvious. When loading paper in the printing frame, these wings are in front of the printing light, making the light perfectly safe. By pressing the foot treadle, these wings come out, allowing the bright light to print the required work. Immediately the treadle is released these wings, operated from springs, fly back into place, once more making the light safe for unloading purposes.

Before leaving the subject of printing, let us quote the method adopted for timing the prints. After a trial has been made and the proper exposure ascertained, a metronome, or in other words a musical time indicator is used. By adopting this method of timing one need not look at the instrument, but can count its ticks to a nicety, devoting all their attention to the negative, thus securing the best possible print. The printing frame used in an Eastman transparent backed swivel frame, having a capacity of 10 in. square.

The next, and very important, portion of the work

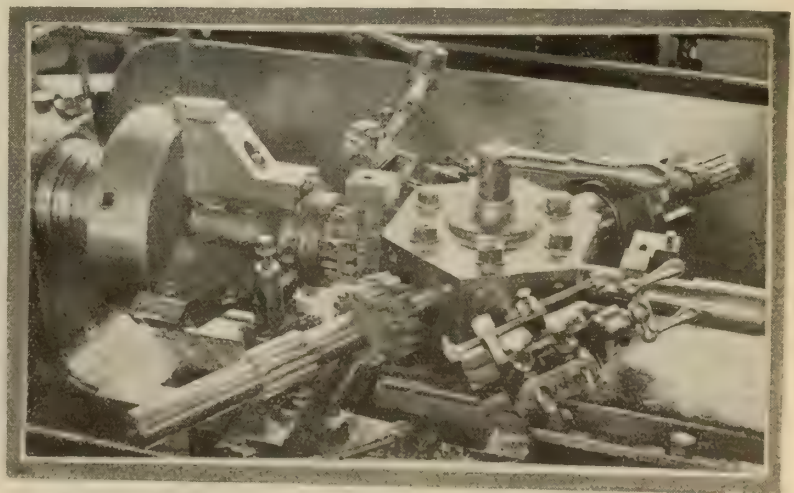


FIG. 4.- ILLUSTRATING THE VALUE OF A PHOTOGRAPH SHOWING TOOL SET UP.

room is that of the enlarging apparatus. This is a Folmer & Schwing outfit, Division of the Eastman Kodak Co., and its capacity is of course more than is ever required by a firm of this kind.

The lens used in the enlarging camera is the same as in the regular camera. This idea can often be adopted, thus saving considerable expense.

Another ingenious arrangement adopted by Mr. Hetherington is as follows: In place of the regular easel, or bromide paper stand on the floor, he has gone one better and built an overhead trolley arrangement to accommodate this part of the equipment.

The entire outfit is made of wood. Two rails run the complete length of the workroom. On these rails is a groove, in which run four stepped pulleys, which are attached in turn to the easel framework. By adopting this principle one is always assured of the easel being perfectly true with the lens of the camera. A tilting arrangement is provided on the easel, should it be desired to move one portion of the paper slightly nearer the lens.

The light for this enlarging outfit is supplied by a Cooper Hewitt type K.K. 3000 C.P. mercury M light. The peculiar shape of this light obviates the necessity of condensors. The tube takes the form of the letter M, in this way spreading the light evenly all over the plate to be enlarged.

Other fixtures in the workroom can be enumerated as follows: An Eastman Co. Safe lamp with Wratten slides to suit the various conditions met with, the regular film holders, plate dryers, etc. In fact, all the usual paraphernalia found in a room of such nature.

Varied Conditions

As shop conditions vary, it is impossible for us to lay down any hard and fast rule to follow. Light conditions are never the same in any two plants, machinery is often placed in very awkward places, and so on. We can, therefore, take only certain supposed cases for illustrative purposes and attack the problems in the best manner possible, storing this knowledge away for future occasions. When the actual photograph has to be made we must exercise our ingenuity to the best advantage and come out with results that prove that we understood our problem thoroughly.

Take for example Figs. 1 and 2. Here we note two views of the same installation, both exterior photographs. Being taken outdoors the exposure was a very short one, something impossible when picture taking inside the plant. Apart from the actual exposure of these negatives, what is the sales value of such pictures?

The photographs have both sales and educational value for the following reasons: As a record showing how the assembling of this installation was accomplished they are ideal, for they serve the purpose of depicting to others the system adopted. From a viewpoint of salesmanship they are also invaluable, for a prospect noting the methodical way in which the work was being accomplished could not help but be impressed by the standard of the company who wished to deal with him. In this way these pictures serve a double purpose at one cost.

Photographs As Records

Photographs as permanent records are ideal in very many ways. They give a truthful representation of the object exactly as it appeared when exposed. Take for example Fig. 3, which illustrates a wrench board as supplied with certain installations made by the company already mentioned.

"How did we make up these boards for such an installation?" is a query often asked. Out comes the photograph and there you have all the details at your command. No guesswork, but plain facts are before you at once. It's hardly necessary to state that this condition means more efficient work, with no loss of time. The system of records can be applied to innumerable lines.

Let us consider another case, this time in a large manufacturing plant. Bill —— (we will call him that, anyhow) sets up the tooling on all the turret lathes while the various operators merely know enough about the machines to keep them running.

Suddenly without warning Bill gets sick. What happens? His assistant (if he has any) has to change over the tooling on one of the machines. "How did Bill fix these?" he enquires of the machine hand. "Search me," comes the reply, and the poor sub is very much worried. Loss of time results with frantic S.O.S. signs sent up to Bill. He in turn may be able to draw up a rough sketch of the arrangement, then again he may not. In any case they have a merry old time and all hands are thankful when Bill returns to work.

How different would have been the above story had this firm used a camera! They would have taken a photograph

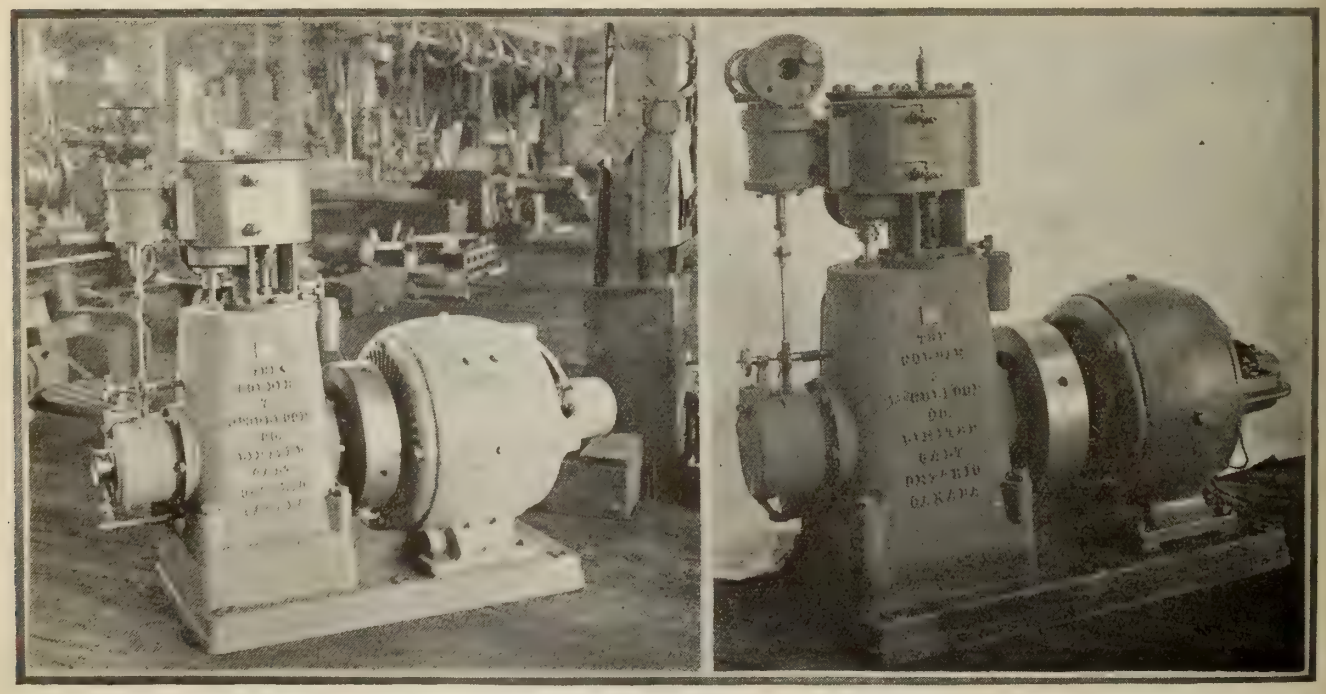


FIG. 5 AND 6, ILLUSTRATING THE BENEFITS DERIVED FROM THE USE OF A PROPER SCREEN.

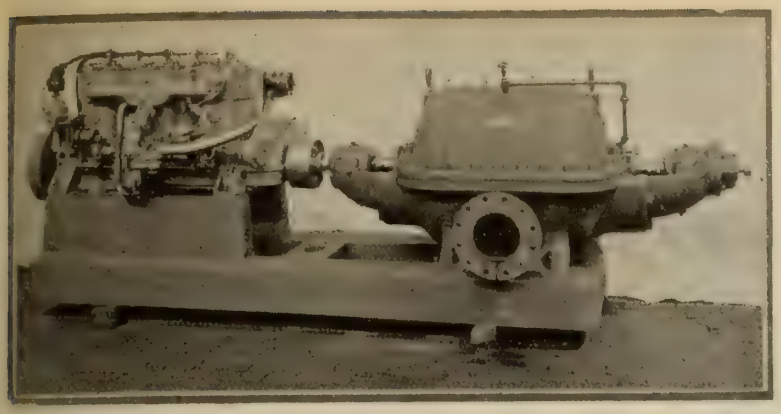


FIG 7. THE VALUE OF FLASH AND DAYLIGHT EXPOSURE. NOTE ABSENCE OF SHADOWS.

of the tool set up, the first time it was completed, and kept a print on file for such occasions. Fig. 4 illustrates the idea exactly. As soon as one looks at the photograph he grasps the various details. Bill becomes unnecessary, the change is easily made and production goes on without interruption. Which is the best system?

The Use of the Screen

When photograping any machine it is always advisable if possible to use a white screen behind it, as this arrangement shows up the picture to better advantage, also saving money on the retouching process.

At Fig. 5 we illustrate the photo with all its confusing background in detail. Not only does the background detract from the subject itself, but it means extra work in the retouching department. Contrast Fig. 5 with Fig. 6.

A white screen has been used in this case to splendid advantage. It is sometimes good practice to scatter sawdust or wood chippings on the floor around the subject, or to work on a portion of floor space that has been specially whitewashed, but these points, of course, depend upon the color of the machine, its shape, etc.

When using a screen it is advisable to keep it in motion, otherwise all wrinkles, dark spots, etc., will show up, making the picture very poor in appearance. Note the smoothness of the background in Fig. 6, yet this screen was both soiled and creased. The moving of screen is easily accomplished. Have two men behind, instructing them to move it sidewise slowly, and as evenly as possible.

The Value of Flash Powder

We could go on enumerating countless cases where by a little ingenuity money can be saved in the later processes, but our space is limited, therefore we must proceed to another section.

In securing photographs of any machine the chief object is to get away from shadows as much as possible. An evenly lighted picture is a joy to the photographer's eye.

We would not have readers infer from this that we advocate the use of flash powder alone, but it is our belief where daylight is procurable, that a combination daylight and flash exposure is ideal. Fig. 7, which illustrates a Ro-Turbo centrifugal pump directly connected to a gasoline engine was taken in this way. The even light with absence of shadows is especially noted in this photograph.

An open flash lamp is about as good as any for such purposes, but where smoke is an objectionable feature the smoke bag should be used. Study your shadows, and play your flash on the darkest portion, making sure your light is well behind the lens so that no lens glare can result.

To illustrate once again the value of a photograph for recording purposes we show Fig. 8. Here we see a triple expansion marine engine after assembly. The value of this photograph is again two-fold. First its sales value is self-apparent. A prospect can at once realize what he proposes purchasing, while from a record standpoint the photo is of great value.

It shows to advantage all the various piping, how it is bent and so on. It also illustrates the position of gauges, etc. In other words, to the shop it is a miniature reproduction of what they must build on some future occasion.

Blocking Out Negatives

This term blocking out is a familiar one to camera fiends, but not so to the tyro, so we had best explain the meaning of the term.

To centre attention on the object itself, the background is painted out with red or black opaque. This brings the entire ground up in white when printed, pushing out the subject in all its details. A small easel is usually made to finish such work with a light striking on the back of the negative, allowing the worker to see all points clearly. A good, steady hand is necessary. Where long straight lines appear on the negative it is a good policy to use a ruling pen for outlining such surfaces. Practice is really the big essential, the more you become familiar with the task, the speedier and more accurate becomes your work.

A good example of blocking out is shown at Fig. 9. This illustrates a compound marine engine. As can be noted by blocking out the rest of the negative, at once we concentrate on the subject itself.

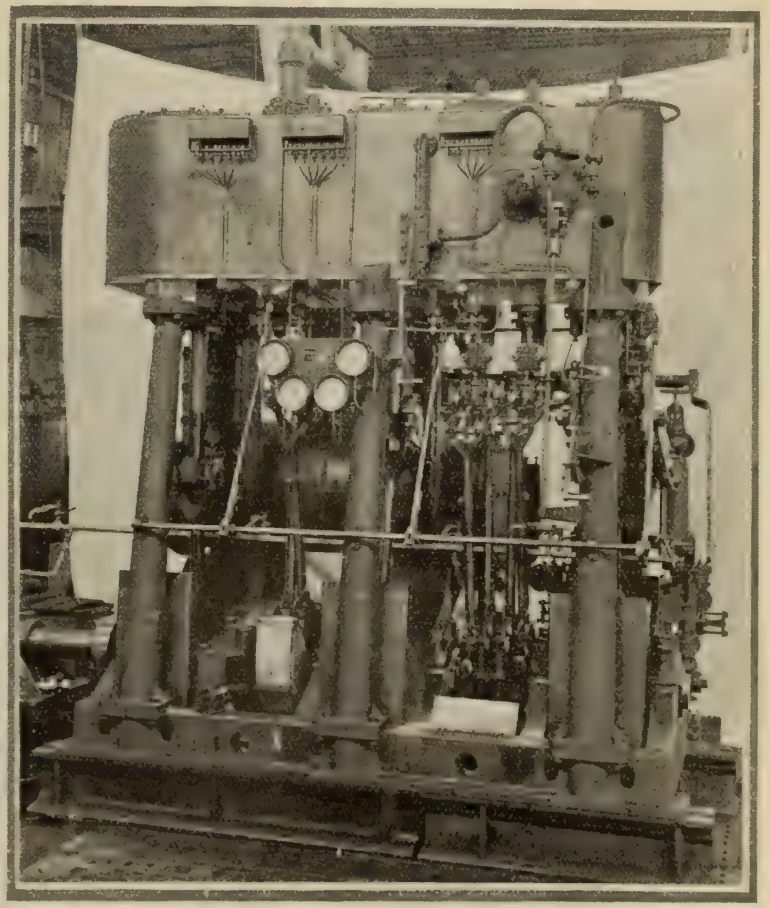


FIG. 8.—THE VALUE OF THIS PHOTOGRAPH AS A RECORD IS SELF APPARENT. PIPING, GAUGES, ETC., ARE CLEARLY NOTED AND THEIR POSITION CAN BE DUPLICATED IN LATER INSTALLATIONS.

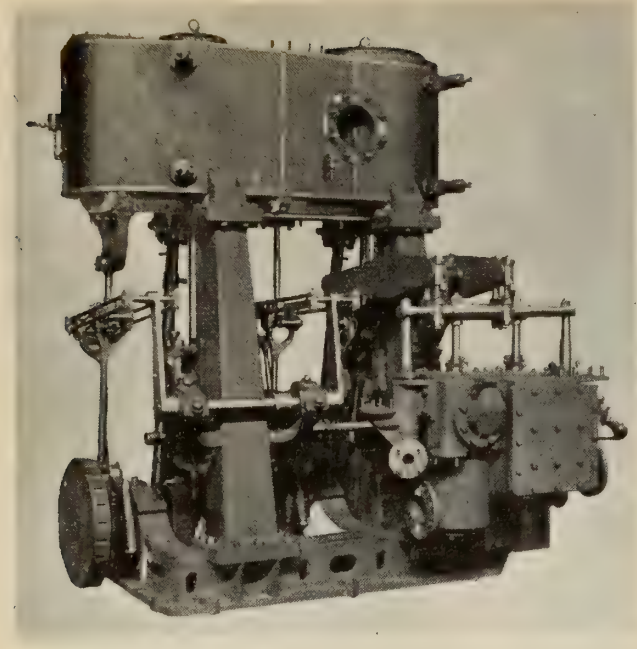


FIG. 9.—A NEAT EXAMPLE OF BLOCKING OUT WORK.

Another section which can be adopted to advantage is the photographing of the artist's retouch (from which the half-tones are made). In this way splendid finished prints are obtained, which will be found very useful in making up travellers' photo albums, and for enclosure with proposals, etc.

Fig. 10 illustrates a photograph of an installation at Montreal Mechanical School showing Heavy Duty Goldie-Corliss Engine. This was photographed from the artist's retouch, and the neat appearance of the print illustrates clearly the value of this class of photograph.

System of Filing

Any photographic department is behind time without a filing system. It should be so arranged that when a negative or print is required, one can put their hand on it at a moment's notice.

Every negative should be enclosed in a separate envelope on which should appear the title of the negative as well as the number. These should be filed on edge in a vertical cabinet similar to that used for ordinary correspondence filing.

A cross-card index, giving the title and number of each negative, makes them easily and quickly found, and after the required prints are made ordinary care should be observed in seeing that the negative is returned to the proper envelope, the number on which makes it practically impossible to put it back in the wrong place.

The finished prints can be placed in folders and handled in a similar way.

It is important in filing both negatives and prints that numerous and intelligent headings be used, such as—turret lathe tool set-ups, automatic tool set-ups, watertube boilers, Corliss engines, etc.

For negative files a heavy pressed board guide with metal title holders will be found most substantial and conspicuous for sub-dividing the various classifications.

Some General Hints

If possible, have the machine to be photographed painted a grey shade. Above all avoid red or blue. Red means a black dismal photograph, while blue ensures the very opposite, the result being a white streak instead of the proper color value. It is not always practical to name the particular shade you desire, but by diplomacy and co-operation between shop and photographic department improvement can be made to a wonderful extent. Where some highly-polished surface appears, it is best to dull this down with suitable paste or chalk, to get away from the glare.

Should it be desired to show cap screws, nuts, bolts, etc., or letters on some casting, rub these with chalk, or cover with a thin layer of white lead. The letters can be painted with the regular white paint, as is often done.

Wherever a machine is taken, showing actual operation, be careful that the cutter or tool is really in a working position. It often occurs that you see some photograph showing the cutter in a position, that from a hard practical standpoint would be quite impossible. When including the operator of the machine, refuse to take the picture before he assumes a natural working position. The tendency of the operator is to pose facing the camera. Be careful to avoid this as the value of the print, from a mechanical standpoint, is materially lessened. His eyes should be on his work. It is often possible to take a picture of this nature without the operator's knowledge, but in the majority of cases the light is so poor that such a procedure is impossible. For this reason it is best to take the operator into your confidence, explain diplomatically, that without his aid your picture cannot be a success, then watch how natural he looks. A little encouragement is all he requires. When arranging machinery care should be taken to see that all small parts such as oil cups, pipe fittings, handles, etc., are properly screwed in place, and in proper alignment.

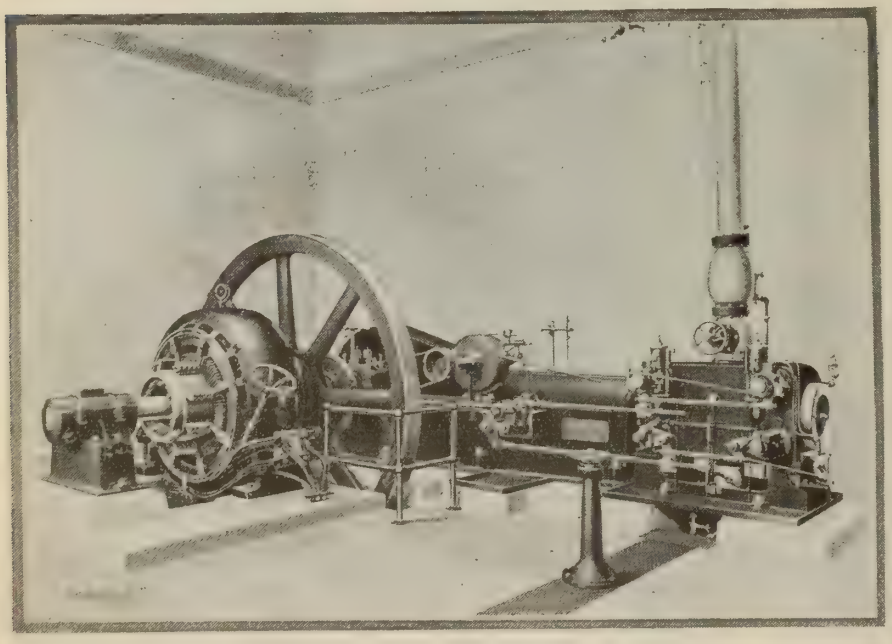


FIG. 10. A GOOD EXAMPLE OF PHOTOGRAPH FROM ARTIST'S RETOUCH WORK.

In some cases it is a habit to place wooden plugs in threaded holes to protect the threads. Watch this point, for many a photograph has been spoiled through lack of care on small details such as mentioned.

While it is not good practice, generally speaking, to use a wide-angle lens, it becomes necessary in some cases where extreme width must be obtained. For such work the firm quoted throughout this article, use a Cooke primoplane series .7A lens working at F 6.5. The principal objection to the use of a wide-angle lens is the difficulty in securing true perspective, and, owing to the small aperture focussing is made more difficult where light is scarce.

When arranging a photograph, take your time. Study your picture. You have, we will suppose, reached the point where you are ready to press the bulb, or remove the lens cap, as the case may be. Before starting the exposure take a final look at the object to be photographed. It will pay you many times over, for countless pictures have been saved through this final glance. Other points to be watched will crop up from time to time, but experience is a great teacher.

A Suggestion

To those firms who feel that the expense of employing a photographer for their work is too great, we make the following suggestion:

Look around your plant. The drafting office is a splendid starting point, and ascertain if there is not someone who could accomplish this work in conjunction with his regular employment. It is a poor plant that does not harbor at least one photo bug. Like the poor, they are always with us. You will find this arrangement very satisfactory, for given the proper equipment to develop his ability, a photographer will break his neck if necessary to obtain results. Expense becomes a very small matter if this arrangement is followed out. Tall oaks from little acorns grow, and a humble photographic department started in this manner will soon make its value so apparent that it will expand in its usefulness as time goes on.

What supplies shall I use? That is the first question the tyro is apt to ask himself. In answer to this supposed query we would say, use only the best of everything. Good work requires good tools. The plates, or films, whichever you use, should be dusted carefully before being placed in holders. A wide camel's-hair brush should be used for the purpose. Developer should be kept at proper temperature and be **clean.** The same holds good for the fixing solution. **Care and cleanliness** should be the slogan of the dark room. For those readers already familiar with the art of photography we publish a formula used by Mr. Hetherington in the developing of prints. This formula is particularly adaptable for use with Azo paper, but will be found equally desirable for almost any quick printing paper. Clean, snappy prints are turned out by means of this solution. Following are the ingredients, which should be added in the order given, each one being thoroughly dissolved before another is added. The developer is non-abrasive.

Water, 40 ozs.; metol, 15 grains; sulphite of soda, 1 oz.; hydrochinone, 60 grains; carbonate of soda, ¾ oz.; potassium bromide, 25 grains; red prussiate, 5 grains; oxalic acid, 5 grains; potassium iodide, 5 grains. This developer is ready for use in this finished form. A feature of the developer is that it requires no alcohol as a preservative.

What One Firm Has Accomplished

In conclusion, we quote what the National Acme Mfg. Co., of Cleveland, Ohio, has accomplished in their photographic department. In common with other manufacturing companies they found a great deal of difficulty in securing suitable photographs from outside photographers. They established in 1910 their own photographic department as a branch of the advertising department.

In three years' time the department made itself self-sustaining, and proved to be a valuable adjunct to the advertising and sales division of the business.

Over 850 photographs per month were used for advertising and sales purpose, which means over 10,000 prints during the year. That was in 1913. Since then the work has still further increased. The advertising department uses all sorts of views of machines, parts, tools, etc., for many purposes. Photographs are sent to those enquiring regarding their products, and for sales promotion work. The pictures help to bring out the truth of the points stated in their various letters.

They use 8" x 10" cameras for general photographing, and an 11" x 14" for catalogue work. A 5" x 7" Graflex is also used on special work. Fouy lens are in use, viz., 19", one 12", one 8" Dagno, and one Bausch & Lomb Zeiss-Protor Series V lens for extreme wide-angle work.

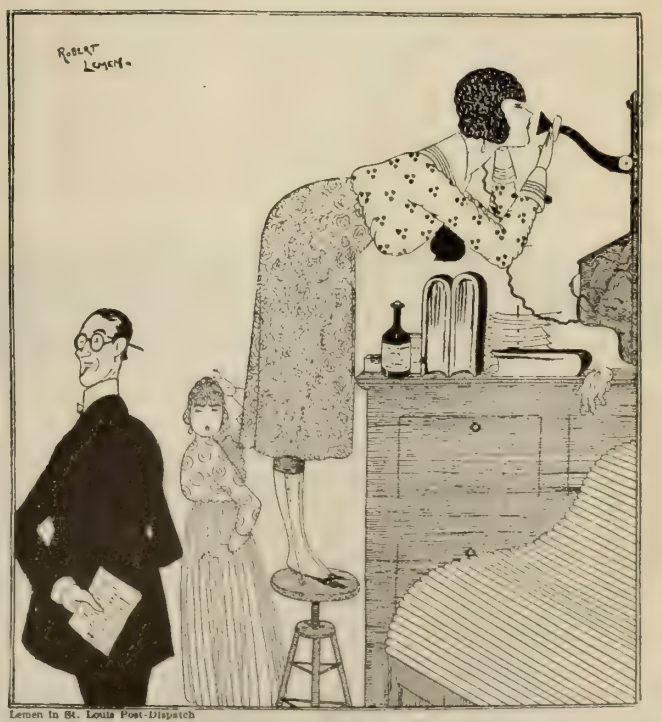
In their case they bring the work to the studio. It is taken from the elevator by a portable crane, and placed on a turntable which allows the photographer an easy means of photographing the machine from any angle. It also allows him to take advantage of the best lighting available at the time. Artificial light is also used to penetrate when the daylight fails to go. A Cooper-Hewitt light is used as an auxiliary to the daylight in the studio.

Usually the machine is specially painted before exposure in order to reduce retouching expense as much as possible. The paint used is an oil paint which is flat but not a dead black. This paint dries smoothly and with just enough lustre to give the image a little snap.

For small parts they use what is known as a sky-scraper camera, placing this in a vertical position on a special stand and arranging the parts on a horizontal table. These few points will impress readers with the fact that this department is far beyond the experimental stage. Everything is worked out intelligently and with the idea of reducing expense always in mind, the result being a well-conducted and profitable department.

While the average concern cannot attempt to enter into this field on such a large scale there is no reason why they should not enter it on a more conservative basis. The day is coming when the up-to-date shop will conduct their own photographic department, as a necessary portion of their organization.

High efficiency in the sifting of sand is secured by a new "sand hog," which is electrically operated. The motor is suspended below the riddle, and by centrifugal force throws the sand toward the rim. The motor is cooled not only by the running sand, but also by the circulation of air through the hollow supporting members. The frame is adjustable for all standard-size riddles. The device, complete, weighs about thirty-five pounds, and is so compact as to require only a small amount of space. It may be easily raised or lowered to suit the convenience of the operator.



THE EFFICIENCY EXPERT GETS BUSY, WITH THE RESULT THAT THE GIRLS CANNOT HOLD CONVERSATIONS OF UNDUE LENGTH OVER THE PHONE.

The Canadian Plant of Crane Limited



By J. H. RODGERS

ENGINEERING activities, for the purpose of developing trade in Canada, have made considerable progress during the past year, and the result of such action is already making itself felt. Many of the more recent enterprises — new to Canada — have doubtless arisen as a direct consequence to the change in world trade conditions following the close of the European war. However, there are some instances where new industries have come to this country—not as an aftermath of the signing of the armistice—but rather as a foresighted policy of old-established and progressive firms.

For some years past the Crane Company of Chicago has contemplated opening a manufacturing plant in Canada in order to take care of the rapidly growing demand for their lines in this country and others in the British Empire. The company of Crane, Limited, was incorporated in February, 1918, and a suitable site was secured at Cote St. Paul, on the south side of the Lachine Canal, and construction work commenced in September of the same year. Steady progress has been made on the buildings which were completed in the early fall of 1919. Since then manufacturing operations have been carried on and gradually increased as equipment was installed (they are rapidly approaching capacity production).

The main building is three storeys high and of reinforced concrete construction, and, as will be seen from the line sketch, the property is in the form of an irregular octagon, enclosing a considerable area in the centre, with ample accommodation for future additions to the present plant. One of the novel features in the layout of the plant is the location of the brass and iron foundries, both of which are situated on the top floor of the main building, with a portion still higher that serves as a charging floor for the cupola. This arrangement provides for exceptionally good lighting and ventilating facilities, the latter having received particular attention in consideration of the conditions under which the moulders are required to work. This not only provides ideal working environments, but facilitates the handling of the material from the casting to the finished product, allowing the natural force of gravity to minimize the physical effort which is too often emphasized in many industrial establishments. The floor construction throughout the entire manufacturing portion of the plant is of creosoted wooden blocks.

All raw materials, such as pig iron, scrap, ferro-silicon, sand, etc., are stored in the basement and arranged in piles and bins for convenient distribution to the different departments. Special machines are installed for machining the different valves and fittings. All



A VIEW OF THE BRASS FOUNDRY.



GENERAL VIEW OF THE CORE ROOM.

ittings are given a careful inspection before being placed in the stock department.

Core Making Department

The core room is on the same floor as the foundries, and is located midway between, so as to conveniently serve both departments. Arranged along the outside wall of the room are the work benches, made of sheet steel and each one fitted with a stool that can be swung beneath the adjoining bench when desired. The moulds in which the cores are made are of cast iron, machined on the inner surface to give a smooth, clean core. Three specially designed oil-fired furnaces—two small and one large—are located in the centre of the room. The door on the larger oven is of the balanced type, and band-iron safety guides are provided on either side to protect the workmen from the moving weights, and which prevent anyone from going directly beneath them, when they are in a raised position. The ovens are designed with small sectional side doors, for observing the progress of the drying process. Like all other departments the floors are of creosoted wooden blocks, with concrete inserts at either end of the furnaces, with inlaid tracks for the oven trucks. The transfer trucks which carry the cores from the benches to the ovens, and from the ovens to the stock shelves, are of the all-metal type, the platforms being supported on compression springs. This arrangement serves as a cushion and reduces the possibility of destroying the cores by jarring of the truck.

Brass and Iron Foundries

The sixteen pit furnaces in the brass foundry are arranged in a row along one side of the room. Two lightly constructed hand-operated traveling cranes —one in each bay—are used to transfer the crucibles from the furnaces to any desired location. A small air-operated hoist is used to remove the crucibles from the pits. Slightly-elevated portable floor tracks are provided to carry the all-metal trucks upon which the flasks are placed after coming from the moulding machines, which are specially designed for economic operation. All flasks are made of perforated metal, being light and durable. The electrically-operated sand riddles are suspended from short fixed runways that are in line with the lower crane rail, the latter serving as a convenient means of removing a riddle from one position to another, suitable electric and air connections being provided for the different equipment. The location on the top floor gives excellent light and the roof is provided with ventilators that can be controlled from the floor level.

The iron cupola is located at one end of the foundry, with the charging floor in a separate room and on a higher level. The most interesting feature in connection with this department is the overhead traverse system, the centre section laid out in the form of a race course, with radial feeders into the side bays. At the junction of the side rails with the main track a special swivel is installed, and so designed that it can only be turned when the side trolley track is in perfect alignment, so that it is virtually impossible to run the trolley off the track. The handle that operates the side crane also controls the locking dog, and the trolley can only pass back to the main track when this dog is in position. The openings in the floors that connect with the chutes to the mill room are protected with sheet metal hoods, with just sufficient space to push in the castings.

Cleaning the Castings

The mill room, which is located below the foundry section, is equipped with several tumbling barrels and heavy duty grinders, the wheels of the latter being protected by special sheet steel guards, the front slide being adjustable. To transfer the castings from the foundry to the mill room, special chutes are installed, down which the castings are delivered as they come from the moulds. At the lower end of the chute is a fair-sized hopper that retains the castings until the operator is ready to load the mill. This is accomplished by raising the hopper door sufficiently to allow the required quantity to pass into the mill, when the door is again closed. No lifting is required to place the material in the mill, but provision is made to raise large pieces from the interior by means of the small chain block that is supported on a trolley running on a monorail suspended from the lower portion of the inclined shoot. An I-beam monorail is suspended from the ceiling and supports a chain block, which in turn carries a steel bucket used for transferring the milled castings to the benches alongside the grinding wheels. Dust receiving pipes are fitted to all mills and grinders to take away all dust and carry it to the general storage bin above the railroad siding.

A machine of interesting design is that used for sand-blasting the castings. The body is made of wood and is fitted with a number of nozzles at varying heights around the circumference. Extending from the ceiling where the power is applied are a number of rods, which are revolved individually while passing around the central vertical shaft. In this way the castings are subjected to a steady blast on all portions before making the complete circuit. All the operator is required to do is to place on and remove the pieces from the hooks.

In the case of brass valve bodies, or other fittings intended for high pressure, the castings after sand-blasting, are given an individual hydraulic test, so that every piece going to the machine department is perfectly sound and free from defects. In the case of iron fittings the pieces are thoroughly inspected after coming from the mills, to eliminate faulty material before the same passes on to the machines.

Pipe Bending and Storage

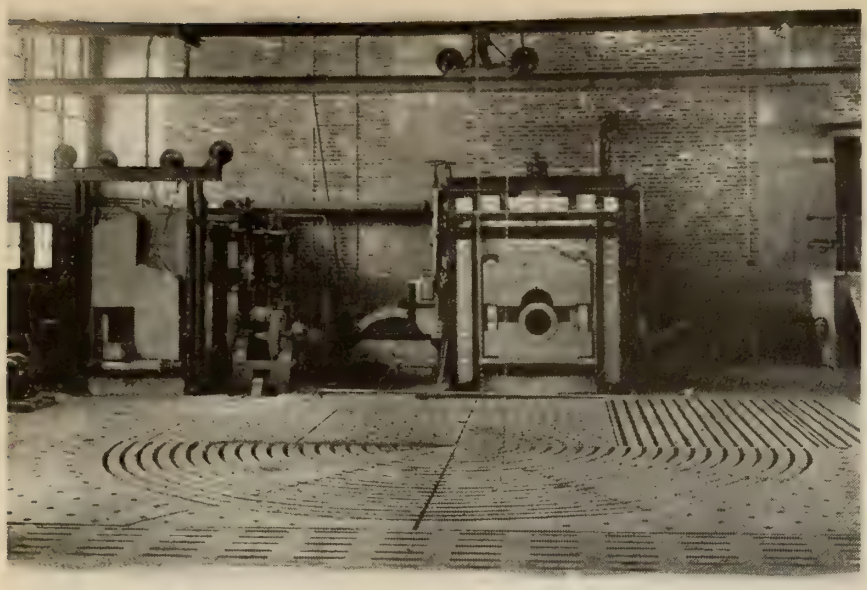
An interesting department is that division of the plant devoted to pipe bending; this branch of the company's activities marking a pioneer move in Canada in regard to work of this char-



GENERAL VIEW OF BOILER ROOM, SHOWING STEAM HEADERS AND RETURN SYSTEM.



A SECTION OF THE MILL ROOM.



PIPE BENDING FLOOR PLATES AND HEATING FURNACES.

acter being carried on on a commercial basis. The furnaces for heating the pipes are of the oil-gas type. The furnaces are arranged across one end of the room and are specially designed to meet the various requirements for pipe bending and flanging. The large one to the left is for heating long sections, the small one in the centre for local heating, and the one to the right is used for flange work. The Craneweld and Cranelap joints are also made in this department. The equipment installed is capable of bending and threading pipe up to 18 inches in diameter. Directly in front of the furnaces are installed a number of heavy cast iron floor plates, so designed and arranged as to take care of any class of bend. The centre plates are made with circular slots of different radii for facilitating the bending of the pipe to desired arc of contour. Several tons of auxiliary equipment, such as fixtures, forms, clamps, etc., are carried in stock and can be fitted to the floor plates with very little trouble. For the convenience of maintenance and repairs a space has been left below these plates. A hand-operated traveling crane is installed above the floor plates to handle the pipe during the bending operations. To the extreme left of the department is a deep pit, in which the pipes are placed when filling them with sand, this being an essential detail, where sharp bends are required to prevent distortion.

Adjoining the bending department is the pipe storage, the various sizes being arranged in racks for convenient access. Between the two divisions is a railway track, and an overhead electric trolley facilitates the loading and unloading of the different materials. A number of pipe threading machines are installed in this department.

Heating and Power Equipment

The buildings are heated with steam, three low-pressure boilers being installed for this purpose. An interesting feature of the heating equipment is the return of the condensation to the boilers without the use of pumps. This is accomplished by the use of Cranetilt non-return, three valve lifting and direct return traps, the non-return traps draining the headers, the three valve-lifting traps lifting the water of condensation, and the direct return traps delivering all condensation to the boiler. This not only gives a saving in fuel over the use of feed pumps, but allows the water to be returned to the boiler at a temperature higher than a pump could deliver it.

Electrical power is purchased from Montreal Light, Heat and Power Consolidated, and is brought in at 12,000 volts and transformed to 220 volts. In addition to the regular service line, an auxiliary line is brought in which can be used in case the main service line is cut off for any cause.

A notable detail of the power installation is the method of connecting each motor to an individual line that runs direct to the switch board located in the engine room. Each line is fitted with a circuit breaker, so when trouble develops the engineer has little difficulty in locating the cause. The system has the added advantage of minimizing shut-downs and inactivity in the plant.

The compressed air supply for the plant is furnished by a belt-driven compressor driven by a 150 h.p. motor.

Stock Storage Department

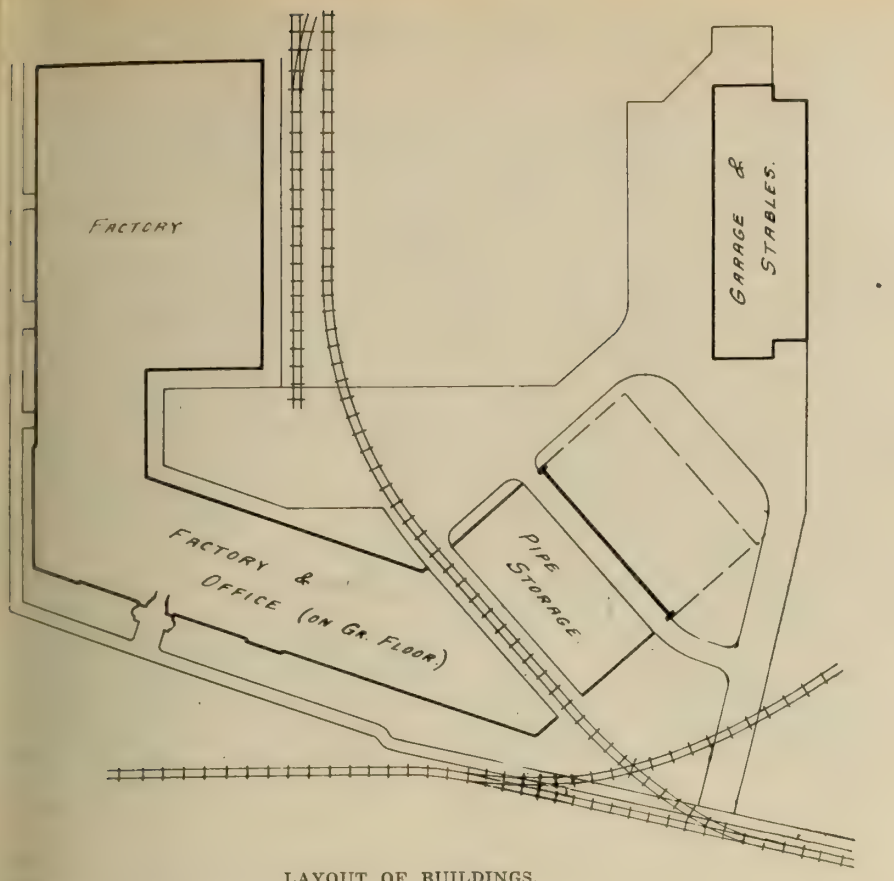
Probably the most imposing department of the entire plant is the finished stock section, and a large portion of the ground and second floor are utilized for this purpose. The layout of the various divisions facilitates the stocking and shipping of the different valves and fittings, the bins for the heavier lines being on the lower tiers. To eliminate the necessity of using a ladder and at the same time utilizing the full height of the room, a platform gallery is provided that extends throughout the entire net-work of stock bins. Provision is made at the elevator shaft to truck the goods on and off the car at this level. A safety railing is fitted on the outer edge of the platform. Each section is set apart for a certain class of fitting and each individual bin is in-



PARTIAL VIEW OF THE FINISHED STOCK DEPARTMENT.



VIEW OF THE STABLES ABOVE THE GARAGE.



LAYOUT OF BUILDINGS.

exed to specify the character of stock nd for convenience of locating the ame.

Stables and Garage

A highly interesting feature of the rane organization is the care that is aken in acquiring horses for local and istrict delivery. The raising of the tock for many years has received parcular study by Mr. Crane, and the ajority of the local horses are of ize-winning stock, and no effort has een spared to provide comfortable uarters for the animals. The stables re located on the upper floor of a two-torey building, the lower portion being eserved for a garage and drive shed. n addition to the modern and well-quipped stables, the company has proided comfortable living quarters for he hostler, at one end of the stable, nd every convenience, even to a shower ath, is furnished.

The comfort and the welfare of the ntire staff of employees have been given articular attention. Lavatories, wash asins and shower baths have been installed in every department, and drinking fountains are well distributed hroughout the entire plant. Needless to ay, Crane fittings and equipment is sed wherever possible.

Excellent shipping facilities are proided, as both the G.T.R. and C.P.R. ave sidings into the plant. The plant s in close proximity to the Lachine anal, and within a few miles of the Montreal harbor, so that ideal shipping conditions are available, both by rail and water.

The president of the Canadian company is R. T. Crane, Jr., and E. C. Townsend, 2nd vice-president, is the managing director.

Montreal is the head office and branches are maintained at Vancouver, Winnipeg and Toronto, where full stocks are carried. Offices and representatives are located at Calgary, Ottawa and Halifax.

Crane, Limited, also have a London, England, branch—Crane-Bennett, Limited, No. 45 Leman street, and have recently opened a sales office at No. 4 O'Connell street, Sydney, New South Wales.

RADIO ACTIVITY

Public interest in radio-activity has been heightened by Sir Oliver Lodge's picturesque description of atomic energy. In the December issue of "Engineering," the British technical journal, he says there are two concealed stores of energy not yet utilized, that of the Atom and that of the Ether. The energy of the Ether exceeds the bounds of imagination and is at present utterly beyond reach; but the energy of the Atom is not helplessly so. To quote:

"All atoms possess energy, but some cannot hold it all. These are the radio-active elements, and they periodically fire off projectiles with more than volcanic violence. A radium atom firing off a particle, which turns out to be a positively charged atom of helium, is like a two-ton gun firing a hundred-pound shot. That is about the actual proportion between the projectile and the rest of the atom, which naturally recoils each time it fires. The recoil has been observed. Before it has exhausted its ammunition it fires off five such projectiles, and then settles down into a quieter existence as lead—or, if not exactly lead, something chemically indistinguishable from lead. A uranium atom had already fired off four projectiles in order to become radium. Radium is a temporary half-way house between uranium and lead: it is active, but not so fiercely active as some of the intermediate substances which last so short a time that they barely have names. They destroy themselves by their own activity, and consequently are very scarce—like a population with a high death-rate. Radium is of moderate activity; its lifetime is of the order of a thousand years, whereas the lifetime of some of the intermediate substances may be measured in weeks or even minutes. Yet they are real elements, with a place in the series, and they have definite spectra and chemical properties."

Sir Oliver adds that it is not by any means their whole energy that atoms thus exhibit—it is the energy they expend and get rid of, their waste energy, that is perceived. The explosion is not the bursting of a gun, but merely the firing of a shot, except that in the atomic case the shot is far more than the energy expended. When its active transformations have ceased and left it in a stable state, like lead or gold, or silver or copper, or iron or any common element, we are not to suppose that because it is quiescent it has no store of internal energy. Cordite looks harmless enough, and so it is until a suitable stimulus is applied.

Sir Oliver asserts that there is enough energy in one atom to blow the submerged German fleet in Scapa Flow to the top of the highest mountain in Scotland. Let us hope that if science finds a mode of releasing atomic energy to the utmost, the discoverers will be friends of humanity.

Steam tube blowers, if not properly drained before using, will, when the valve is first opened, discharge considerable water as well as wet steam. This moisture causes an accumulation of soot between the tubes, particularly if there is a deposit on the bottom row. For this reason only dry or superheated steam should be used with steam tube blowers. The deposit of a clinker or scale on the bottom of the lower row of tubes is usually found with stokers using forced draft, and this cinder or clinker accumulation cannot be removed with the usual tube blower. It must be scraped off with hook or scraper. This is readily done since this deposit does not as a rule adhere strongly to the tubes.

Dominion Steel Corporation Big Plate Mill

Work Almost Completed for Turning Out Great Quantities of Ship Plate on the Eastern Coast—Views of the Plant Show Size of the Undertaking

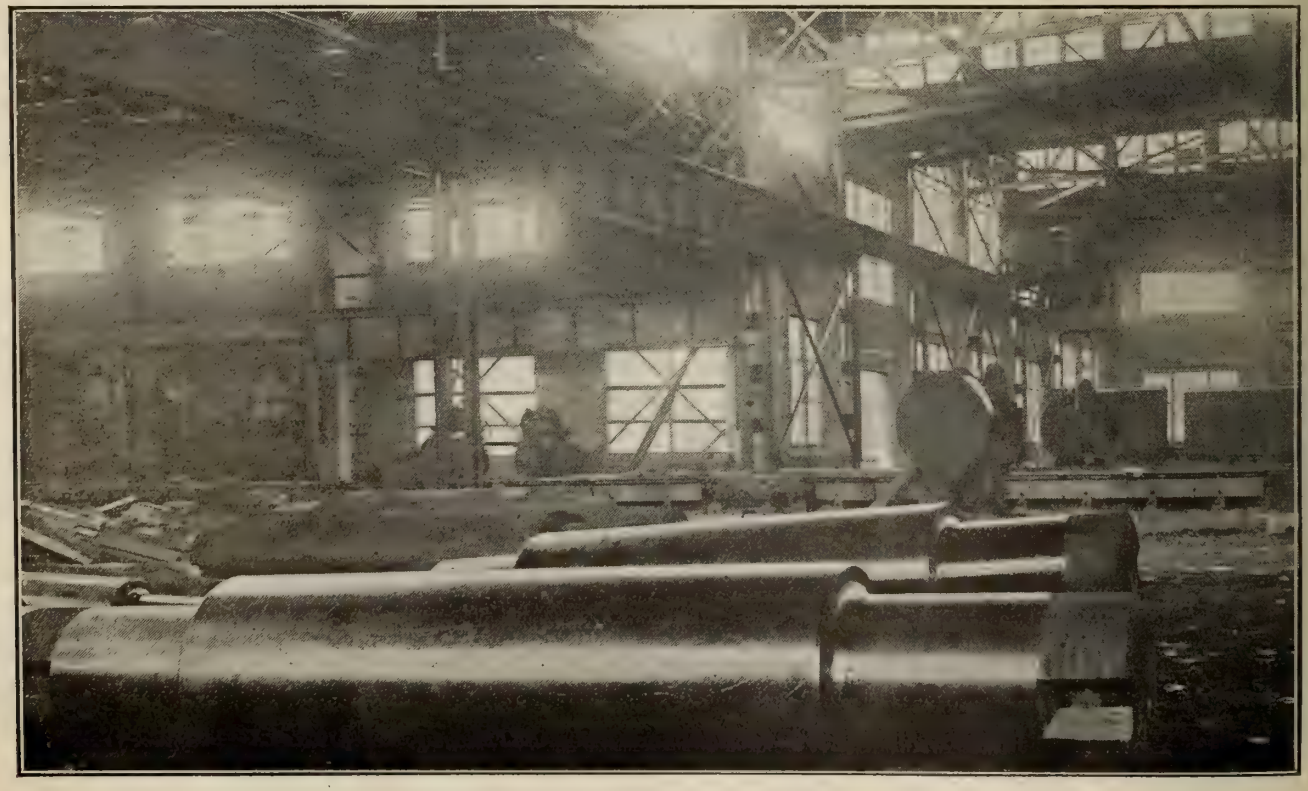
CANADA has much to be proud of in her industrial development. The achievements of her manufacturers in supplying the much-needed war munitions have resounded through the world. She has created a shipbuilding industry during the last five years which can bear comparison with that of much older countries. Hitherto, most of the plates for the ships built in Canada have been imported; but, in the near future, these plates will be "made in Canada." The steel works of the Dominion Steel Corporation, at Sydney, C.B., will supply the ingots, and these will be rolled in the huge plate mill now being erected on the company's premises. This will be the first mill to roll large ship plates in the Dominion. The Nova Scotia Steel & Coal Company have a mill for rolling small plates at their New Glasgow plant, but ½-inch thickness is the limit of their capacity. The mill now in course of erection will roll plates up to 2¼ inches.

The idea of establishing a mill was developed during the early days of the shipbuilding revival, when the Imperial Munitions Board was getting steel ships built in Canadian yards. Considerable delay was encountered at various yards through difficulty in obtaining plates. It is probable that, even at that date, the idea of a Canadian merchant marine was germinating in the minds of the Government officers most interested. Naturally, the plate situation would claim their attention, and thus the establishment of a plate mill was first promulgated. The exact nature of the pour-parlers are not public property, but eventually the announcement was made that arrangements had been concluded between Hon. Mr. Ballantyne, on the one hand, and Mr. Mark Workman, on the other, representing the Government and the Steel Corporation respectively, for the erection of a plate mill. Work was started on June 15th, 1918, was stopped for two months from May to July, 1919, and is now rapidly approaching completion.

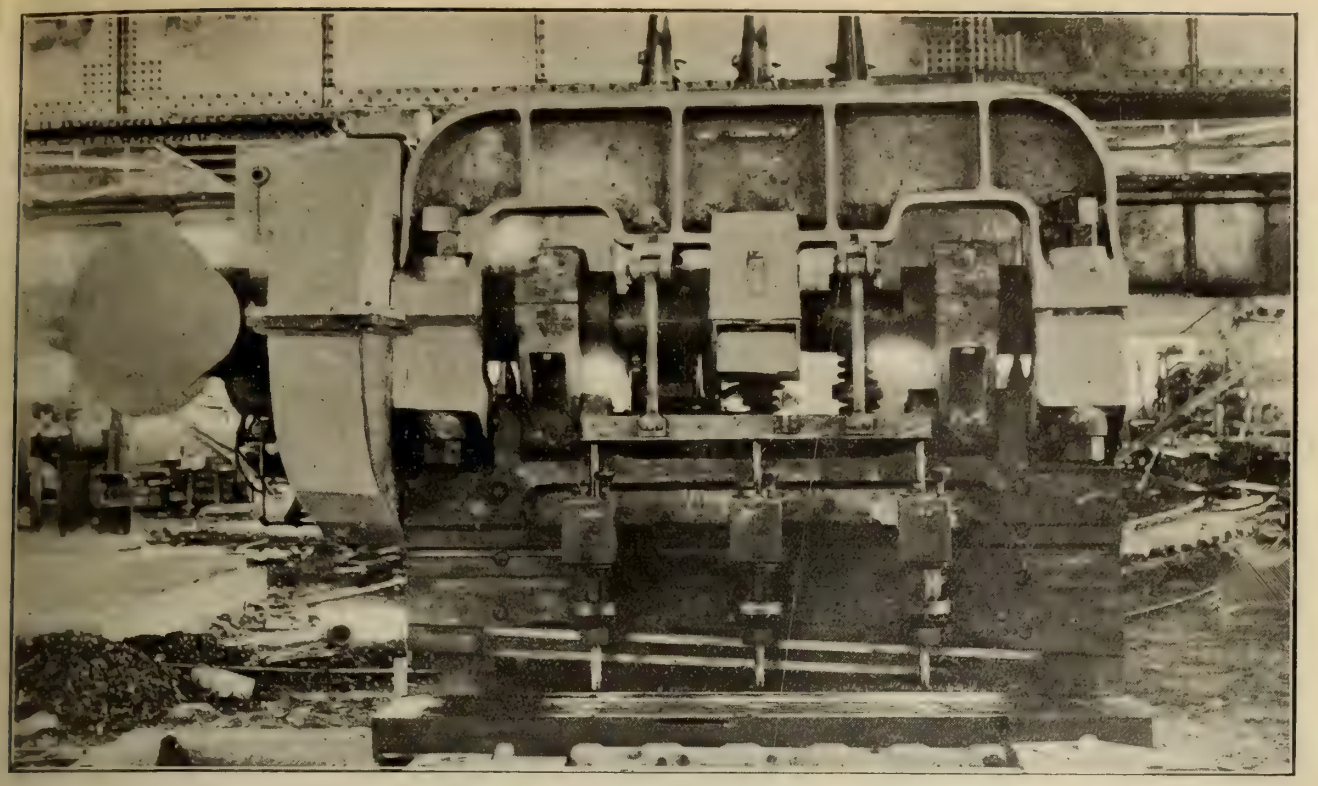
Some Particulars of the Mill

The mill will cost, altogether, $5,000,000 for construction, and will have a capacity of 12,000 tons per month. This means, in terms of days, 500 tons per day. Taking a definite size, say ½-inch thick, this becomes a capacity of 50,000 square feet of this thickness every 24 hours. The capacity of the rolls is from 3-16 inch to 2¼ inches in thickness, width of plate up to 80 inches, and length up to 80 feet. A plate rolling mill, of course, involves many more details than the rolls themselves. There are the open hearth furnaces where the steel is made and cast into ingots. There are the re-heating furnaces, or soaking pits, where the ingots are re-heated fore going to the rolls. There is conveyor, or hot bed, handling the in on the way to the rolls, and from th to the rolls which flatten and straigh any inequalities in the plate. There the shearing machine to trim the pla to size, and castor conveyors and tra elling cranes to handle the finished pl duct for shipping or storing. Natural all this apparatus requires considera room for its accommodation.

The buildings cover an area of 24,0 square feet, divided as follows: The fu nace building is 140 feet by 227 fee the conveyor, or hot bed building, 1 feet wide by 560 feet long. The m building is 80 feet wide by 250 fe long. The slab crane runway is 80 fe by 200 feet; the shear building bein 300 by 350 feet. The total length ground devoted to mill operation 1,260 feet. The plan of the building in the shape of a T, the cross-piece, top end, being devoted to the shearin and storing of the plates. The long en or leg, contains the apparatus for hand ling the ingot as it comes from th heating furnaces, the rolling mil flattening roll, inspection table, etc. I adjoining buildings to the rolling mill or rather adjoining rooms, are house the mill motor, scale pit and water tank The buildings are of steel frame con struction, on concrete foundations, an



THE ROLLS FOR THE MAIN PLATE MILL.



MACHINE FOR SHEARING ENDS OF PLATE.

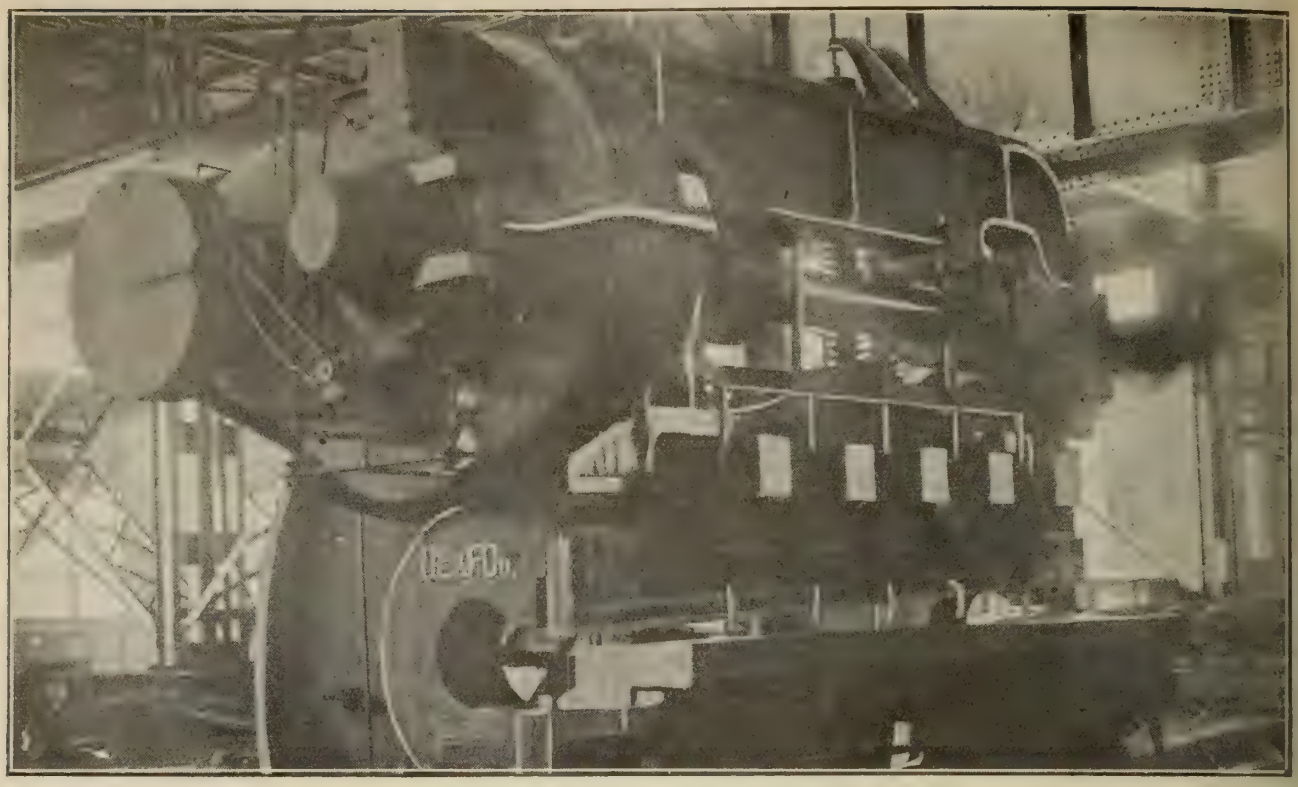
ie roof is supported on steel structural usses, which eliminate the necessity of olumns, and give clear floor space for he necessary operations. The roof is uilt with a lantern, for purpose of light nd ventilation.

The Manufacturing Process

The ingot, as we have seen in an arlier portion of this article, comes rom the open hearth to the re-heating furnace. These furnaces are four in number, and are gas-fired, regenerative, reversing type. Each furnace has a capacity of 8 slabs, 96 inches long. They are each 38 feet long, 9 feet wide, 7 feet high, and in the construction of all the furnaces and stacks 2,000,000 fire bricks have been used. To bring cold stock up to the heat required for rolling would require three hours; but, of course, the ingots are fairly hot when they are put in the furnace. The length of time they are kept in the re-heating furnace will, of course, depend on the speed with which the work is running through. These re-heating furnaces are often termed, in steel mill parlance, "soaking pits," and this is a good name. It describes, literally, just what takes place, the soaking in or absorbing of heat by



GENERAL VIEW OF SOAKING PITS.



MATCHING MACHINE IN SHEARING BUILDING.

the ingot while in the furnace. These ingots weigh anywhere from three to ten tons. The gas for the re-heating furnace will be supplied from the coke ovens of the company.

From Furnace to Mill

When the ingot has been sufficiently heated, the withdrawing crane is brought into play and reaches into the furnace It grasps the ingot, hauls it out, and places it on an electrically-operated truck. This truck carries the blazing ingot to a table, which receives it, and then tilts up, shooting the mass of hot metal onto the conveyor. The conveyor leads direct to the rolling mill itself, and is continued on the further side of the mill to the flattening rolls. It continues again beyond these rolls till it meets a chain conveyor at right angles. However, the description is proceeding faster than the ingot, so we must retrace our steps. The conveyor is a roller arrangement, electrically operated and water-cooled.

The rolls, or the plate mill itself, is, of course, the leading piece of apparatus in the building. The mill is of the three high type, 36 ins. x 110 ins., the rolls being water cooled. It requires two thousand gallons of water per minute to carry off the heat imparted to the rolls by the hot metal. The mill complete weighs about 800 tons. The ingot passes through the mill between the lower and middle rols, and back again through the upper and middle rolls. After each pass the rolls are adjusted to squeeze the metal still thinner, till the desired dimension is reached. The whole operation is commanded by a man stationed in a controlling tower. other men are in attendance, but the gauges and indicators shewing pressures and thickness of plate are contained in the control car. The rolls will make a plate from ½ inch in thickness as a minimum to 2¼ inches thick as a maximum. This latter plate is, of course, not used for ship plating, but is required for heavy boiler sheets. Having been rolled to its approximate dimensions in the main mills, the plate is ejected on to the conveyor, which bears it along to the finishing roll. In this roll all inequalities are ironed out, and the plate is made commercially smooth. Once more the plate emerges on to the roller conveyor, and travels on towards its completing stages. The edges, not having been treated at all, are naturally rough, and the plate as a whole, though possessing one definite dimension, the thickness, must be brought to a size. The width is the first thing dealt with.

It will be understood by the reader that the plate, by the time it leaves the finishing roll, is cold or comparatively so. It would be too hot to place the bare hand on, but would be black. The trimming of the sides to the desired width is accomplished by passing the plate through two circular saws, which can be adjusted to any required width. The plate is forced through, the saws revolving and cutting through the metal with absolute undeviating precision. Thickness makes no difference, except that more power is required to cut the same length in the same time. If the thicker plate is fed through more slowly, the same power will suffice.

Having trimmed the sides, the ends of the plate are trimmed in a shearing machine. This machine will be familiar to anyone who has been in a shipyard or a boiler-making shop. It is really a large steel knife, contained in a heavy frame, and operated by a motor of sufficient power to force the knife through any thickness of steel that may be presented to it. First, one edge of the plate and then the other are brought under the knife, the power is applied, and the plate is completed and true to the required dimensions. These operations have brought the plate through the mill building and it now rests in the assembling department. The method of moving the plate around in this department is by rolling it over inverted castors, which are mounted on vertical supports. These castors are on ball bearings, and the plate resting on them can be moved with the greatest ease, friction being practically eliminated. It can be moved forward, backward, sidewised or diagonally as the situation requires. There are a total of 2,500 of these castors. The plate can be sent to the storage or to the shipping platform. Alternately it may be directed to any one of three shearing machines contained in this building. Two of these are arranged so that the plate may be cut diagonally, and the third is what is known as a matching machine, and is used to match different kinds of plate as required.

To serve the mill three travelling cranes are being installed. They are of ten tons capacity each and the tracks are carried through the entire length of the furnace, mill, assembling and storage buildings. There is a crane for the rolling mill proper with a capacity of fifty tons.

The Plate Mill Motor

To operate the plate mill 4,000 h.p. is required, and to provide this power an induction motor, operating at 6,600 volts, 60 cycle, 3 phase, is installed. It has a momentary overload capacity of 300 per cent. It has a speed of 82½ revolutions per minute, the mill being geared down to 53 revolutions per minute. The floor

Continued on page 90

Shop Management---the Old and the New Idea

Being a Summary of the Changes in Management, Principles and Ideas During the Past Few Years—The Reasons Behind the Changes That Are Taking Place

By E. T. SPIDY, Production Engineer, C.P.R. Angus Shops, Montreal

WHO has not heard the saying "There is nothing new under the sun"—nobody, and yet when one comes to look back a few years to the time, say, when we served our own apprenticeship, we cannot but admit that something that did not exist at that time, something new, in other words, must have entered into the methods of shop management to bring about the great changes that we know have come about.

It is very fitting, especially at this period of the year perhaps, that we should give a little thought to such a subject as this and to follow the reasoning for the changes to be seen, if for no other reason than to give us a line on ourselves to find out whether we are in the "leader" class, whether we are in the "imitator" class or whether we are still "old style."

Perhaps I had better define what these three classes are a little more before going any further. Every man is a manager in the sense I am talking, whether he has to manage himself or whether he manages the largest business.

The second class I mentioned, the "imitator" class, does new trails. He has a line on all developments of his business, he follows the world's discoveries and "thinks" about them. He is one who noted keenly about ten years ago that a group of engineers started something that was called "scientific" management. He studied them to find out what they had that was new. Maybe he found it—perhaps he didn't, it is not the easiest thing in the world to grasp, but eventually, he decided that the principles of this group of men were right, realized then what they had was not anything new at all, it was merely a new application of the old stunt of specializing, which he had done for "years" in the shop, but had never applied it to the management of the shop. This manager "got" the big idea and has developed it some more still. There is always "some more" to develop. He is a "leader" because once he decided he stood behind his decision and made it go.

A Large Class This

The second class I mentioned the "imitator" class does not need much comment, although it cannot be passed because it is quite a large class. Our man here has followed, with dubious eyes somewhat, the progress of management by production specialists since the beginning. He hates to start. The war came and he in common with lots of us undertook his share to manufacture something essential. He saw again that the maximum output was only obtained by "specialists." He later on gets fidgety, because his costs are getting away from him and he then starts to "put in," as he says it, scientific methods himself. What result does he obtain? Nothing. Why? Because he had "not got the idea," he was not himself convinced and he really was giving it a "try out." There is no such thing really as a "try out." Scientific methods are a success or failure from the word go. A showdown comes quickly when you take from some of your old foremen some of the responsibility they have carried for years, and tell them that in future a special department will handle this; it either does or it doesn't depend on whether these making the change know what they are doing or not.

I called this class the "imitator" class, because it simply copies in detail what it has seen, read about, or heard of. No very great success can possibly come without the application of the principles being made to suit conditions as they exist.

Then the Stand-Pat Man

The third class, what I termed "old style," is the manager who does not see anything in these "new fangled" ideas. He will tell you he expects his supervisors to do this and that and so on. True enough he expects it, but does not get it. He can't get it if he supervises more than fifty men because it is more than one human being can possibly do—right. This manager never makes the deliveries he promises, does not know why his costs are high, because he can't pick out which jobs are the expensive ones. He only knows his final costs. He has his foremen and operators chasing around for material that should be at the machine. He has idle machinery—needless to say, he does not know how much, and so on. In other words, this manager still expects his supervisor to be an expert in half a dozen lines and refuses the entire output possible by a change in organization that gets everyone doing one job right.

We are all in one of these classes. It is in everybody's interest to be in the first class, because progress and prosperity to all are assured thereby. Goods produced at the right cost and sold at the right price have the greatest number of possible customers.

Production methods—what are they? Production methods aim to set a task that can be accomplished for every shop, department or man, and to co-ordinate or bring together the operations of the whole plant to accomplish the tasks set.

The Canadian Pacific Railway Angus Shops at Montreal have adopted production methods which are applicable in principle to all manufacturing industries. While the Angus Shops are the largest of their kind on this continent, employing over nine thousand men at the present time, it is to be noted that they are made up of many shops, and the shops, of departments, all of which are supervised by foremen and assistants. I find it very difficult to think of any trades not represented at the Angus Shops.

Now, as in your own plant, you will recognize that every foreman does a certain amount of work which, if someone else qualified did it for him, would give him more time to look after his men and really supervise them. At the Angus Shops the Production Department undertakes some of these duties. It acts somewhat in the same capacity as a clearing house does for the banks. It being in direct touch with the Works Manager, it provides an "Operations due" sheet for every department every day. This means that it plans the work of each department for each foreman. It does this by a series of schedules and graphic charts, from which it takes off for each department a list of all operations that must be done each day. These "Operations due" sheets are all sent out the evening previous to the day it covers. Each day the Production Department checks each shop with its sheet, investigates and summarizes late operations, so that proper action may be taken to prevent them causing delays to output.

Another function of production methods as applied at the Angus Shop applies to material. Every foreman is dependent on the proper supply of material, whether purchased, manufactured or finished stock being available when it is required. Instead of each foreman having to trace his own material from stores or whatever the source to the shop, an especially trained material tracer from Production Department handles the entire transactions. Failure to get any required material results in it being placed on special lists which get the attention of proper officials. When it is seen that deliveries will not be made in time, arrangements for substitution are made as quickly as possible.

At the Angus Shops there are functional foremen

who check all the work done in each department from a point of view of the efficiency of the individual operations. It must be noted that in the performance of these duties, the Production Department does not act in a way that the foremen of the shop is ignored. Quite the reverse is true. Before any function is taken over and also at every change in policy or program, the foreman is consulted and agrees that the final modus operandi decided on is to his best interest. These systems, having now been in effect for nearly two years, have proven to all that the Production Department is out to boost each man's output by making it possible for him to do it. Foremen have confidence in the work because they realize that a single department tracing all sources of information must be able to do it better than they could individually.

In the development of this work also we make the greatest endeavor to disperse any idea of mystery such as one unacquainted with how it is done is liable to. This being an unfortunate situation brought about by the crop of so-called "efficiency" men who discredited the real thing just before the war. Naturally, a foreman at first feels that it is not possible for an outside department handling so many other departments to cover the ground properly. Our answer is: "Come and see, there is nothing about it you won't understand in a minute. Everything we have is an open book and we "want" you to know just what we do do." The result is co-operative effort. As each man understands he uses. He realizes that in the head office there is a record of his own performance and he endeavors to make it show right. To the foreman it is a satisfaction, if he is the right kind of foreman, to know that the manager knows hows he is doing. The manager has also the satisfaction of really knowing what is going on, what is causing delays and why. There are many other phases to this work which need not be enumerated here. Sufficient is it to say that specializing carried beyond the shop is the real thing and time will show it to the doubters, when they find themselves at the tail end of the race. The ideas are logical and necessary to meet the social changes of to-day's world.

Which class are you in—and why?

Rules for finding length of crossed belts. First find the length for straight belt. Square each the diameter of the large pulley and distance between centres. Add together and extract square root of sum. Subtract from this the distance between centres. Multiply the remainder by two and add to length of straight belt as previously found. The result will be the length of crossed belt.

Belt slip. As a belt depends entirely on its power of adhesion to the pulleys to perform its function, see to it that its power of adhesion is maintained at the maximum by not overloading, and by the consistent use of suitable belt dressing, sparingly but regularly applied. Do not allow the dressing to clog on the pulleys. As belt slip is such an insidious danger—it makes no noise—and may be going on unsuspected until irretrievable damage has been done to the belt. Begin the application of belt dressing immediately the belt is put into use.

Rules for finding length of belt required. When it is not convenient to measure with the tape line the length required, the following rule will be found of service: Add the diameter of two pulleys together, divide the result by two, and multiply the quotient by 3 1-7; add the product to twice the distance between centres of the shaft and you have the length required, substantially. If one pulley is considerably larger than the other, a little extra allowance should be made, because the distance from the centre of the top of one to the centre of the top of the other is a little greater than the exact distance between the centres of the shafts.

To ascertain the number of feet in a roll of belting. Add diameter of roll in inches to diameter of hole in centre. Multiply the result by the number of coils in roll, and then by 132; the three left hand figures being the number of feet in roll.

A process by which fibre of good quality can be manufactured from the bark of the Australian eucalyptus tree consists in passing the bark through a "softening" machine to loosen out the fibres, and then through specially adapted carding and spinning machines. The inventor of the process has opened a factory near Melbourne, where samples of twine, rope and bagging, for the manufacture of which the fibre is chiefly utilized, are exhibited. It is claimed that these goods are equal in quantity to the best flax and Indian jute goods, and can be produced at half the cost. Waste fibre is employed for furniture stuffing, fibrous plaster work, placing refrigeration chambers, etc.

A novel method of storing coal in carbonic acid gas, which combines the advantages of the overhead bunker with the absolute safety of storage under water against spontaneous ignition, has been adopted in an installation described in the "Iron and Coal Trades Review" as having been recently erected at Dortmund, in Germany. It consists of three cylindrical bunkers—with semi-spherical tops and bottoms—each bunker holding 2,500 tons of coal. There are three outlets in each bunker for withdrawing the coal and three holes at the top for receiving it; the lower outlets close gas-tight, whilst those on the top, though requiring a good fit, need not necessarily be gas-tight, since carbonic acid gas is nearly twice the weight of air, and does not therefore escape at the top. A simple structural steel tower unloads the coal by grab from a barge; the coal is then shot into a small hopper from which it is fed on to a push-plate conveyor, the path of which completely envelops the three bunkers in the vertical plane. It can therefore both feed and reclaim the coal. There is a slight leakage of carbonic acid gas during the withdrawal of the coal, but this is stated to be small, and can be easily replenished.

An investigation of the temperature of a 24-in. ingot during the process of heating it up to forging heat is described by Mr. F. E. Bash in a paper read before the American Institute of Mining and Metallurgical Engineers. He says that after seven hours' heating the surface temperature may be 2370 deg. Fah., while the temperature at the centre is 2287 deg. Fifteen minutes after the ingot was taken from the furnace the corresponding temperatures were 2125 deg. and 2280 deg. respectively. Mr. Bash thus comes to the conclusion that, although it is possible to heat a 24-in. ingot from room temperature to forging temperature in seven hours, the question is raised whether this fast rate is not injurious to the steel. While the steel is still comparatively cold, large stresses are set up which may cause internal fissures. The rate at which an ingot can be heated without injury depends on the kind of steel, chrome steel being very tender, while low-carbon steel will stand more abuse.

In his presidential address to the Institute of Engineers and Shipbuilders in Scotland, Dr. T. Blackwood Murray pointed out, as an example of the advantage of using special steels, the fact that the weight of a motor car gear is less than 12 per cent. of the weight of an electric crane reduction gear transmitting a similar load at similar speeds. He also dealt with the increasingly important part being played by aluminium alloys in the construction of motor vehicles and aircraft, and said that particulars of a new light piston alloy, the chief constituent of which is magnesium, with a specific gravity of 1.74, had recently appeared in America.

The permanent field magnets used on magnetos are easily recharged by inserting them in solenoids wound for a current of 20 amperes at a potential of 6 volts so they can be coupled up to an automobile starting system battery of that voltage. The connection is made only for an instant as several contacts of a second's duration are all that is needed and this will not injure the battery. It is stated that a freshly charged tungsten steel magnet of a large magneto will lift in the neighborhood of 20 lbs. as ordinarily energized.



DEVELOPMENTS IN SHOP EQUIPMENT



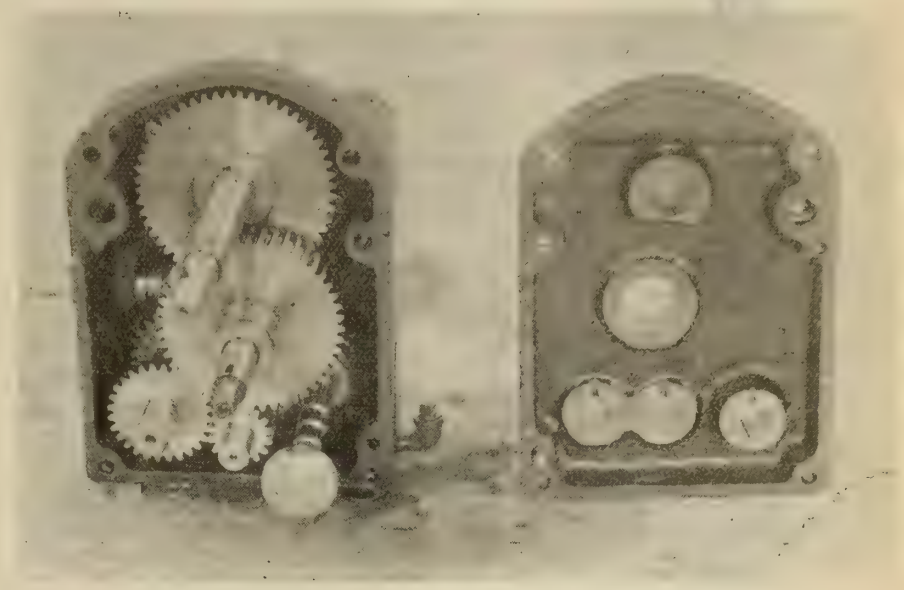
FOSTER NEW LINE OF HAND SCREW MACHINES

The Foster Machine Company of Elkhart, Indiana, has recently designed and perfected a complete line of hand screw machines embracing five sizes. These are to be known as the Nos. 0, 1, 3, 5, and 7 Screw Machines, and the sizes of same are, respectively 7/16 in., 13/16 in., 1-5/16 in., 1-13/16 in., and 2-9/16 in.

Several new features, which will be described, have been perfected and incorporated. Taken as a whole, the machines do not represent any radical departure from established practice, but are built upon fundamental principles of correct machine design incorporating the best features. They represent the latest and highest developments in this branch of the machine tool industry. The design is founded upon a knowledge of work performed on this type of machine and of a keen understanding of the possibilities of still further widening of the field for same. The material used for each individual part throughout has been given a thorough study.

The power and rigidity provided is in excess of the requirements made necessary by the latest developments of high-speed steel and stellite. The margin above these maximum requirements has been added with a view in mind of taking care of and providing for any additional improvements in cutting steels.

Three different styles of cut-off units, viz., the lever feed cut-off, hand screw feed cut-off and power feed cut-off are being built. These are interchangeable and either one can be furnished as required. The power feed to turret is a separate unit and a machine can therefore be built with either power feed to turret slide or with hand feed. The automatic chuck and bar feed are independent units and can be furnished or not as required.



NO. 2 SCREW MACHINE APRON FOR TURRET SLIDE AND SADDLE.

The No. 0 and No. 1 Screw Machines, which are of 7/16 in. and 13/16 in. bar capacity respectively, are designed for high-spindle speed and sensitiveness of operation so essential in machines of small bar capacity. They are built in the three-step cone pulley Plain Head type only. The turret slide, which is operated by means of a hand lever, has an effective longitudinal movement of 3 in. for the No. 0 Screw Machine and 5 in. for the No. 1 Screw Machine. The No. 0 Screw Machine can be equipped with a compound rest, which is interchangeable with the lever feed cut-off ordinarily furnished with this machine.

The No. 3 Screw Machine, the bar capacity of which is 1-5/16 in., is built in both the Plain Head and Friction Head types. No. 5 and No. 7 Screw Machines, of 1 13/16 in. and 2 7/16 in. bar capacity respectively, are built in the Friction Head type only. The large diameter cone pulley and the powerful friction provide more than ample power for the heaviest requirements. The turret slide has an efficient travel of 7 in. for the No. 3, 9 in. for the No. 5 and 11 in. for the No. 7 Screw Machines.

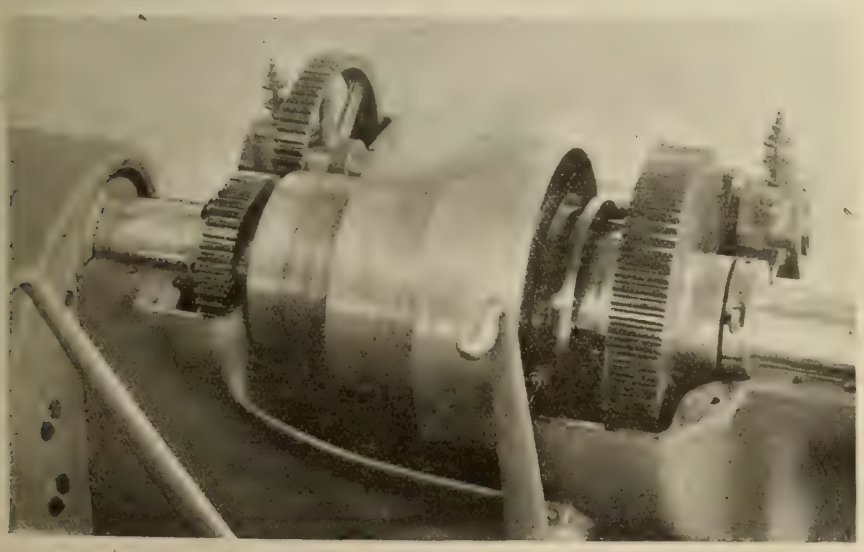


FIG. 1.—OPEN VIEW SHOWING FRICTION HEAD.

Design of Head

The half-tone figure, No. 1, shows the gear friction head for the No. 5 Screw Machine. The gear covers and spindle caps have been removed in order to more clearly show the design. The powerful friction clutch, mounted on the spindle between the cone pulley and the friction gear, serves to engage the spindle into driving connection direct

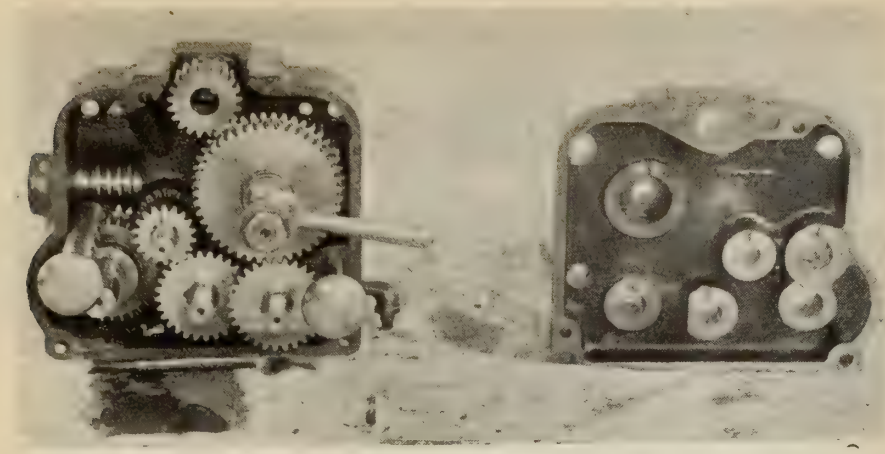


FIG. 3.—APRON FOR NO. 3 SCREW MACHINE, WITH POWER FEED CUT OFF.

with the cone pulley on one side or with the back gears through the large diameter spindle gear on the other hand. The frictions are of the cone type and are operated by the hand lever through the medium of a long movable sleeve and four fingers mounted on the spindle. The friction is very sensitive in operation and extremely powerfud.

The front and rear spindle bearings are made of special high-grade bearing bronze. The spindle is made of high carbon steel forging.

The head is cast integral with the bed. The rigid double girder type of bed is very heavily ribbed internally and is designed throughout to gain the maximum rigidity without the use of unnecessary large amount of cast iron.

Automatic Chuck and Bar Feed

The automatic chuck is of a standard spring collet type. The automatic chuck hood and spindle nose have been designed so as to gain as short overhang as possible from the front spindle bearing. The collet operating mechanism differs materially from the design which has heretofore been used.

Instead of the well-known sliding fork principle the fork lever principle has been utilized. This eliminates the cocking action and the unduly large amount of friction in the already mentioned sliding fork type operating mechanism. The automatic chuck fingers have been equipped with rollers to eliminate friction at this point.

The bar feed operating mechanism is also new in design. For the No. 0, No. 1 and No. 3 Screw Machines the single supporting rod is used, but for the No. 5 and No. 7 Screw Machines the stock support slides on two parallel bars. The continued motion of the automatic chuck lever, as it opens the collet, feeds the bar forward. This is accomplished through a system of links and levers in such a manner that the automatic chuck and the bar feed are operated intermittently.

Turret Slide and Saddle

The No. 0 and No. 1 Screw Machines are equipped with the round turret, while the No. 3, No. 5 and No. 7 Screw Machines, owing to the fact that flanged tools are desirable for the heavier work done on these machines, have the hexagon turret. As already mentioned above the turret slide on the No. 0 and No. 1 machines is operated by a hand lever pivoted on the top of the slide near the rear end of same.

The turret indexing mechanism is very sensitive in operation. The vertical lock bolt is mounted underneath the front side of the turret virtually directly beneath the working tool.

Fig. 2, which is a view of the No. 3 Turret Slide and Saddle, with the slide tipped up and standing on front end, shows clearly the main working parts of the turret indexing mechanism.

Attention is called to that, the end of the lock bolt lever, which intermittently engages the tumbler for withdrawing the lock bolt preliminary to the indexing of the turret, is equipped with a roller for the sake of the sensitiveness and reduction of wear.

The rearward travel of the slide indexes the turret by means of indexing pins in the bottom of the turret and pawl pivoted in the saddle.

The No. 3, No. 5 and No. 7 Screw M chines are equipped with a system of r volving independent stops which a geared to the turret and index wi same. The stop screw working in co junction with the working station of t turret abuts a movable stop in the sa dle. This movable stop stands in wor ing relation with the mechanism dise gaging the automatic feed in the sadd apron.

The system of independent stops f the No. 0 and No. 1 Screw Machines di fer considerably from the one just d scribed for the larger Screw Machine Instead of having the stops revolve wit the turret, the stops are mounted in th end of the turret slide. A revolvin stop working in the slot between the tw lugs on the rear end of the saddle in dexes with the turret and acts to brin the proper stop into working relatio with the forward turret station.

Additional sensitiveness of indexin is thus gained as the stop screws do no have to revolve with the turret. This i a vital point on a small machine work ing on delicate work. Its importanc can readily be appreciated when atten tion is called to the fact that frequentl several hundred parts can be turned ou per hour on this machine and that ever one of these pieces might require th turret to be indexed several times. Th design of the turret indexing mechanism is the same as on the larger machines.

Power Feeds

The half-tone, Fig. 3, shows the interior view of the power feed apron for the turret slide. Three sliding gears provide means for obtaining the feed changes. These three changes are multiplied by a cluster of two sliding gears in the gear box at the end of the ma-

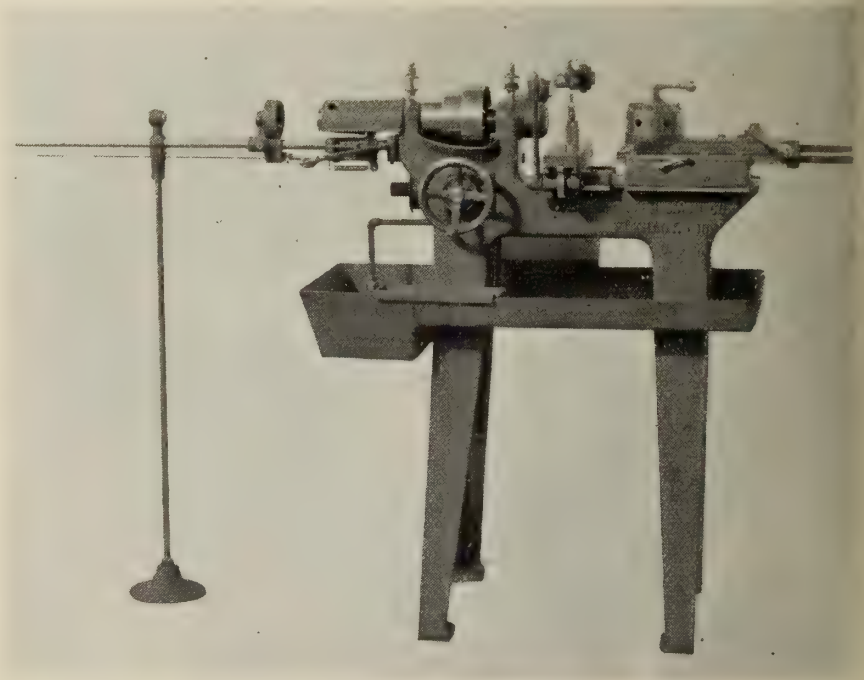


FIG. 4.—NO. 0 SCREW MACHINE—FRONT VIEW.

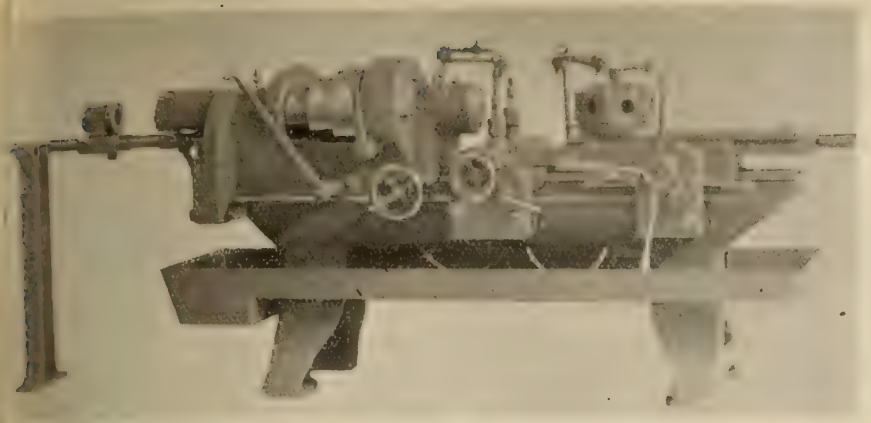


FIG. 5. NO. 7 SCREW MACHINE FRONT VIEW.

nes. This provides six changes in . The power feed is engaged and dis-gaged by a friction working in con-ction with the gear engaging the ge driving gear of the pinion ft. The face cam on the outside of apron and the drop-out lever serve purpose of engaging the feed fric-n Thus drop-out lever stands in work-r relation with the system of indepen-nt stops as already described above.

Attention is called to the fact that the ron is filled with oil up to a certain el, and that, therefore, the lower gears the gear train, including the worm ar, run in a bath of oil.

The cross feed apron shown by the lf-tone, Fig. 4, is similar in design to e saddle apron, with this difference, wever, that additional sliding gears e introduced in the train to obtain the verse of the feed movement. The d friction which works in conjunction th the two large intermediate gears operated by a rapid acting and power-l cam manipulated by a hand lever. is power feed apron, together with the rriage and cut-off slide, constitute a separate unit which is interchangeable with the hand screw cut-off, shown in the front view of the machine and also with the lever operated cut-off, either of which three cut-off units can be furnished at the option of the customer. The three-step sliding gear nests in the apron in conjunction with the two changes obtainable in the gear box, at the head end of the machine, as already described, provide six changes of feed to the cross slide.

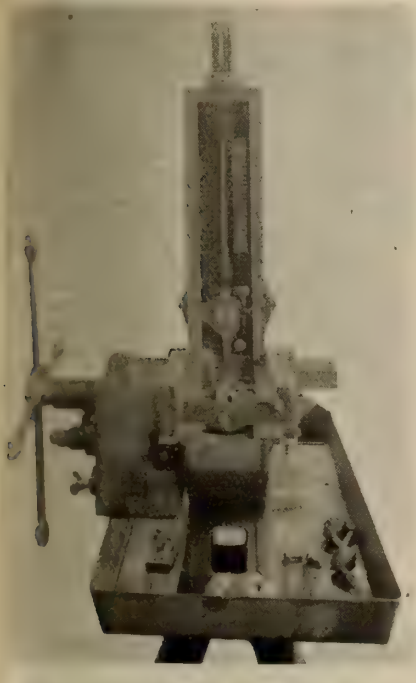


FIG. 6. NO. 3 SCREW MACHINE TURRET SLIDE AND SADDLE.

An important feature is the location of the hand longitudinal feed screw for the various cut-off units between the ways of the bed. The force moving the cut-off carriage on the bed is thus applied in the middle of the guide where same should be, instead, as is customary, on the front side, where it will cause a cocking action to be introduced resulting in inaccuracy of the adjustment and undue wear of the machine at this point. Immediately inside of the hand wheel for the hand longitudinal feed is mounted a large diameter graduated dial equipped with observation stops. This facilitates the ease of adjusting the cut-off carriage longitudinally. A similar graduated dial with observation stops is also mounted on the cross feed screw and used in conjunction with the movement of the cross slide.

Control Systems

Referring to the front views of the machines, attention is called to the centralized control and the ease with which the various control levers and knobs can be reached by the operator when standing in his natural position in front of the machine. The principal feed changes are located in the aprons, which is ideal. The lever operating the automatic chuck and also feeding the bar forward is within easy reach of the operator and, as has already been pointed out, operates with unusual ease.

For applying the proper amount of coolant to the work and the cutting tools, the larger machines are supplied with a double system of piping, one working in conjunction with the turret slide and the other with the cut-off. On the smaller machines, where a smaller amount of coolant is required, only a single system of piping is used.

The remaining cuts illustrate other general views of this line of machines.

GANG DRILLING MACHINE

A gang drilling machine of unusual design especially adapted for boiler shops, structural steel fabrication and ship-plate work has been built by the Hilldrill Co., 2141 North Nineteenth Street, Philadelphia. The drill spindles are chain-driven, and by virtue of the almost direct application of power, require a comparatively small horsepower consumption for the operation, enabling great latitude in the number of drills driven. The flexibility and strength of the chain drive also makes for a machine that is adaptable not only for heavy duty but for gang drilling on any type of work. The cycle of operations in the actual drilling is automatic and the spacing of the spindles is universal, above a minimum, which on the heavy-duty type here shown is 2¾ in. centres. This spacing may be cut in half by shifting the work.

The application of chain drive for drilling is the basic feature of the machine, which has been designed by Aaron Hill, 1028 West Forty-eighth Street, Los Angeles, Cal. The invention gives virtually a direct pull on the spindles and is found to eliminate power losses or chatter. On ⅞ in. boiler plate, drilling 44 11/16 in. rivet holes through plate and ½ in. inner and ½ in. outer butt straps, about 11 hp. net was required. The spindle sprockets engaging the chain are staggered, to distribute the load over the several chains provided; and the web of the drill carriage forms a lubricated runway for these roller chains and serves to prevent the chain from slipping off the sprockets.

The mechanism clamps the work in place with a pressure of about 10 tons, sufficient to straighten any ordinary sweep or buckle, feeds and lubricates the drills and at the end of the cut raises the drills, stops both the drills and lubrication and releases the work, all automatically.

A radical departure in drill design are the drill heads, built as independent detachable units. Each unit consists of a small bridge casting which straddles the chainway and is machined at each end to slide easily along the carriage rails. At the top and just above the spindle socket are hinged clamps operated by levers linked to the adjusting handle. In placing the unit in position on the carriage seats the clamping device is only partially tightened. The spindle is then racked into position by rotating the spindle by means of a loose lever inserted by hand in a drift hole in the spindle socket. Racking the spindles to correct centres is facilitated by means of a steel tape stretched across in front of the spindle heads. The units, weighing from 4 5to 65 lbs., are easily handled by man and helper, and the entire gang can be set in about 8 mins.

The accepted practice in drilling calls for higher speed and slower feed the smaller the diameter of the drill. This principle is automatically taken care of without changing feed or speed on the machine proper, but by corresponding differences in the design of the various

size units. For example, a unit designed for a No. 3 socket, taking up to 1¼ in. drill, is equipped with a 10-toothed sprocket turning up to about 160 r.p.m., with an average feed of 0.004, while the unit for a No. 5 socket holding 3½ in. cutters is equipped with a 20-toothed sprocket turning 80 r.p.m. and feeding at an average of 0.008 per revolution.

To start the cutting cycle, the motor is started and the clutch thrown in. In the starting position the disk cranks hold the carriage just past the upper dead centre, so that the initial drill feed is a minimum, in the first stages approaching a maximum of 0.005 in. per revolution passing through the body of the work and automatically diminishing to about 0.003 in. at the break-through. This variable feed safeguards the machine against shocks and minimizes losses from breakage of drills by "hogging" on the break-through.

The drill units are locked into place by bringing the adjusting handle down tight, forcing the clamps home into grooves in the cross-rail. Keyways cut in the face of the lower seat and staggered serve to prevent any tendency on the part of the units to cock over while being racked into position. The drill heads are likewise alternately staggered, so as to insure a close setting where required.

During the return to starting position, a small cam on the hub of the large gear at the driving end operates a lever to throw the clutch out and break the motor circuit, bringing the entire machine to a standstill.

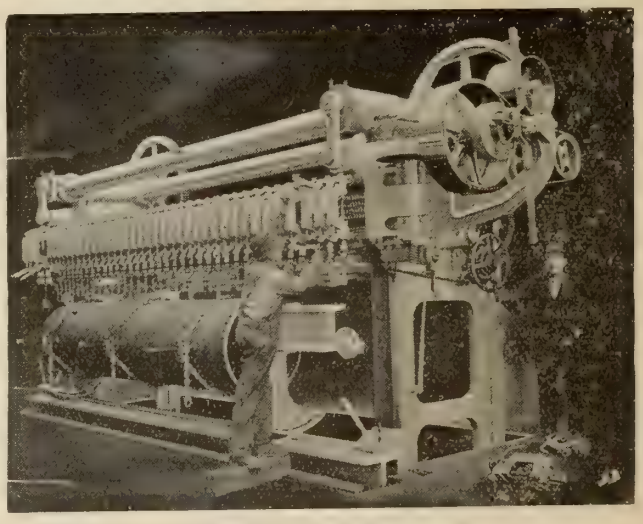
The machine is adjusted to feed slightly beyond the break-through before reaching the lower dead centre; and upon passing this point 600-lb. counterweights on the two large spur gears simultaneously pass over the top point of equilibrium and throws out of balance, whirling the spur gears through an arc of 180 degrees and raising the drill beam back approximately to starting position.

The lubricating system is especially noteworthy. A shallow trough directly behind the spindle sockets is filled with lubricant to a depth of about 1 in., from which it is fed mechanically through independent lubricating units to each drill individually. These units are essentially a disk carried on a hollow spindle suspended from the drill housing. The disks carry fins or ribs on the back, curved to pick up on these narrow shelves driblets of the fluid, which are run centripetally by a slight oscillation into holes through the hub opening into the hollow stem. A small downward pitch to the stem suffices to carry the cutting compound out on to a gutter on the spindle, bored to drop it through so as to run down the drill surface. The units are turned back and forth approximately 180 deg. by a small connecting rod and piston driven off the shaft pinioned to the worm gear. A quadrant lever oscillates a chain which turns the lubricators by means of sprockets just back of the disks.

The driving chains run over sprockets at each end of the cross-rail. Those at the left end run on idlers. At the right hand end of the machine they are keyed to the same shaft as the flat at bevel gear driven by a bevel pinion on the shaft carrying the pulley belt-driven by a 50-hp. alternating current motor which is rated to run at least 60 1-in. spindles through 2 ins. of soft steel.

The drill feed mechanism is operated by the worm gear on the lower end of this driving shaft, which drives a chain actuating a gear keyed to a shaft running across the back of the machine and connected at each end by trains of reduction gears to two spur feed gears, 4½ ft. in diameter. These large spur gears are mounted on shafts, on the front end of which are disk cranks. The connecting rods, on which the drill beam is hung, are eccentrically mounted on the disk cranks, and at the lower end are pinned to the drill carriage.

The drill feed is, therefore, controlled by the rotation of the large spur gears. The adjustment of the drills to the starting position is done by hand, for the reason that it requires but a moment, and tends to breed caution in the operator before starting the machine. After the work has been set in position, the drill man steps to the hand wheel, seen in the side view beneath the motor, and by a few quick revolutions advances the spur gears to bring the drill spindles almost in contact with the work.



GENERAL VIEW OF THE GANG DRILLING MACHINE.

The low power consumption permits the use of this machine with great economies wherever multiple drilling through heavy sections is required, notable results along these lines having been accomplished at the plant of the Badenhausen Co., Philadelphia, in boiler making. As shown in the illustrations, the production of boilers is reduced to a manufacturing process.

For riveting the boiler drum the plate is first rolled to shape. Then the outer butt strap is set along the seam of the shell and gripped in place by chain slingjacks placed at intervals along the shell and tightened by hand lever to secure a perfect butt. For supporting the work during the operations use is made of a super-beam consisting of a special H-beam equipped at the head end with a caster. The inner butt strap is first laid on the beam, after which the tail is lifted by the crane and it is rolled through the shell on the caster. It is now slung on bow slings and then raised by the crane against the butt joint and screw clamps are placed at each end holding the parts firmly in place. The work so rigged for drilling is now set upon special rockers in position upon the drill table.

For most operations the base of the machine is set in a concrete pit and bolted in place. This brings the table about at floor level and the drill spindles approximately breast high, beneath the eye of the workman. The table is carried on two slides on the forward flanges of the frame and is raised and lowered by means of four 3-in. screws operated by worm drive, which on the machine here shown, for example, allows of work on cylindrical boiler drums up to 48 ins. in diameter.

The work may be done either in the flat or after rolling and shaping, carriages designed for the various types of work being readily fitted upon the table of the machine. The cross-rail carrying the drilling heads or units, a strong I-beam in section, is brought into position and the rigging adjusted to line the drills with the centre line of holes to be drilled. The work is then clamped, and the drilling started. For clamping the work and holding it secure while cutting is going on, a powerful lever clamp is provided. It consists in a heavy pivoted frame set inside the frame of the machine back of the drills. The forward part is linked to the upper side of the cross-rail, and at intervals clamping fingers reach out over the work. As the drill carriage is brought down to starting position it presses these clamps firmly against the material to be drilled. Heavy compression springs act to cushion the device and compensate for the vertical travel of the drill carriage. In the heavy duty plate drill the mechanism has a binding presure of about 10 tons; but this is variable with the strength of the springs.

The radii of the sectors or rings insures that the holes will all be at right angles to the shell, and inasmuch as the butt straps and shell are drilled simultaneously, all parts are bound to come "fair." As an oversize hole of but 1/32 in. is required for the easy insertion of the rivet, this clearance is provided for in the drilling and the time usually consumed in punching, drifting and reaming is done away with. The uniformity of the holes with proper riveting practically insures that the swaging of the rivet will completely fill the space, reducing

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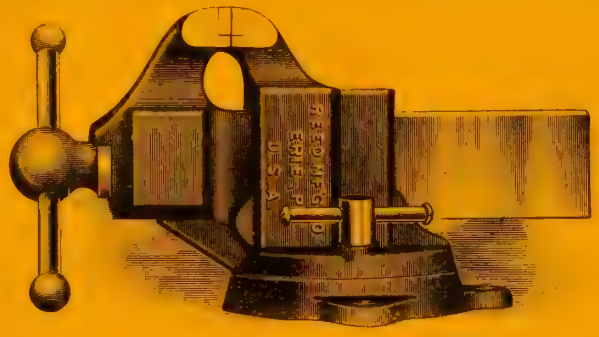
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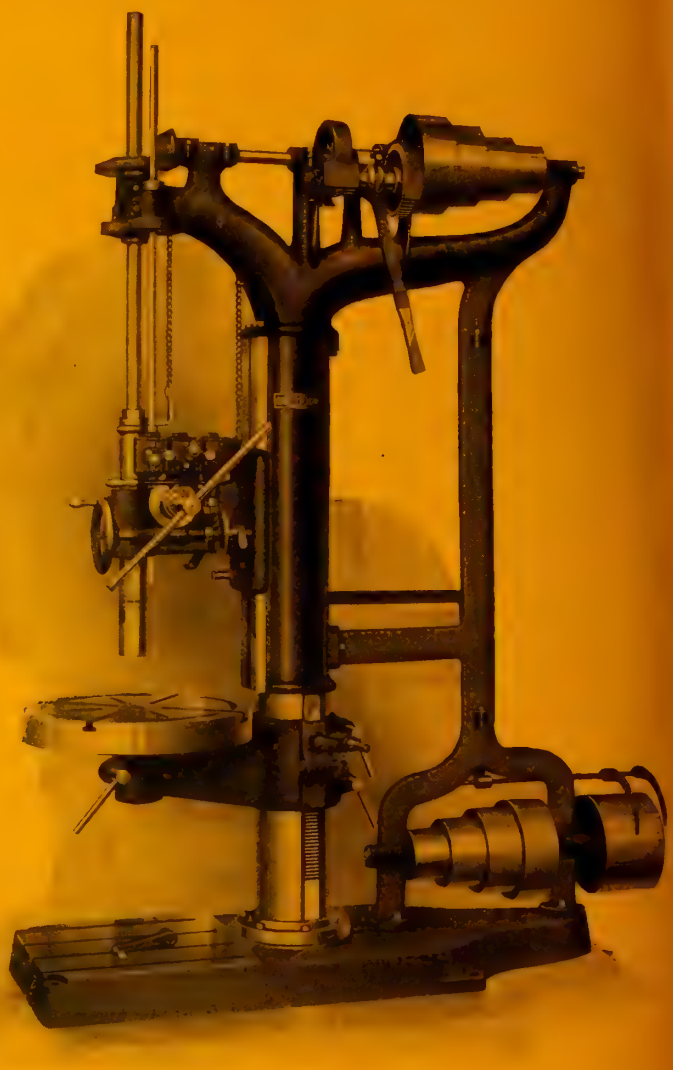
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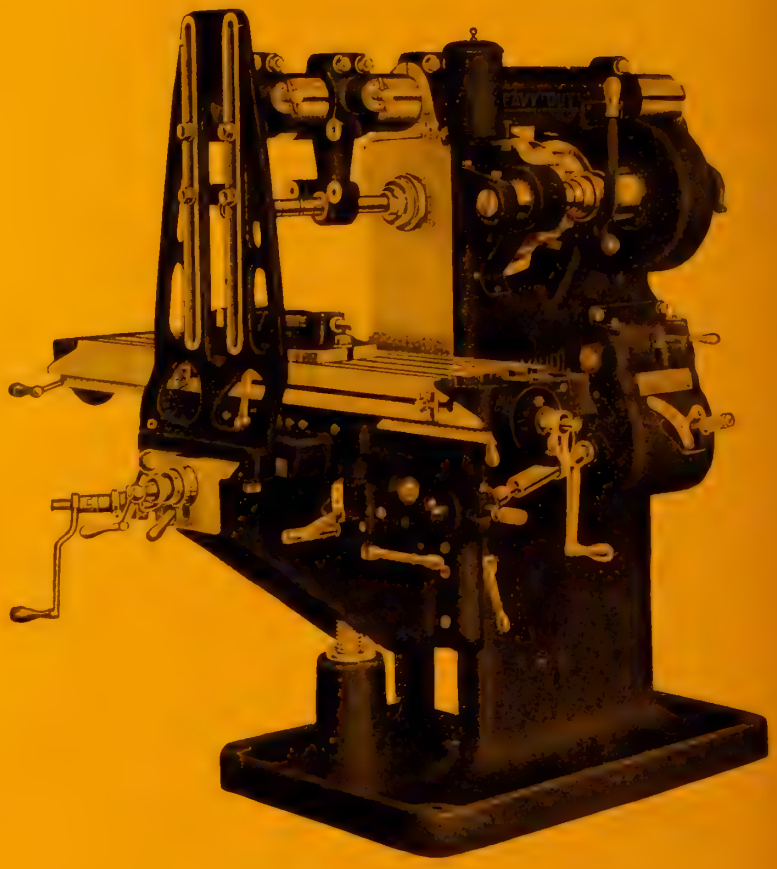
PLAIN or Universal types —Cone or Gear Drive. All commercial sizes—No. 0 to No. 5.

Adapted for the heaviest manufacturing or the most exacting tool room service. A suitable range and capacity for every class of milling.

An over arm 50% larger than the average of other builders with a positive key locking device for rigidly aligning spindle and arbor.

An exclusive right hand system of control whereby all feeds, speeds and operating functions are controlled from the operating (right hand) side of the machine.

Sliding chrome nickel hardened gears and clutches. No tumbler gears, chains or ratchets in the drive. Just a successful automobile transmission carried out several stages and provided with a powerful back gear.



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Cincinnati, Ohio

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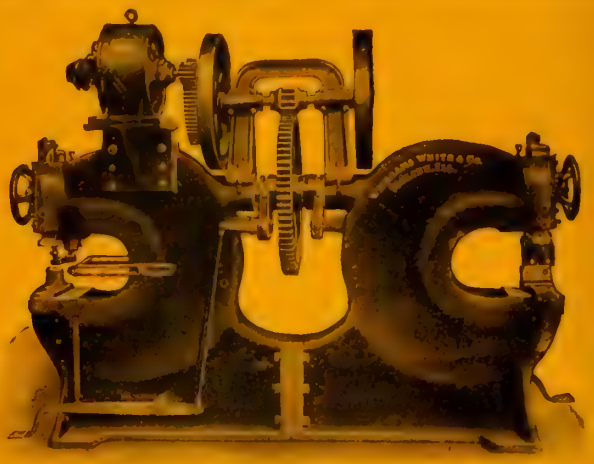
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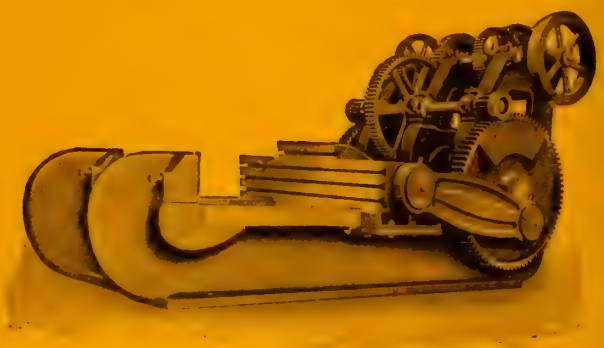
OF EVERY KIND

Forty years of experience in the development of first-class machinery for the making of iron and steel parts has established our reputation for superiority. We are constantly called upon in an advisory or engineering capacity to propose machinery and processes for manufacturing new parts, as well as to secure greater economies in manufacturing operations already established. Our wide experience and the great variety of machines that we make enable us to render services that may be called unique.



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We are the originators of the **Bulldozer** and have built this machine for forty years. We can furnish Bulldozers to suit any requirement, and with any modification or change necessary to suit particular conditions. Improvements of Bulldozer design in recent years are the strengthening of cross heads and trunnions, and effective counterbalancing.



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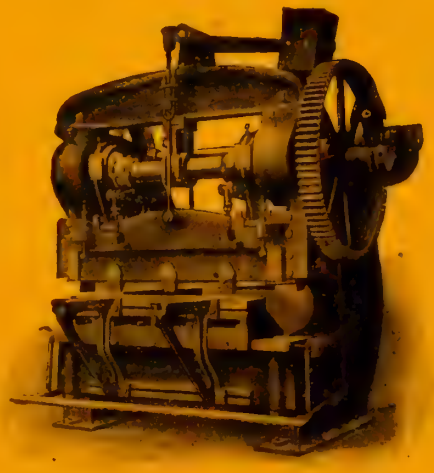
The 1¼" Upsetting and Forging Machine is the smallest of a range of machines for this purpose. Our designers have overcome vexatious sources of weakness and have succeeded in producing a machine which operates continuously without annoying delays and in which the wear after years of use can be repaired at trifling expense. **The patented automatic spring relief** relieves the machines from jamming and yet is unyielding in the closed position, thus eliminating the annoyance and loss of time in replacing breaking bolts, or the uncertainty of directing acting springs.



1¼" Upsetting and Forging Machine.

Designers and Manufacturers of standard and special machinery of every description.

Write for our new Catalogue



No. 35—Gate Shear

Williams, White & Co., - Moline, Ill., U.S.A.

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If interested tear out this page and place with letters to be answered

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WHITCOMB-BLAISDELL PLANERS



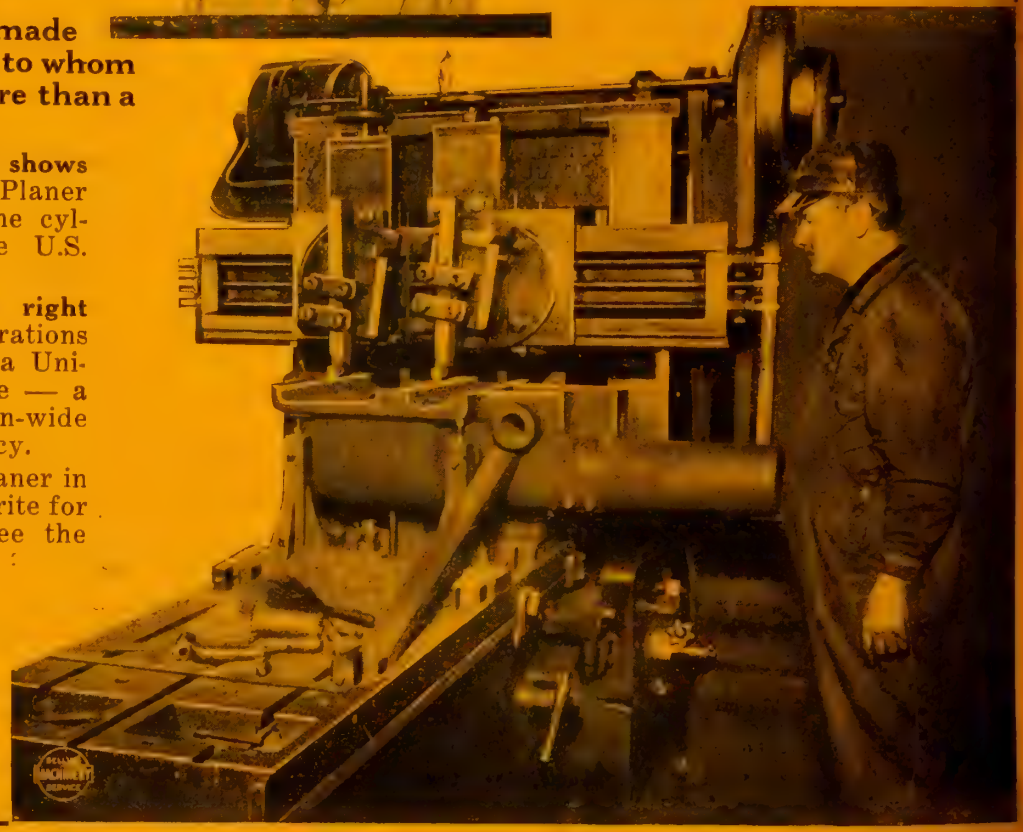
Those who give more than ordinary care to the selection of equipment usually decide on "W-B" Planers. They have found that these tools are made for large production with exceptional accuracy — all round machines for high-grade work, equipped with labor-saving contrivances that add to their convenience and permit speeding up without endangering accuracy.

"W.-B." Planers are made for particular people to whom Accuracy means more than a name

The illustration above shows a Whitcomb-Blaisdell Planer machining ice machine cylinder plates for the U.S. Merchant Marine.

The picture at the right shows machining operations on the head post of a Universal boring machine — a machine with a nation-wide reputation for accuracy.

You'll need a W-B planer in your work; but first write for the catalogue and see the whole line.



Whitcomb-Blaisdell Machine Tool Company

Worcester, Mass.
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HENDEY LATHES



Hendey Lathes used for quantity production in one of the large electrical shops in the United States.

Favorites in the Tool Room

Hendey Lathes are popular tools in the toolroom. They have earned by fair competition an unexcelled reputation for masterly design, for splendid workmanship, for unfailing accuracy and for ease in operation.

They have the advantage of a number of valuable features almost essential in tool room work—such as automatic stop for carriage, working in both directions—reverse for carriage, controlled from apron—relieving attachment for "backing off" taps, reamers and milling cutters—automatic thread-cutting attachment with quick carriage return.

There are other features which deserve your attention. We shall be pleased to send you our complete catalogue on request.

THE HENDEY MACHINE CO.

TORRINGTON, CONNECTICUT, U.S.A.

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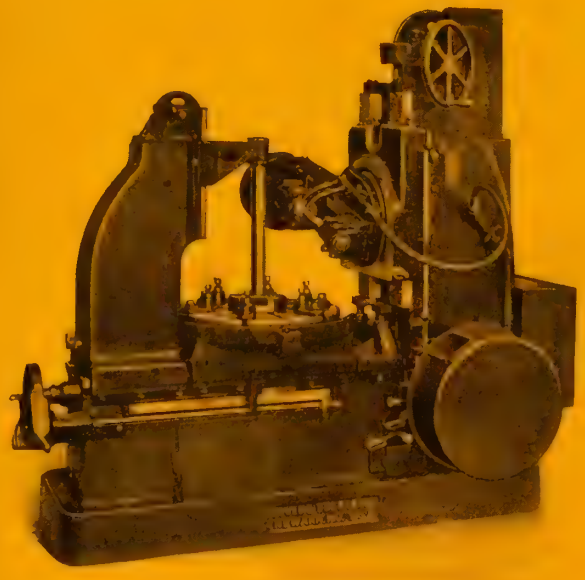
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Our **"High Duty Shapers"** have been on the market long enough to merit the title, "A Well-Seasoned Shaper." Over 13,000 shipped to date. Why experiment when you can buy a sane investment?





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"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
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"La Salle" No. 2 Automatic Surface







No. 3 Plain and Surface Grinder

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GRINDERS

American Drill Grinders



La Salle Grinders have earned an enviable reputation in general shop and tool-room work. They are carefully designed, and are built with the precision essential in accurate grinding.

The La Salle American Drill Grinder is a great production booster on drilling jobs. Most of the drill trouble such as dullness, burning and breakage is not due to poor drill quality, but nothing more nor less than improperly sharpened tools—drills ground with the wrong cutting angle, or with the point off centre. The La Salle American Drill Grinder is a machine of distinctive type which sharpens drills perfectly.

The La Salle plain and surface grinders and **automatic surface grinder** cover a complete range for general shop and tool-room work. The No. 1 machine has an astonishing capacity for surface grinding work of all kinds. The other two machines are more or less standard in general design, but we have made provision by improving the design for the preservation of the original accuracy and alignment of the machine. All conveniences, such as micrometer dials, etc., are embodied in the design.

We shall be pleased to send you complete details regarding any or all of these machines.

La Salle Tool Company

La Salle, Illinois, U. S. A.

No. 1 Plain and Surface Grinder with Micrometer Adjustment



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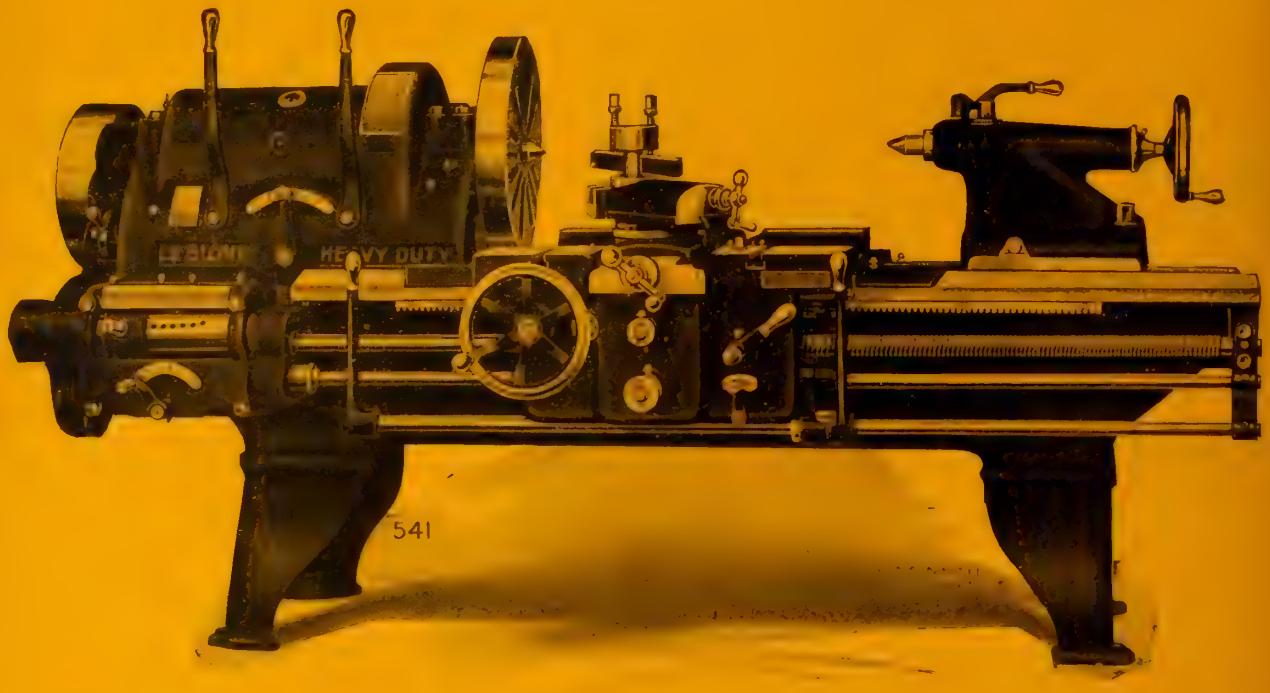
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21" LeBlond Heavy Duty Lathe Geared Head Single Pulley Drive

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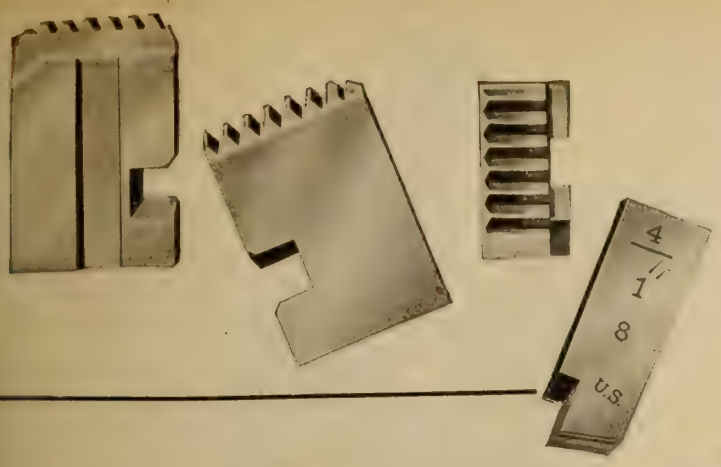
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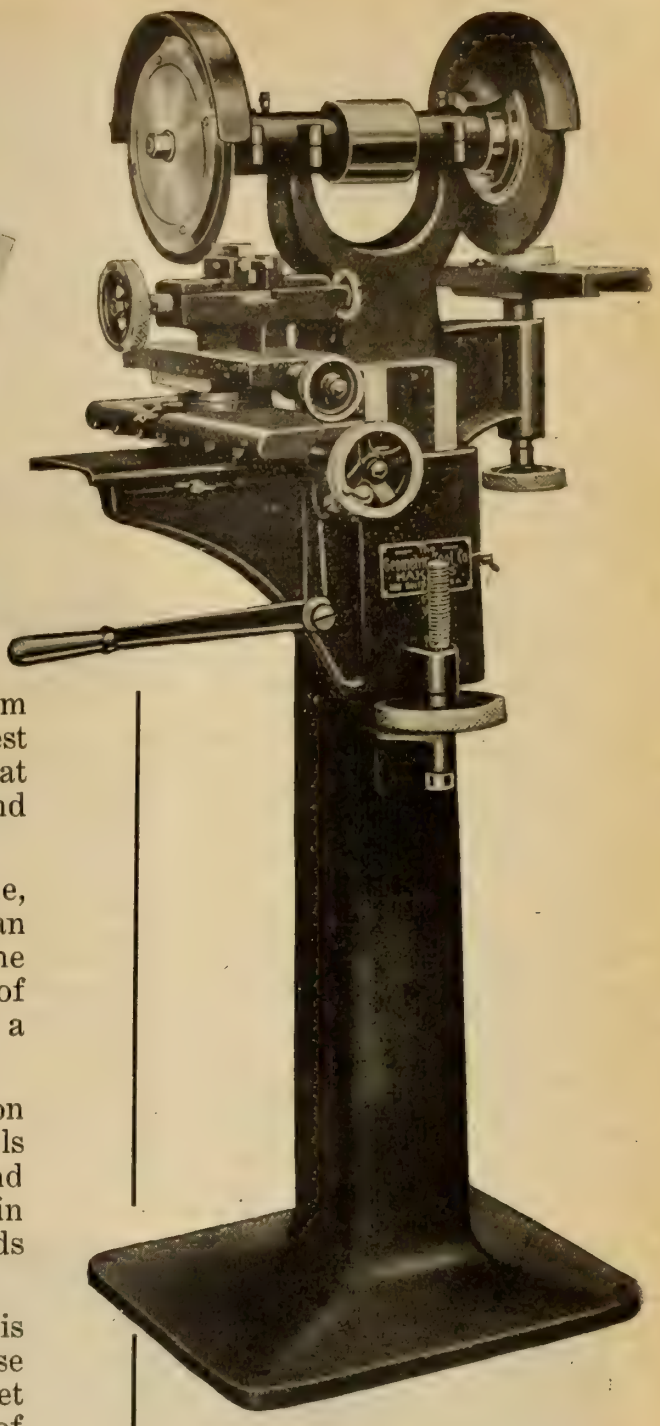
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Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine—the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, Winnipeg, St. John, N.B.

the tendency to shear as a result of any unequal expansion and contraction of the shell. The necessity for first laying out and then centre punching each hole is dispensed with.

For drilling additional rows of holes, as in boiler or plate work, special stands are employed to suit conditions. For butt-strap rivet holes the super-beam becomes the bed of a cradle, which is set upon rockers and fastened by set screws. The rockers rest on curved beds, and are toothed along the outer half to mesh into pinions on a shaft extending between them. Detachable hand levers at the ends are used to turn the cradle until the next centre line is brought beneath the points of the drills. A pointed sleeve jig is slipped over the end spindles and slid down to touch the work until correct alignment is obtained. For appropriate work, such as drilling tube holes in water-tube boilers, the shell is placed in rings instead of a cradle.

The type of machine built for heavy work is designed for a length up to 40 ft., or to carry not less than 75 drills; but it is stated by the manufacturer that any desired number of drills and any span may be had. The illustrations are of a model of 20 ft. working span weighing about 25 tons. When running there is an entire absence of jar or vibration, the only sound audible being the quiet hum of the drills cutting into the metal.



6-TON VOLTA FURNACE IN POURING POSITION.

VOLTA ELECTRIC FURNACES

The electric furnace has become the recognized means of making the steel necessary for the steel foundry. Canadian steel plants have been fully aware of the advantages offered in economy and ease of operation and the installation of Canadian-made furnaces in the plant of the Dominion Foundries and Steel Co., Ltd., Hamilton, is a feature worthy of note. This firm manufacture carbon and alloy steel castings and are now operating the two 6-ton furnaces recently installed by the Volta Manufacturing Co., Welland.

These furnaces, while of the Heroult type, contain a number of exclusive Volta features which make for improvement in operation both as regards ease and economy. They are installed on the open hearth floor of the main foundry building, and, owing to the necessity for keeping the charging floor in the rear free for the open hearth charging machine, the transformer rooms are located on the floor below and to the rear of the furnaces. The furnace transformers have a capacity of 1,500 kv.-a. and connection is made to the furnace catenaries by means of the usual copper busses. The secondary is connected up in delta while the primary is in star. Current is obtained from the company substation at 13,200 volts by means of underground cables.

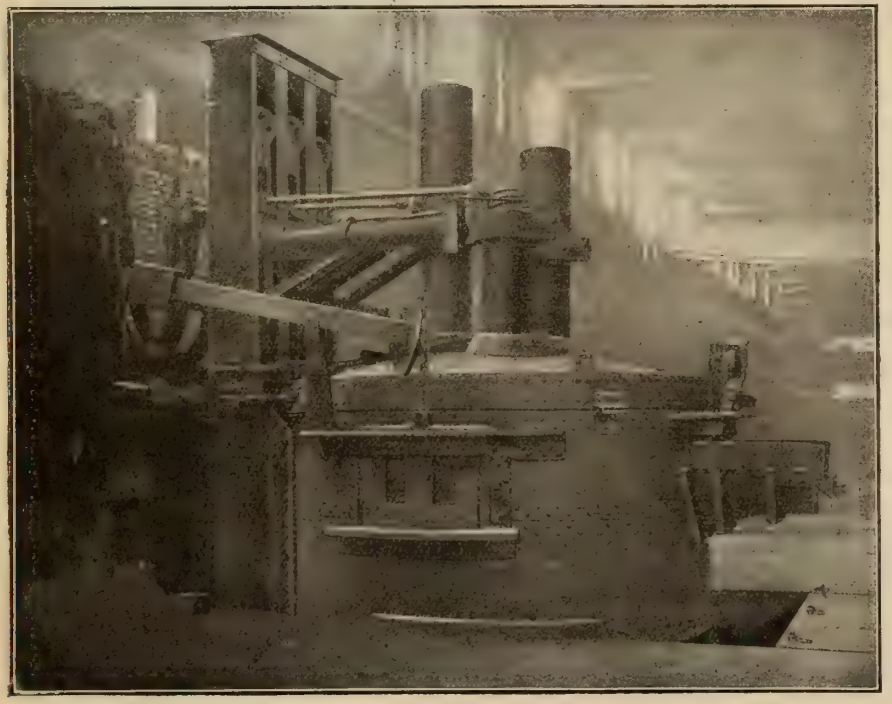
An interesting feature of the Volta furnace is seen in the electrode arrangement. The electrode clamps on a furnace of this size are usually water-cooled, and in most types of furnaces water pipes as well as copper leads have to be carried by the electrode hoisting arrangement. This has been done away with in the present instance and copper tubes serve to conduct both the current and water. Two tubes are employed for each electrode, and while both serve to conduct current, one serves as a water-feed while the other is used as a return.

In heavy current engineering the question of skin effect is of much importance; the current tends to crowd to the outside of any conducting member while the interior is of little or no use. By using a tube and utilizing the bore for water the economy effected is at once apparent. The electrodes themselves are of a patented design, which allows the use of electrodes of varying diameter.

The tilting arrangement is also of some interest. It is not of the rocker type but a heavy shaft is employed, placed well forward towards the front of the furnace. The furnace is so arranged and balanced that a comparatively small-sized motor is all that is necessary to give the desired tilt.

The Thury regulator of an improved design developed by the Volta Manufacturing Co. is employed. They are equipped with no-voltage devices which prevent the travelling of the electrodes downward under the action of the regulator in the event of power failure. In place of the carbon arcing types employed in regulators of former design, copper contacts fitted with magnetic blow-out coils are now used.

The two furnaces now installed make possible six heats a day, with an aggregate production of from 80 to 100 tons.



6-TON VOLTA FURNACE IN RUNNING POSITION.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1887)
JOHN BAYNE MACLEAN, President. H. T. HUNTER, Vice-President
H. V. TYRRELL, General Manager.

PUBLISHERS OF

CANADIAN MACHINERY
AND MANUFACTURING NEWS

A weekly journal devoted to the machinery and manufacturing interests.
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The Outlook For 1920

IT is not necessary that a person should resort to soap box oratory to make it plain that there is going to be good business done in Canada during the present year.

The one thing that at present is holding up more rapid development is the inability of many firms to secure the equipment they need. The lines wanted are oversold, and production cannot keep pace with the demand, which is insistent and financially sound.

The price of the equipment is not now the determining factor. This fact alone makes it plain that those putting in the machinery have a good working knowledge of what they are going to do, and are satisfied that they see a market for their product big enough and extensive enough to easily discount any increase they may have to pay for the equipment they need.

Steel can be accepted as the barometer for the metal trades. The bookings of steel for this year are large—very large, and they come from such a wide variety of interests that it is apparent that activity is going to be widespread. Shipbuilding, structural workers, automobile builders, boiler and engine firms, agricultural implement shops, and scores of other lines are in the market for material.

Representatives of these concerns state that their big problem is not one of selling, but of producing. They are making things that the people want in order to increase the production from the land. They are making it possible for us to have more for sale than we have had in the past, and in this fact lies our best chance for righting the exchange that is telling so forcibly against our coinage in the United States market at the present time.

It is hard to see where there is going to be a slump in prices for some time to come. Indications are not that way. Those who have stayed out of the market waiting for a lower level have been disappointed, and it is hard to see where such a course can be justified in the light of the volume of business that is now piled up against the producing capacity of the steel mills, the machine tool works and other kindred lines both in United States and Canada.

Given freedom from labor troubles, and an honest attempt on the part of the manufacturers to put real merit into their product and real foresight into their sales programmes, Canadian industries should go ahead in 1920 as they have never done in a similar space of time.

Get Straight For 1920

START the new year by getting your books in good shape. It does not make any difference whether you have an elaborate set of books, or only the little book that the savings department of the corner bank gives to you.

If you have accounts outstanding collect them.

If you have bills to pay, get out and pay them off.

Don't resort to the poor expedient of financing on money that you honorably owe to other people.

If you cannot pay off your debts now the chances are that you will not be able to pay them off in the future.

If you cannot collect your accounts now, in these days of free circulation of money, the chances are that you will have trouble in realizing on them in the future.

Get your house in shape for a clean year as far as credits and debits are concerned. Don't pigeon-hole accounts that you know you owe and ought to pay. It hurts your feelings a whole heap more to pay for something after you have used it than before. For instance, you can see the reason and wisdom for paying for coal now. In the spring the straightening out of such an account would be accompanied by a wry face and a grouch.

Remember the man you buy from cannot finance on promises any more than you can.

Have your business in good shape, if it is nothing more than your household affairs, then no matter what comes, you will not be found running for cover at the first sign of a setback.

The Granary and the Workshop

POLITICIANS used to refer to Canada as the Granary of the Empire, and no doubt that is a reputation worth the having.

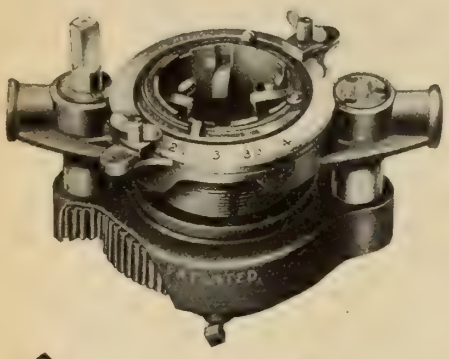
At the same time Canada is making rapid strides toward becoming one of the great workshops of the Empire. Developments are under way in the matter of increasing the steel producing capacity of this country that can hardly be grasped by the ordinary citizen. The plans have the backing of all necessary money, and they are not on a small scale, either. The work is being undertaken with the idea that there is a great future ahead of this country.

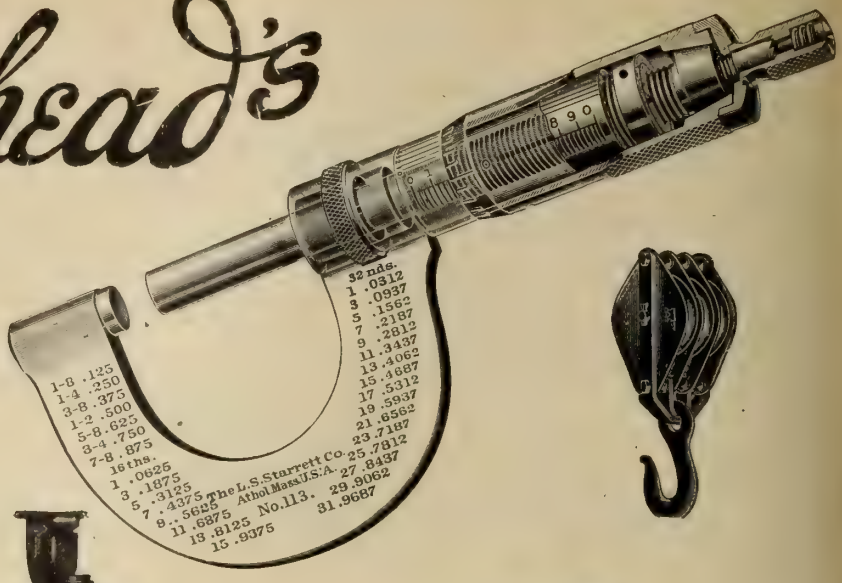
The way in which American branches are coming across indicates that these people have a tremendous amount of faith in this country, and in the ability of the mechanics of this country to make an article that can compete in the markets of the world.

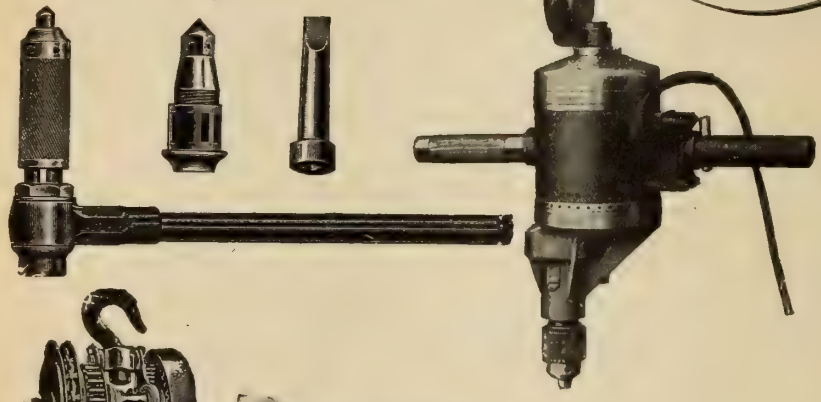
The Canadian is a good mechanic if he has a chance. He can think and he can plan, and he can hold up his end in the matter of turning out the quantity.

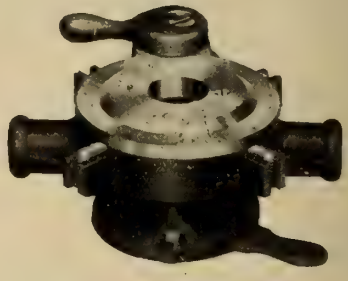
Canada is demonstrating that it can be not only the granary of the Empire, but the workshop as well. Agriculture, from the size and extent of our country, should be our basic industry. It is a sure foundation from which to grow. But the industrial section of the Dominion is coming to a point where it is going to crowd closely on the heels of the supremacy of the farmer. Together, these make a great combination.

Aikenhead's

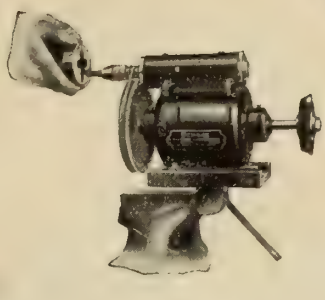










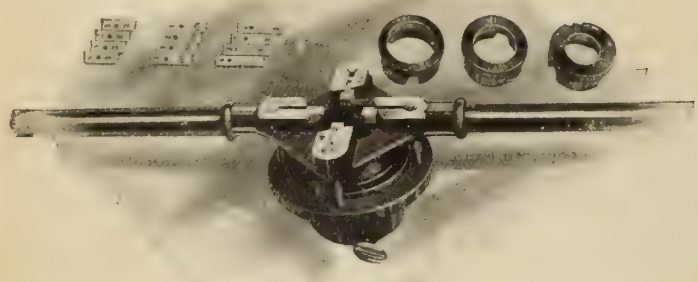


Aikenhead's

For The World's Best Tools

When a tool manufacturer has spent years in developing the quality and workmanship of his product, building up his reputation in the teeth of strenuous competition, he will not needlessly take chances with this reputation—his greatest asset. He will not allow his tools to be displayed promiscuously among obviously inferior and little-known makes. The firm which represents him to the purchaser must have a reputation (equal to) his own for quality, honesty, and service.

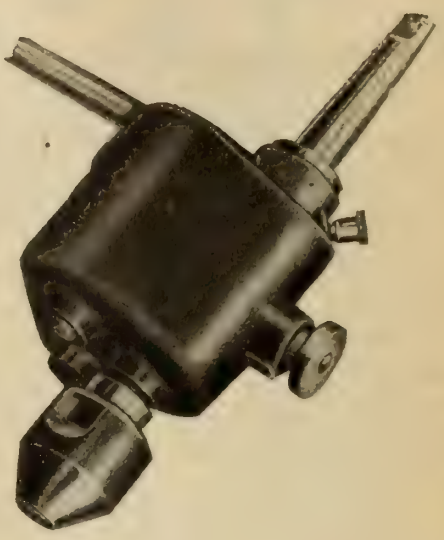
Aikenhead's is the Canadian headquarters of a number of makers of the world's finest tools.



AIKENHEAD HARDWARE LIMITED

Aikenhead's

Wahlstrom Tapping Attachment



Why the heavy tap breakage with machine tapping?

Obviously, because the tapping machine is usually sufficiently powerful to snap a jammed tap.

But that's not the real reason. In hand tapping the tool *doesn't jam*—simply because the tap is reversed for part of a turn every revolution to free the chips. Machine tapping makes the tap jam, because no attempt is made to free the chip from the cutting edges. Result; the lands packed with chips, the cutting edges are smothered, either a soft spot draws the tap off centre or it wedges tight in the hole—and the machine breaks the tap.

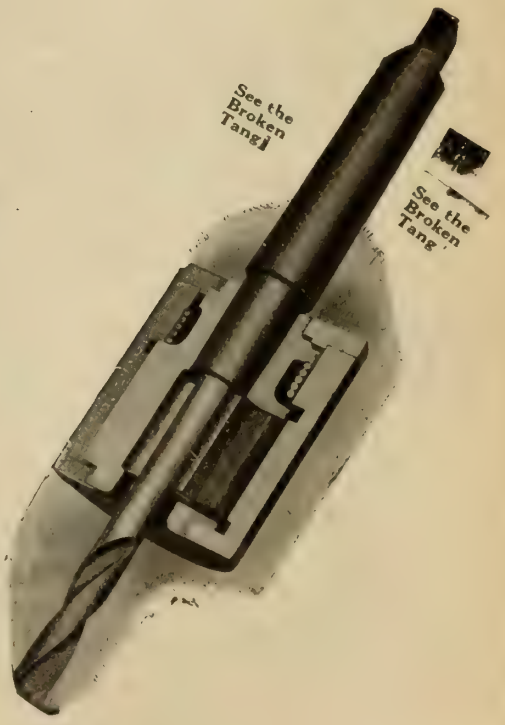
The Wahlstrom Tapping Attachment saves taps and turns out clean, squarely cut threads, because it produces the simple reversal of tap movement which frees the chips. The tap is driven with an oscillating movement which closely imitates hand tapping.

This attachment gives you the time and labor saving of machine tapping with the accuracy and tap economy of hand tapping. Nothing to get out of order; built for long service.

May we send you one on trial.

Aikenhead's

Automatic Wahlstrom Chuck



Two seconds — that's all

Two seconds is all you need to change the operation from drilling to reaming, to counterboring, or to tapping—and you don't stop the spindle.

Your operator can drill any number of holes of different diameter, one after the other, simply by grasping the chuck with one hand and replacing the loosened drill with another—and two seconds does it. Figure out the labor saving in your plant on drilling jobs.

This Wahlstrom Automatic centers the tool, and its instant-acting jaws close on the *entire* shank in a grip that becomes firmer as the resistance to the tool increases. The clutch can't slip, and the jaws never mark a tool.

Made in a number of sizes to take straight or taper shank tools.

Write for the Wahlstrom Booklet

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If interested tear out this page and place with letters to be answered.

WHAT THINGS ARE DONE IN NAME OF SAFETY!

Devices Grow and Thrive in This Rare Atmosphere—and What Will Be Coming Out Next?

Editor, CANADIAN MACHINERY:—The pursuit of safety methods is laudable. As an ameliorator of industrial conditions it ranks highly, and the literature diffused so liberally by the High Priests of Safety First add greatly to the gayety of the race. However, like many other good things, it can be overdone, and on some of its devotees it reacts in strange fashion. Looking through the pages of a technical magazine recently, we came across a section headed: "Platitudes for Puzzled Practitioners." This was not the exact wording, but it indicates the meaning. After reading of a bright individual who conceived the idea of putting a fixed obstacle on a lever to prevent a sliding piece sliding too far, we were going to try another section, when a spirited sketch attracted our eye. It showed a hand grasping a cold chisel, and another hand poising a hammer as though to strike. There was nothing in this to cause comment, but on both the hammer and chisel were depicted strange protuberances. That on the chisel was arranged near the end, and looked as though some lady mechanic had tied a ruff round its neck to make it look better. The hammer was decorated right on the end of the shaft, and close examination revealed the fact that the excrescence was an ordinary round washer held on with a coach screw. Now for many years we have used a hammer and chisel, but never saw them fitted up in this manner. Therefore, we anxiously read the text, to find out the raison d'être of such a peculiarity.

It appears that a sturdy mechanic grasped his trusty hammer, and prepared to smite the chisel a resounding blow. Alas, the hand that grasped the hammer was a greasy hand, and instead of striking the chisel, the smooth hammer shaft slid through the greasy grip, and smote an unoffending laborer on the apex of the cranium. Nothing daunted, the mechanic grasped the hammer again and this time his hold was so firm, and his aim so true, that the chisel drove through the metal, slipped through the holder's hand, and hit a second workman who happened to be adjacent. This was too much. Safety First was outraged, and the safety expert called in. One glance sufficed, and the remedy was determined on in a twinkling. Simply fasten a large washer on the chisel, above the hand, and a similar one on the hammer, below the hand, and the trick was done. Oh, safety, what things are done in thy name! For the benefit of those who are interested, we offer some further suggestions:—An inspector should be appointed who will periodically inspect the men's hands, and see that all superfluous grease is removed. Lessons should be given twice a day on the proper way to hold a hammer and chisel. To make absolutely sure, any man engaged in chipping should be enclosed in a boiler plate compartment. Men operating lathes shall be provided with a suit of mail and asbestos gloves in case of being burnt with flying chips. Men engaged in grinding operations shall be located in another room, and watch the operation through a periscope. We might go further, but have fear of being mistaken for a safety expert.

Safety first is an excellent motto, but should be attended with a little common sense.

COMPANY IS REORGANIZED

ANNOUNCEMENT is made this week of the reorganization of the Garlock-Walker Machinery Co., Limited, which will, in the future, be known as Garlock-Walker Machinery, Limited. A Dominion charter on fairly broad lines has been secured, and the capital of the company increased from $50,000 to $500,000. Of this amount $250,000 will be issued, the balance remaining in the treasury for future development.



WM. GARLOCK, JR.,
Pres. Garlock-Walker.

The firm has secured a long-term lease on the Mill Building, of the Toronto Furniture Co., on Dufferin St., which has a floor space of 16,000 feet. The repairing and rebuilding work carried on by the firm will be done at the new premises. On this account Garlock-Walker Machinery are giving up the warehouse and shop on Adelaide Street, as well as the warehouse on the Don. At the new warehouse and works the firm intend to carry considerable machinery in stock.

There has been no change made in the personnel of the company; they remain as follows: President and general manager, Wm. Garlock, Jr.; vice-president, A. B. Walker, and secretary-treasurer, J. Albert Brown.

Progress in Marine Power

SINCE the day when the old paddle and sailing vessel "Savannah" crossed the Atlantic, ships and ships' propulsion have gone through a constant process of evolution. The first great change was the introduction of the screw propeller, to replace the paddle. This in turn brought about modification of the engine, and many and various were the expedients adopted. The trunk engine, the return connecting rod, the geared engine, in which the propeller was geared up instead of down, as regards revolutions, all had their day. The inverted vertical type then made its appearance, and speedily gained favor. In its early days it was a single crank engine, with a huge fly-wheel, and some of these steamers were running from Antwerp to the far East as late as 1906. They belonged to the famous Blue Funnel line of Alfred Holt & Co., Liverpool. Pressures were low, from 15 lbs. to 25 lbs. per square inch. With more knowledge of metallurgy, and better manufacturing facilities, higher pressures came into vogue, and the compound expansion engine appeared. The advantages of this type were so marked that a further development was soon made, and triple expansion was adopted. This seemed to mark the limit, for although quadruple expansion was adopted in some large ships, the triple expansion became the main marine prime mover. However, the marine engineer never feels content with any achievement, and it was not many years before the Hon. Chas. Parsons adapted the steam turbine to marine propulsion, marking the greatest innovation since the days of Fulton. About the same time Dr. Diesel's oil engine was being adapted to marine work. The steam turbine rapidly came into favor for high-powered, fast vessels, but was unsuitable for the ordinary steamer. This was on account of the efficient speed of the turbine being too high for the efficient working of the propeller in the ordinary slow vessel. This seemed to limit the usefulness of the turbine, till the inventor of the turbine tried out a reduction gear between turbine and propeller. It proved successful, and was further developed, double reduction gears being used, till now the largest and fastest vessels in the world use this type of prime movers. The oil engine, backward for a long time as a marine proposition, has been rapidly developed in the last four or five years, till now it is taking its place as a competitor of both turbine and steam reciprocator. Future development will no doubt result in the supremacy of either the geared turbine or the oil engine, with the gradual disappearance of the reciprocating steam engine.

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MARKET DEVELOPMENTS



Better Deliveries Are Much Wanted Now

Capacity is About 80 Per Cent. Now, But Against This There Are Bookings for About 150 Per Cent. of the Nominal Output—Bar Iron Prices Are Up This Week

IF a vote were taken at the start of the 1920 business year of the machine tool and steel trade, as to the one thing most to be desired just now, the verdict would no doubt be "Better Deliveries."

Authorities of the United States Steel Corporation state that production at their plants is now 80 per cent. normal, although the strike there has never been officially declared off. That is very encouraging, but the trade faces a deficit of a good month's output by reason of the strike. It is safe to say that against the 80 per cent. production, there is now a demand equal to 150 per cent. of normal, so there is still a large gap left.

Bar material moved up in Canadian points during the week. Mill prices in most cases work out around 3.80 Toronto, against a former 3.30, and warehouses have left the 4.25 price that has remained for a good many months and gone to a 4.75 level. Mills are sold out on all wanted lines, and although more finishing capacity is coming in shortly, this will simply tend to make more demands upon the already rushed open-hearth capacity.

Business is coming to the market from many sources, such as shipyards, agricultural implement firms, automobile factories, while large tonnages of structurals have been carried over from 1919.

Prices for machinery and small tools remain about the same. Large quantities of used machinery are coming into the market, from the winding up of the shops that carried war contracts.

English makers of small tools are cutting the price pretty close in order to secure business from some of the large firms, but as a general thing there is not much price shading being done at present in machine tools or supplies.

BUSINESS GETS AWAY TO A GOOD START IN MONTREAL THIS YEAR

Special to CANADIAN MACHINERY.

MONTREAL, Jan. 8.—The slight disarrangement in the general market, caused by the holiday season, is gradually being adjusted and conditions are taking on a more normal appearance. The spirit of optimism marks the advent of the new year and dealers are anticipating a good business year in 1920. The realization that existing conditions are likely to prevail for an extended period has impressed many with the immediate need of a more progressive plan of reconstruction than was shown during the past year.

The state of industrial unrest that has been so pronounced during the past six months is slowly taking on a more settled condition, and this will help to bring about an adjustment that will enable business to become more stabilized.

Despite the fact that the first post-war year has gone by, the industrial world is apparently operating under war conditions, the domestic peace demands being such that the production is still insufficient to meet the trade requirements. This is particularly true in respect to some lines of finished steel, the market for which is far beyond the present capacity of the mills. The filled-up condition of many of the large mills makes the delivery question one of marked uncertainty. Machinery inquiries are exceptionally good, and the prospects in this direction look bright for the early part of this year. The scrap situation has developed little of interest, and apart from the firmness in steels the market is uneventful.

Steady Demand For Tools

There is a well-distributed inquiry for a wide range of machine tools and general supplies, and a large portion of this comes from the Middle West. Farm demands are quite heavy. Railroad requirements are falling off a little, but dealers are still reporting considerable business of a light and varied character. Second-hand tool business is quite active, as a result of the delayed delivery on some American lines. There is every reason to believe that prices on tools and supplies will be subject to advances in the near future.

Brighter Future For Scrap

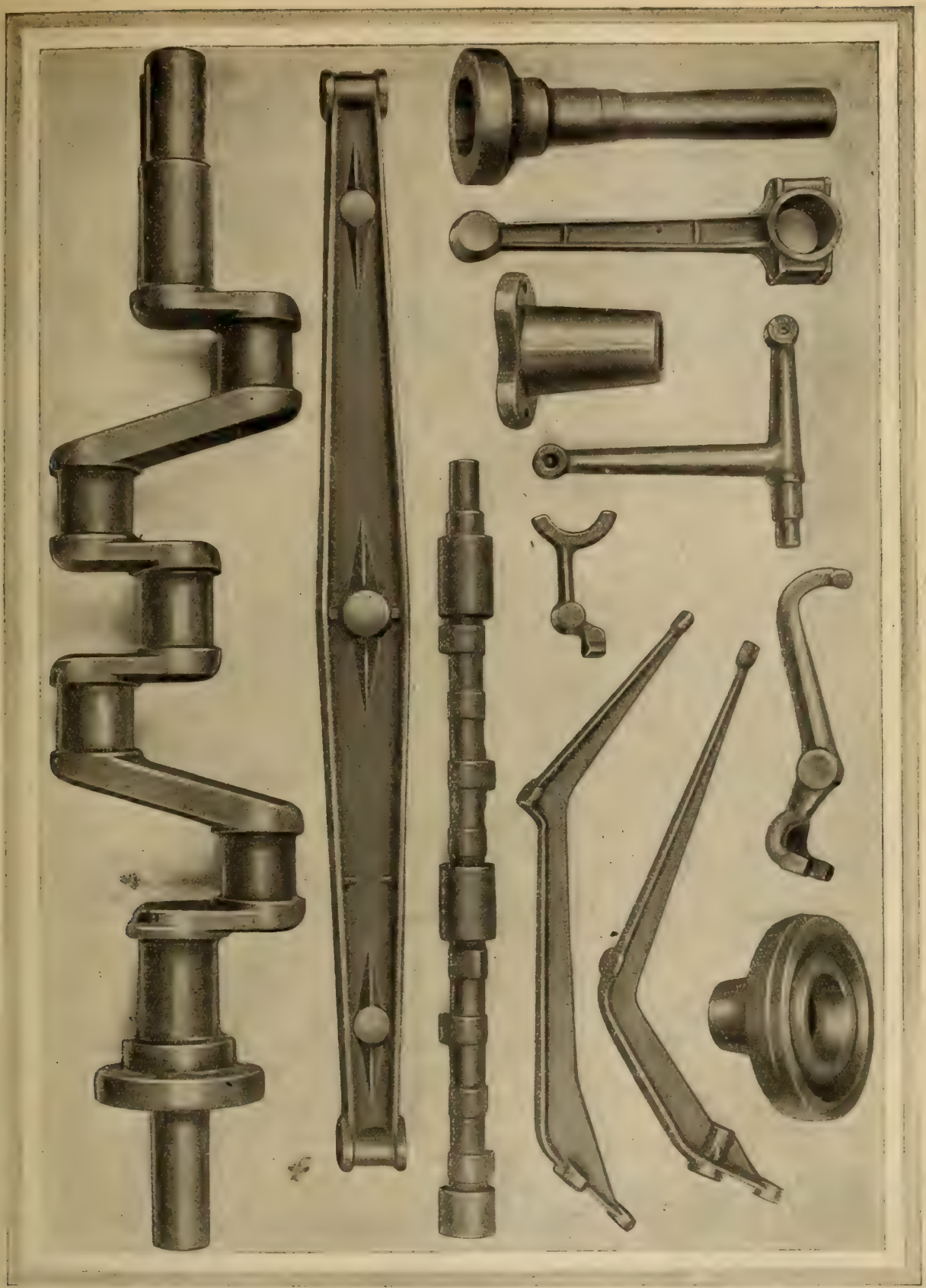
While there is a prospect of an early revival of scrap activity, there is little to indicate that a move of this kind has, as yet, developed. Inquiries, however, are more promising and dealers are hopeful for the coming months. Irons are comparatively firm and may be stronger in a short time. Non-ferrous metals are inclined to be weak, but current quotations are unchanged.

BETTER DELIVERY THE WISH OF 1920

Otherwise Outlook is Bright for the Industrial Outlook in This Year's Trade

TORONTO.—The start of another year's trading is well under way, with prospects all that could be desired. It may be well to modify that phrase "all that could be desired" by a little explanation. If one were to go to the steel trade or to the machine-tool trade and ask what would help them more than anything in the present year, or especially in the immediate future, the chances are that the verdict could be summed up in a couple of words, viz.: "Better deliveries."

There is such an expansion of business on all hands that the makers of tools cannot get out the orders. As a matter of fact production per man in the shops



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of the tool builders is not as high as it was before the war.

Buying is General

One of the largest dealers in steel in this district showed CANADIAN MACHINERY a list of business that was carried over from 1919 to 1920 on his books. It was not chance trade, or orders that might be withdrawn, but all placed on the understanding that a contract is a contract. The tonnage was large and the industries represented were representative of almost every line in the country. They took in shipyards, automobile shops, agricultural implement works, boiler makers, and a number of other lines. Besides this there was a large booking of structurals, all of which means good business in this country during the year that has just been entered upon.

Indications that are coming up now bear out the prediction that has been made in these pages recently, viz., that prices of certain lines of steel would move upward. This week some of the Canadian mills moved bars up. The Toronto price from the mills has been raised from 3.30 to 3.80, which means that the warehouses will in all likelihood be quoting bars, iron or steel at 4.75, a figure which CANADIAN MACHINERY is quoting this week for the first time as the average price to the buyer who gets his materials from the warehouse. The former price of 4.25 has stood for a long time, but had to give way in view of the recent action of the mills.

"We are doing the best we can for our old customers," is the way one importer sized up the situation. "Judge Gary says that the mills of the corporation are running about 80 per cent. That is very good," he concluded, "but it must be remembered that against this 80 per cent. production there is a demand that looks like 150 per cent. of normal."

Good Business Reported

In last week's CANADIAN MACHINERY reference was made to the fact that one buyer who had a large order to place for cutters and drills was looking for a special price. From what CANADIAN MACHINERY can learn he was successful in his quest for part of the business, getting some sag in the price. Most of the representatives of Canadian concerns are standing pat on their prices for small tools, and they are getting good business.

POINTS IN WEEK'S MARKETING NOTES

New York reports state that dealers look forward to 1920 as the best year in their machine-tool business.

Belgian buyers in the U. S. market have a long list of requirements so large that even the U.S. war stock cannot fill the list.

The prices of steel and iron bars have been advanced, and warehouses here are now quoting 4.75 base, against a price of 4.25 which has held for a good many months.

The production capacity now in operation at the Steel Corporation plants is stated to be about 80 per cent. Against this there is a demand that would represent about 150 per cent. of normal.

There is going to be more finishing capacity in the steel trade, but that does not affect the tonnage of steel. The blast furnace and the open hearths are the real pace setters.

Large orders at the steel mills are looked for when the U. S. railroads are returned to their owners. It is hoped that the mills can catch up with their business before that takes place.

There is a demand in this district for foundries that can handle castings for certain lines of machinery.

Wire nail prices at the mills are going up. Fancy prices are being paid for nails shipped from stock for instant delivery.

Premiums for sheets at U.S. points are ranging around $10 per ton up, according to the urgency of the sale.

Shops that were a long time tooling up for new lines are getting up their production rate, and with this it is to be expected that there will be a greater demand for small tools.

1920 TO BE THE BEST YEAR THE MACHINERY TRADE HAS EVER HAD

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 8.—The year starts out promisingly for the machine-tool trade. While there has been something of a lull over the holiday period, it has by no means been as quiet as has been the rule in past years. December was an excellent month and rounded out a very good year for the entire trade. Many of the machine-tool manufacturing companies are holding meetings this week of their sales representatives. To say that there is optimism in the trade is putting it mildly. Some go so far as to predict that 1920 will be the best year the machine-tool trade has ever experienced. While it appears like plain sailing, there is in some quarters a degree of apprehension over the price situation. Labor troubles seem to be fairly well out of the way, but there is a fear that advancing prices, not only of the ordinary necessities of life, but of all articles, may eventually cause some hesitation on the part of buyers. Certainly there cannot be the greatest degree of prosperity until production reaches somewhere near a normal basis.

During the past week the General Electric Co., Schenectady, N.Y., has continued to buy for its new plants and for replacements. The E. W. Bliss Co., Brooklyn, has again come into the market for milling machines and boring mills and will have some planers to buy. Other purchasers include the Bantam Ball Bearing Co., Bantam, Conn.; the Redington Standard Fittings Co., Redington, Pa.; the Farrel Foundry & Machine Co., Ansonia, Conn., and the Newport News Dry Dock & Shipbuilding Co., Newport News, Va.

The Rolls-Royce Co. of America has issued a new list of about fifty tools to round out the equipment for its new American plant at Springfield, Mass.

A Belgian mission, headed by M. Jean Jean, and representing the Societe la Construction de Metallique, of Brussels, is in this country to select a large number of machine tools from the surplus stocks of the United States Government. The mission brought lists of tools desired by Belgian manufacturers, but could not find more than 600 of these tools in the stock held by the Government. Efforts are being made to purchase the remainder of the needed tools, numbering several hundred, from other sources.

ANNUAL BONUS BY GEAR SHAPER CO.

Custom Was Inaugurated in 1916 And This Year Called for Sum of $25,000

Following a custom inaugurated in 1916, the Fellows Gear Shaper Company on December 24th distributed an annual cash bonus to its employees. Approximately 665 employees received this bonus, which amounted to a total of $25,000, $20,000 of this amount being paid in gold.

The rating of this bonus is governed by the length of continuous employment, and is based on the total wages earned during the year. For the first and second years it is 2 per cent. of the total wages earned, and increases by 1 per cent. each succeeding calendar year up to 10 per cent.

The bonus distribution this year was of special interest to those who were in the "service" during the World War. To all of those who returned to the employ of this company the bonus was calculated from the time of their original employment. That is to say, when they returned they were not considered as new employees, and the time spent in the service of "Uncle Sam" was not deducted.

Effective January 1, 1920, Lieut.-Col. B. Ripley, Toronto, was appointed district engineer of the C. P. R., succeeding Mr. A. L. Hertzberg, retired.

CANADA'S PREMIER MACHINERY HOUSE



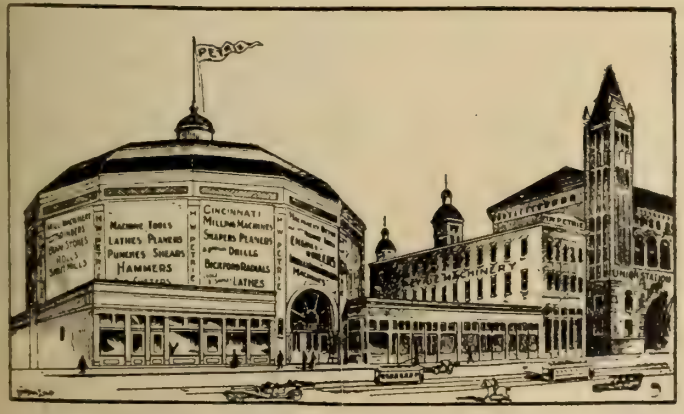
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THROUGH half a century of industrial expansion, through wars and rumors of wars, through financial panics and trade depressions, the H. W. Petrie Limited, has stood, and stands to-day in unchallenged supremacy, the acknowledged machinery headquarters for Canada—the firm with a national reputation for quality, service and fair dealing.

The policy of Efficiency in Service is one of the sterling qualities that have built up and sustained the public confidence in the H. W. Petrie Limited, for fifty years.

In Toronto alone we possess 130,000 square feet of floor space for the storage of modern machinery. This, and the excellence of our buying and selling connections, enables us to handle a contract of **any** size in the quickest possible time and at most reasonable prices.

Our facilities for repair work of every description (stationary and marine) are magnificent.



H. W. PETRIE LIMITED

TORONTO

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NOT MUCH PROSPECT OF CATCHING UP WITH THE SHORTAGE OF STEEL

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 8.—Activity in the search for prompt lots of steel products is increased, as compared with conditions prior to the holidays, while on the other hand there is little business being done for extended deliveries. The decline in the volume of contract business is a necessity of the situation, since the mills that were willing to accept contracts are filled for such periods as they were willing to consider, the half year in some cases, and the first quarter only in other cases. Thus there is practically no opportunity to place open contracts.

The shortage in steel is not relieved, nor is there any prospect that it will be relieved in the near future. There is even a question whether it ever will be relieved as long as the period of industrial prosperity continues. The common view is that conditions will be approximately back to normal in a period of months, six months being the longest term usually mentioned.

While this six-months-to-normal is a common view in the trade, there is some ground for disputing it. There are two considerations: First, that production is likely to increase sharply in the next few weeks, and, indeed, if production does not, the steel industry will be in a bad way, for it has always made its good profits when it was operating on practically full tonnages. Second, railroad buying on a fair-sized scale at least is expected almost as soon as the railroads are returned to their owners, the date for that operation being March 1, while the approach or advent of spring is likely to bring heavy demands for steel for construction purposes. Hence, it would seem that if the steel mills do not catch up with their customers' requirements in the first three or four months of the year, they will have little opportunity to do so later.

It is easy to over-rate the so-called "shortage" in steel by comparison with capacity. While the market demand for spot and prompt lots is insistent, it is generally for carloads to 1,000 tons, and thus a few hundred thousand tons would be a large aggregate. That, however, is not much when viewed in the light of production or capacity figures. At the time the iron and steel strike started, September 22, there were at least normal stocks of steel in the hands of jobbers and manufacturing consumers, and probably somewhat greater stocks than usual, as the strike certainly had been expected by many, both sellers and buyers. Production of finished rolled steel just before the strike was at the rate of about 600,000 gross tons a week. In the 15 weeks intervening, production has averaged about 400,000 tons a week. The present rate is probably 550,000 or 575,000 tons a week, while capacity is about 725,000 tons a week. Buyers got along somehow when they were restricted for 15 weeks to an average of 400,000 tons a week, and a shortage of a few hundred thousand tons if the mills, during the next two or three months, work up to 650,000 or 725,000 tons a week.

Fancy Prices Paid

The lowest price on wire nails for quick shipment seems to be $4.50, base, per keg. Just before the strike the independents were on their $3.50 basis, while the American Steel & Wire Company has continued its price at the March 21 level of $3.25. The $4.50 price is made by some large mills, rather than by small producers or by middle interests. Nails purchased from stock may bring dollars per keg more. Merchant steel bars show a great range. The March 21 price, adhered to by the Steel Corporation and some independents, is 2.35c, while some large mills quote 2.50c and can make delivery in two or three months, and some rolling mills, including iron mills, producing from purchased billets, ask and secure 3.00c and higher, for delivery, say, in 30 days. In limited tonnages one can frequently buy at 3.25c from warehouse, particularly warehouses maintained by mills that have a price of 2.35c to 2.50c for mill delivery, time uncertain. In sheets, which, by the March 21 schedule, are set at 3.55c for blue annealed, 4.35c for black, and 5.70c for galvanized; premiums on deliveries over the first quarter are usually about $10 a ton, but black sheets from stock command from 5c to 6c.

Stabilization Policy Firm

The United States Steel Corporation's adherence to the March 21 price schedule has been reaffirmed and thus is booked for indefinite continuance. There was possibly a little room for doubt recently whether the policy would be contained after 1919, for the basis was the March 21 arrangement between the Industrial Board and the steel producers, and all that was settled upon at the time (irrespective of the fact that not long afterwards the Industrial Board disappeared) was that prices were to be "stabilized" for the remainder of 1919.

The reaffirmation comes by way of a public statement made by Judge Gary, chairman of the Steel Corporation, declaring the corporation's adherence to the schedule and its feeling that steel price advances would tend to encourage further increases in the cost of living. Thus the policy is to be of indefinite duration, and as the statement makes no reference to time, or to a new calendar year having come, there is no admission that at any time the Steel Corporation regarded its policy as one adopted for 1919 alone.

The higher prices being paid by many buyers of steel, accepted by the majority, if not nearly all of the smaller independents and by a few of the larger independents, must thus be considered a premium price above the market basis, the premium being paid for the early delivery involved. There are relatively few cases of premiums being paid for second quarter, and none involving third quarter.

Pig Iron

Pig iron advanced an average of about $11 a ton from June 1 to just before Christmas, when advances practically ceased, the market having been relatively dull since then. Some furnace interests now talk as if the advancing movement is to be renewed. Undoubtedly pig consumers have it in their power to put the market up further on themselves if they desire, and perhaps they will do so. There does not seem to be altogether good ground for an additional advance at this time, if indeed, the previous advance was entirely justified. The furnaces are either back into blast or are scheduled to go into blast. On the March 21 price some furnaces claimed they could not make a profit, but prices $10 a ton higher are a different matter. A $10 clear profit would easily pay in one year for the best furnace built. There is much talk of labor shortage and labor inefficiency, but if such conditions continue, the influence will be to make pig iron plentiful, rather than scarce. About 80 per cent. of the pig iron made is used by steel works, nearly all the balance going to iron foundries. Labor shortage and labor inefficiency would restrict the operation of steel mills, and hence their consumption of pig iron. With a blast furnace, however, it is chiefly a question of the raw material being dumped in and of the superintendent having the requisite ability to operate the furnace.

OBITUARY

The death is announced from Cleveland of a well-known citizen of St. Catharines, Mr. Ralph B. Hamilton. Mr. Hamilton, who was for twenty years manager of the Packard Electric Company in St. Catharines, was 44 years of age and a graduate of Cornell University. He was born in Toledo. He was president of the Carey Safe Company, Buffalo; Packard Fuse Company, Canadian Standard Products Company and Precision Manufacturing Company all of St. Catharines. He went to Cleveland three months ago to become production manager of the National Safe Company, of which he was vice-president.

Belgium to Buy Locomotives.—Belgium, which is badly in need of locomotives, is about to place a contract with the Montreal Locomotive Works. The Belgian Government recently placed an order for 100 locomotives with Armstrong, Whitworth Company in England. There is a possibility of orders for cars being placed in Canada also.

"..... not worth the paper they are written on"

We refer to Production Cost Figures that depend on pencil records.

What pencil records?

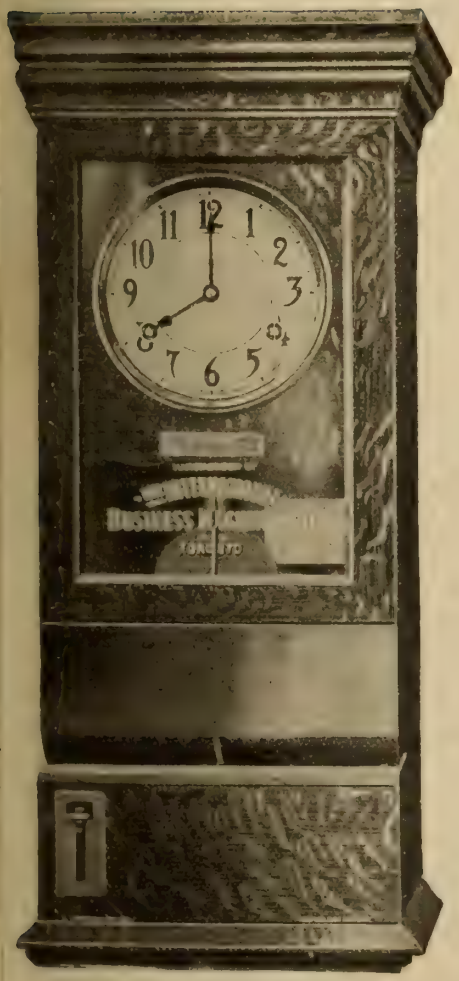
The time-cards on job work that your workmen or foremen now fill out in pencil.

Why aren't they good in pencil?

Because pencil records can be changed and a working-time balance can be forced.

And if your factory production costs are "leaky" the whole question of your costs, your overhead, etc., is "up in the air."

The International Job Recorder absolutely corrects this condition. It enforces a printed, machine-made, unchangeable, infallibly accurate record of the time spent on any job or operation.



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Knight Metal Products

Used Machinery

2—No. 2 Foster Back Geared Friction Head Screw Machines, with wire feed.

1—2 x 24 Jones and Lamson Flat Turret Lathe, for chucking.

3—Fox Brass Lathes, with chasing bar 16″ x 6′.

2—20″ Back Geared Champion Drill Presses.

1—18″ x 8′ Stevens Engine Lathe.

1—14″ x 6′ McKenzie Engine Lathe.

1—Garvin Plain Milling Machine, with power feed. Size of table 42″ x 12″. No. 15 with Universal dividing head and vice.

3—No. 1 Burke Hand Milling Machines.

2—Cataract Bench Milling Machines.

2—Brown & Sharpe Mfg. Millers, No. 12.

Large stock hangers, pulleys, belting, shafting, couplings, Chapman Ball Bearings for hangers.

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Toronto

IRON AND STEEL TRADE IN 1919

THE war restrictions which surrounded the American and Canadian iron and steel industry during 1918 were happily removed, and during 1919 the market has been left free to work out its own salvation. The effort of the more prominent producers to co-operate with other forces towards reducing the cost of living showed itself in a reduction of prices, first, at the beginning of the year, and, secondly, in March last, when prices were established at levels $10 to $15 per ton below those authorized during the war by the U.S. Administration. This conservative policy has been firmly maintained, and steel products have the distinction of being one, if not the only one, of the basic commodities obtainable at values considerably under those ruling at the conclusion of the war.

While demand was fairly well maintained during the first quarter, timidity on the part of buyers was apparent over the following three months, due largely to the difference between the views of the steel producers and the U.S. Administration on the question of rail prices. An indifferent demand with rather weakening prices during the early summer months was followed by a gradual rising volume of business and increase of production, but with no appreciable price changes. This was the position when the American steel strike started on 22nd September, to be followed by the coal strike at the beginning of November. The effect of a sharp curtailment of mill and furnace operations was immediately apparent. There was a scramble among buyers to be covered for their requirements during the first six months of 1920, and between October 1st and the end of the year prices on pig iron and steel products were advanced as much as $10 per ton. As matters stand to-day, the American mills are carrying over to 1920 the equivalent of the loss of eight to twelve weeks' output, caused by the strikes. Not only so, but a very active demand for all steel products has arisen in the interval. The prospects are that for the next few months deliveries will be difficult to obtain, and that the present increased level of prices will be fully maintained.

The adverse exchange situation with the United States is one of the striking features of the year. While benefiting certain industries in Canada which have the advantage of an excellent market in the States, it cannot be said to be altogether an unmixed blessing to the Canadian steel manufacturers. While they are in a position to take advantage of the situation by advancing their prices, should they care to do so, this advantage is partially offset by their dependence on the United States for much of the essential raw materials. Until the international exchange situation clears, it is likely that American exchange will continue to operate against Canada, and this will have the tendency to restrict purchases.

Reports recently received from Germany indicate that it will be some years yet before the steel industry in that country can reach the position it occupied prior to the war. As regards export trade, Germany can be left out of the reckoning for the present year.

Notwithstanding the low rate of sterling exchange, it is expected that only trifling quantities of British iron and steel products will find their way into Canada for some time to come. Prices in Great Britain remain at a high level. Production, however, is below the average, and cannot cope with the demand.

In a general way, the experiences of 1919 have been marked by some disappointments, but at the same time, have served to reveal the unsound movements in the new era of reconstruction. The tendency, therefore, will be towards more settled conditions in all branches of labor, as the common-sense of the community is beginning to assert itself in no uncertain way, and it is becoming increasingly evident that no extreme element in any industry will be allowed to control the situation, or deprive the vast general public of their necessities.

With the gradual settlement of these labor troubles, the outlook will be for lower prices in all commodities, but this can scarcely come in the steel trade until the huge productive capacity of the mills in the United States can catch up with the demand, and this, at best, will be a matter of some months. During the first half of the present year, therefore, it will be a matter for Canadian users of steel products to anticipate their requirements, and to bring all possible pressure on the mills to secure deliveries.

We can well bear in mind the words used in the days of Good Queen Bess: "Let us carry with us ears and eyes for the times, and hearts for the events."

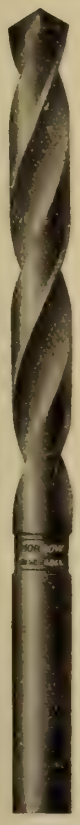
J. T. McCALL,
President and General Manager,
Drummond, McCall & Company, Limited.

January 5th, 1920.

Announcement !!

MORROWS AT INGERSOLL

The pioneers at Twist Drill making in Canada, who always made—not cheap drills—but *good drills*, have now perfected something better, a *Twist Drill of really wonderful performance.*



A demonstrator—an expert on Drill Tempering—will go into your plant if desired to show you, without cost to you, what these *Morrow High Speed Twist Drills will do.* If you are trying for maximum production on rough work, write us at once.

If these Morrow High Speed Drills will do for you what they are doing in some of the large auto manufacturing plants *then* you want them.

Morrow High Speed Drills will positively give you *more holes* than you can get with other makes.

JOHN MORROW SCREW & NUT CO., LIMITED

INGERSOLL -- -- CANADA

STRENUOUS WORK FOR TOWING MACHINES

CONTINUED demand for Canadian-made marine equipment is indicated in reports from manufacturers of towing machines, cargo winches, deck hoists, steering apparatus, etc., and very much of this machinery is being employed in strenuous spheres of usefulness. The Corbet Foundry & Machine Co., Owen Sound, state that the Government wrecking tug, the "Lord Strathcona," which is equipped with one of their No. 5 towing machines, has been engaged recently on heavy service in connection with the several groundings and wrecks on the Atlantic coast. For the time being the tug's headquarters have been shifted to Halifax. The G. T. P. tug "Lorne, equipped with Corbet machines, is the largest on the Pacific coast, while the "Strathcona" is the largest on the Atlantic coast. The tug "Lucknow," of the Midland Transportation Co., also having Corbet equipment, is the largest tug on the Great Lakes.

As indicating the service that her Canadian-made equipment is performing, the Corbet people recently received a letter from a large Buffalo shipbuilding concern, stating that five of the six automatic steam-towing machines have been placed in U. S. navy tugs. These machines all passed the preliminary trials. The first tug has been in commission all summer, towing barges from Chicago to Buffalo, and has met all requirements. The other tugs have escorted Eagle boats from Buffalo to New York over the St. Lawrence route. The automatic release and take-up possible by use of the Corbet machines means a practical economy in the application of power to towage, there being no pulling and hauling and jerking, as is the case when the automatic take-up is lacking. Some thirty of these machines are in use on the Pacific coast. Many others to the Atlantic, and not a few have been supplied to foreign buyers.

GOING IN FOR EXPORT BUSINESS

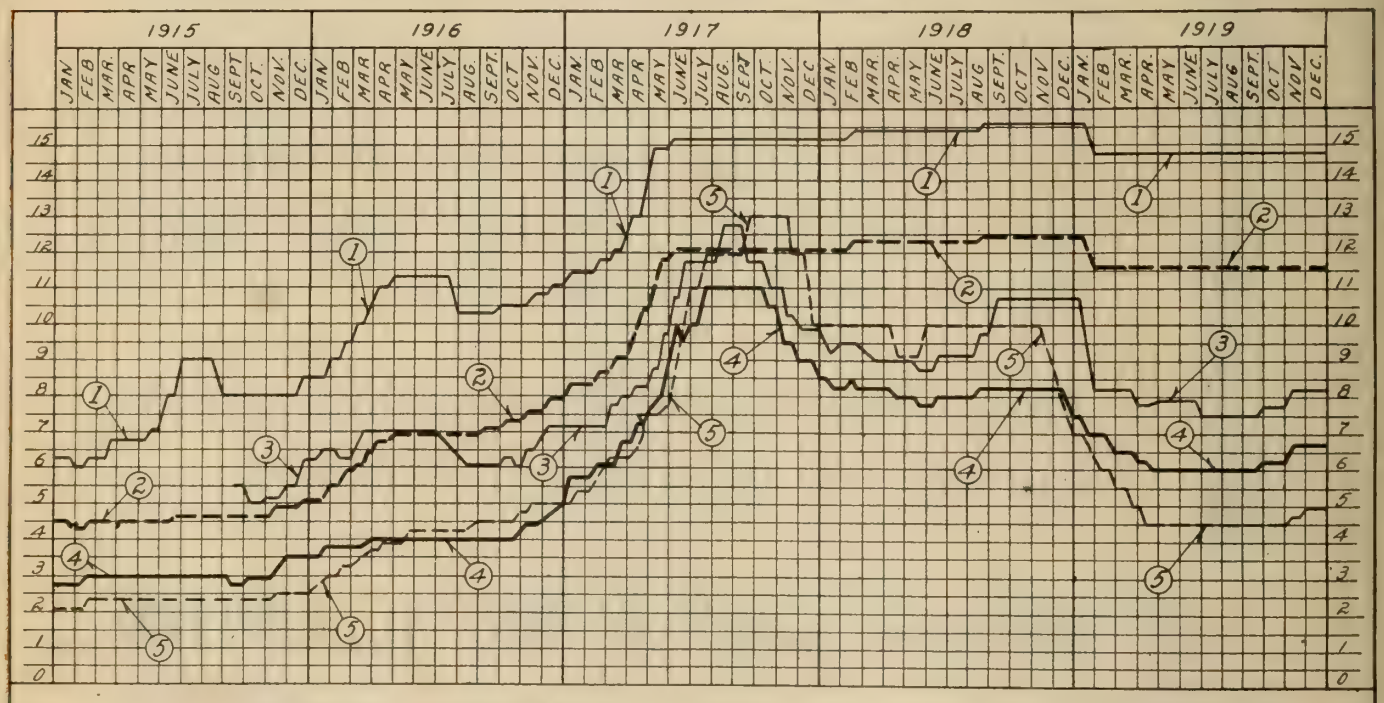
Took Advice of Trade Agent and Sent Their Own Man to Investigate Conditions

During the past year the old-established firm of T. McAvity & Sons, Ltd., of St. John, N.B., has been at work in what is probably the best export fields for Canadian manufacturers: Britain, Australia and France, and have made many additions, alterations and improvements to their several plants to enable them to compete successfully in these places with the many other makers of products in their line.

As no doubt every exporting manufacturer knows, it is a different proposition now than was selling the foreign trade before the World War, with trade conditions altered, exchange rates to be considered, and manufacturers everywhere seeking bigger markets for their goods, and while in some cases "before-the-war" trade connections can be re-established, it is mostly a case of go over the ground again. Exchange is by no means a small item to be considered as it affects the exporters to low-rated countries adversely. A pound in English currency, if spent in England will, of course, purchase more than the same money sent over to Canada in payment for Canadian goods, and therefore the Canadian article, although nominally of the same value as the English, will be higher in price when taken into that country.

Early in the game Messrs. McAvity took the advice given by the Canadian Trade Commission, of having a man right on the ground, and this policy has proved to be the only practical one to be followed. Lieut.-Col. T. Malcolm McAvity, upon his return from France, made his headquarters in London, Eng., and from there has been opening up an extensive and promising export business both in Britain and on the Continent, and he will take charge of the branch office and warehouse there which the firm intends opening shortly where they will carry a large stock of their manufactured material.

Price Fluctuation During the Years 1915-1919



Prices	1-1" Bt. Wld Gal Pipe $ Per 100 Ft	2-1" Bt. Wld Bl Pipe $ Per 100 Ft	3-Premier Sheets $ Per 100 lbs	4-Black Sheets $ Per 100 lbs	5-Boiler Plates Cts Per lb.
Pre-War	6·25	4·45	5·50	2·75	2½
Record High	15·56	12·41	12·75	11·00	13
Lowest 1919	14·71	11·56	7·50	6·00	4½

The Week's Events in Montreal Industry

The Hellenic State Trade Commission, Drummond Bldg., Montreal, have an inquiry from Greece for small oil engine and water distributing units manufactured in this country.

The Davie Shipbuilding plant at Lauzon, Quebec, which has been practically closed for some weeks, has been acquired by the Canada Steamships Lines and building operations will be resumed shortly, when about 1,500 men will be employed to carry out new contracts which have recently been closed.

The Montreal Motor Show, which will be held the week of January 17-24 at the Motordrome, promises to eclipse any that have been held in previous years. Over one hundred makers of cars and accessories will be represented, and excellent accommodation has been provided for every exhibitor. Special lighting and decoration has been made to add beauty to the display.

The fate of the steamer "Canadian Recruit" and the serious position of another of the merchant fleet in the icy passage of the lower St. Lawrence, has drawn the attention of the Government to the imperative need of providing adequate facilities for the protection of such vessels as may be late in getting away at the close of the season. The Hon. C. C. Ballantyne, Minister of Marine and Fisheries, has expressed his belief that it may be necessary to provide equipment in the way of ice-breakers, that will assist navigation on the St. Lawrence after ice conditions become severe.

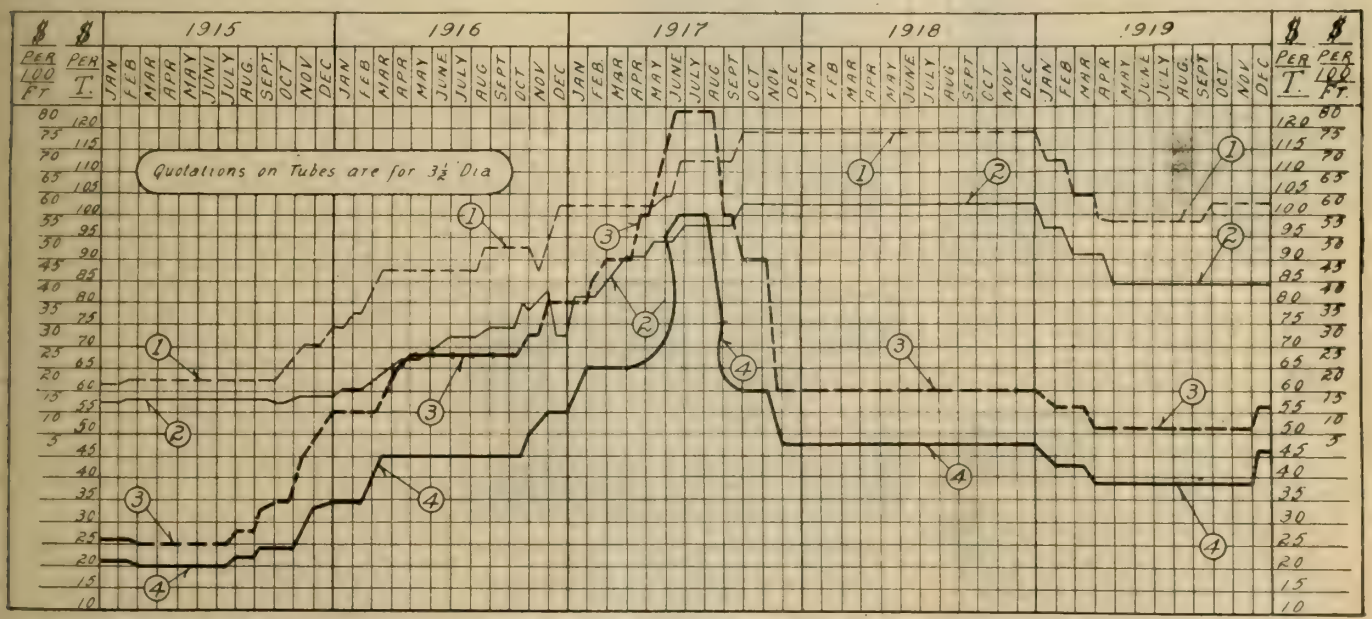
Shipments of Canadian products, approximating 30,000 tons a month, are going to Greece through the agency of the Hellenic States Trade Commission to Canada, with headquarters at the Drummond Bldg., Montreal. The bulk of this freight has been in grain, food and clothing as these are the present essential needs of that country. Stamos Zographakis, who is in charge of the Canadian office, stated that, so far, the trade developed by individual concerns was on a very small scale, and that personal representation would be necessary before increased business could be expected.

Everything possible is being done to reach the Canadian Government steamer "Canadian Spinner," which is drifting in the ice of the Lower St. Lawrence. The ice-breaker "Montcalm" is making every effort to reach the vessel and it is expected that this will be accomplished in a day or so. The "Canadian Spinner" has been fighting the ice for nearly two weeks, and unless the "Montcalm" succeeds in reaching her there is a grave danger of the vessel sharing the fate of the "Canadian Recruit," which is now stranded near the Saguenay River and will stay there until spring.

The Dominion Engineering and Machinery Co., a recently incorporated subsidiary of the Dominion Bridge Co., Montreal, has taken over the plant of the St. Lawrence Bridge Co. for the purpose of manufacturing pulp and paper mill machinery. Work of this character has been carried on by the Bridge Company for some time past at their own plant, but the increasing volume of business necessitated additional facilities for construction, so the shops of the St. Lawrence plant have been acquired and are being remodelled to carry on this new branch of the company's activities. A portion of the new plant is being fitted out as a modern foundry for supplying the necessary castings for the paper machinery and the line of turbine machinery which they have been making for the past year or more.

B. C. Coal for Industry.—The use of British Columbia coal for Canadian industries is a near possibility, according to Arthur V. White, consulting engineer to the Commission of Conservation. The large demand for United States coal and the high prices being paid for it, may make B.C. coal a commercial possibility in Ontario in spite of the long haul. The Canadian Manufacturer's Association is investigating the question.

Montreal Has Good Year.—The first year of peace was a great year for Montreal port. During the season of navigation 786 ships, 702 of which were Trans-Atlantic, visited the port. The total tonnage was 2,700,000, of which 1,646,532 were British. Inland transportation amounted to 7,499 vessels, of 4,357,734 tonnage. There were 84 vessels engaged in river and gulf traffic, as against 30 in the previous year. Navigation opened on April 14 and closed December 12. The first ocean vessel arrived April 22, and the last ocean departure was on December 10.



(Figures show cords, 000's omitted.)

	Seamless Tubes.	Tapweld Tubes.	Forging Billets	Besemer Billets
Pre-war Price	$18.00	$14.00	$24.00	$20.00
Record High	77.00	60.00	125.00	100.00
Lowest, 1919	56.00	52.00	51.00	38.00



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Give your men a clean drink

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Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself.

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Business Good Here.—The Mason Regulator & Engineering Co., Ltd., Montreal, have just completed and made the last shipment on a contract for the United States navy consisting of 2,000 Mason standard reducing valves, special navy type, flanged. All U. S. navy valves are tested to 450 lbs. hydraulic pressure. This was a stock order for the navy yards in different parts of the United States. It is interesting to note that this is the largest contract for reducing valves ever placed in Canada. This same firm have received an order from the National Shipbuilding Corporation, Three Rivers, for evaporator and feed-water heater equipment for five ships for the French Government. This company is also at the present time furnishing a considerable number of distillers for the drinking water to be used on Government ships.

Fire Did Not Stop Them.—The H. H. Robertson Co., Sarnia, manufacturers of asbestos-protected metals, had a slight setback through fire recently. However they will be in full operation again in a week or ten days, and there will be little, if any delay in orders. The company reports very encouraging bookings, not only for industrial buildings but also for storage and transportation structures.

DOMINION STEEL CORPORATION

(Continued from page 76)

space occupied is 37 x 34 feet. The floor space occupied is 37 x 34 feet. The total weight of motor and flywheel is 659,000 pounds. The asembling of this machine, after its arrival on the ground, requires three months' work.

The Power House

A large power station is being built to furnish the power required for operation. The power house will be equipped with steam-driven generators, the steam boilers being fired with gas from the blast furnaces. The steam from the boilers will drive steam turbines direct connected to alternating current generators. There will be a unit of 5,000 k.w. and one 1,000 k.w., a smaller one of 500 k.w. being also fitted. Besides driving the plate mill, the 28 in. rail mill will be also connected to this power-house. The power-house is of brick concrete and stel construction, and will be equipped with a travelling crane of fifty tons for handling the heavy machinery. The dimensions are 80 feet by 100 feet, and provision has been made for further extensions. The company will gradually substitute electric drive through all their buildings to replace the individual steam engines.

Every effort is being made to have the mill in operation early in the year. All material is traced from the manufacturer to the mill, and no cars are allowed to be side-tracked on their journey. It will be a big thing for Sydney and for the Dominion generally when this mill rolls its first plate.

Have Reorganized.—The Ingersoll Machine Co., Ingersoll, after a thorough reorganization following their activity in war work, now have their plant thoroughly equipped for the production of high quality gear and milling cutters, thread millers, reamers, three-lip drills, etc. This concern proved an important addition to the group of Ingersoll's industries engaged in the manufacture of high standard tools.

America Gets Ship Contracts.—Although the price per ton is much higher than that of British yards, several contracts have gone to American builders recently through inability of British firms to take any more work just now. The Pusey & Jones yard on the Delaware have taken an order for 12,000 ton deadweight tank steamers, and the Bethlehem Shipbuilding Corporation have received orders for four 10,000 ton vessels of the same type. The price is said to be in the neighborhood of $205 per ton. While British prices are considerably below this, they cannot compete on a delivery basis.

C.P.R. to Make Improvements.—Half a million dollars will be spent on improving the lines of the C.P.R. in the London Division next summer, according to an announcement by Mr. Williams, superintendent of the division. One of the largest amounts will go towards installing an automatic block system on the main line.

British Columbia's Ship Output.—During the year of 1919 the shipbuilders of the Pacific Coast built 170,500 tons. This included ten steel and forty-six wooden vessels. The French Government took forty wooden vessels, the Imperial Munition Board took four steel steamers, and six have been built for the Canadian Merchant Marine.

Company Loses Action.—The Russell Motor Car Company lost the decision in an action brought by them against various railway companies for loss of 3,838 castings, which had disappeared in transit. The action was dismissed on the grounds that the company did not count the contents of the freight car on the morning that they broke the seals.

Insure the Employees.—The Taylor-Forbes Company, Ltd., of Guelph, Ont., is putting into immediate effect a profit-sharing plan by insurance for its employees. A notice to the employees states that the Taylor-Forbes Company has insured the lives of all its employees according to the length of service with the company, beginning after the first three months with $500, and ending with $3,000. Medical examinations are not required. Any employees who were in the army will be allowed full time for such service as part of their working years. Every year of continual service with the company will add to the insurance policy value up to $3,000. It will not in any way interfere with any advance in wages or earning capacity.

Vancouver.—The Coughlan Shipbuilding Company successfully launched the steamer "Canadian Exporter," 8,100 tons deadweight, for the Canadian Government Merchant Marine recently

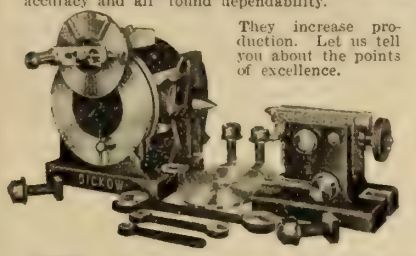
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For blow holes, cracks and defects in castings.
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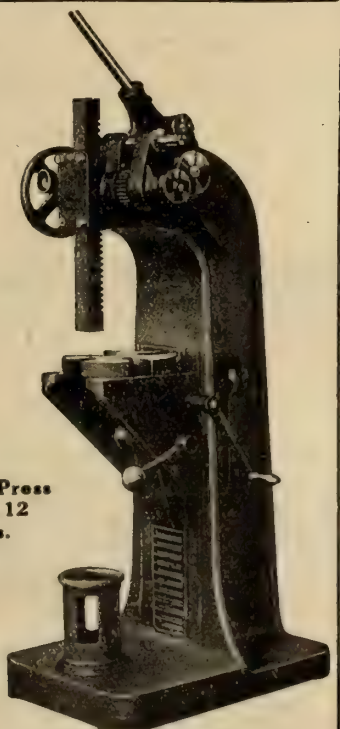
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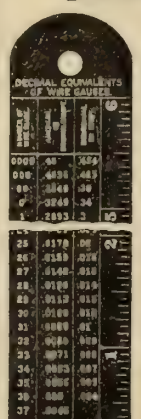
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IMMEDIATELY — ONE PHOTO-STAT MACHine. Must be in perfect working order. Send photo and full description of make and prices. T. McAvity & Sons, Ltd., Box 700, St. John, N.B. (c2m)

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IF YOU ARE INTERESTED IN BUYING A patent for the latest labor-saving device in mitre boxes, address Box 636, Canadian Machinery.

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Pumps
Pyrometers
Reamers
Scales
Scleroscopes
Screw Machines
Shapers
Switch Boxes
Taps
Tanks (Quenching, Oil)
Tensile Machines
(Storage)
Thermometers
Transformers
Trucks
Typewriters
Vises
Welding Equipment

Toronto District Salvage Board
Ordnance Department U. S. Army

39 Adelaide St. East, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

SURPLUS EQUIPMENT FOR SALE

PRESSES

	Stroke Inches	Width Bed	Approx. Cap. Tons
2—No. 666 Toledo Embossing Presses....	2	32	1,200
2—No. 27 Bliss Embossing Presses.....	2	32	1,000
2—No. 87 Bliss Crank Presses, double back geared	16	27	250
2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
9—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
1—Robertson Hydraulic Press with pump and extra set of columns.....	24	27	800

1—360 Brown & Boggs Press.

LATHES

7—11" Blount Speed Lathes, 5' bed.
4—No. 2 Warner & Swasey Speed Lathes.
2—20" Stoll Wood Turning Lathes.
35—Bullard Cartridge Case Lathes.

GRINDERS

2—Wells Cutter Grinders.
1—12" x 72" No. 4 Cincinnati Universal Grinder.
1—No. 70 Heald Internal Grinder.
1—No. 75 Heald Internal Grinder.
1—10" x 24" Landis Grinder.
1—No. 1 American Surface Grinder.
1—No. 74 La Salle Surface Grinder.
1—Ford-Smith Double Head Grinder, 3" x 24" wheel.

FURNACES

1—Gas Muffle Furnace, 3¼ x 1½" x 7" long.
1—Gas Tempering Furnace with oil reservoir.
1—Gas Tempering Furnace with Tray in Reservoir.
1—H.S. Tool Hardening Furnace, 9" x 8" x 9" long.
1—Double Door Gas Furnace, Doors 20½" x 12" high. Fire Space 50" wide, 12" high, 54" long.
5—26 ft. Rockwell Single Chamber Annealing Furnaces, equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

BLOWERS AND FANS

	Size of Outlet	Displacement per rev.
1—Root Positive Blower	8" Vertical	3.3 cu. ft.
2— " " "	6" "	1.5 " "
1— " " "	6" Horizontal	1.5 " "
1—Boland Positive Blower	4" "	

3—Desk Fans.

MOTORS

	Volt	Phase	R.P.M.	Cycle
1—Type Dumore	115	with	buffing	spindle.
1—Garage Pump and Motor	110	1	1400	25
1—10 H.P. Westinghouse	200	2	1245	60
1—20 H.P. Westinghouse	200	3	710	25
1—25 H.P. Westinghouse	200	3	710	25
5—50 H.P. Westinghouse	200	3	715	25
1—75 H.P. Westinghouse	200	3	720	25
1—1 K.W., 2 H.P., Can Gen. Generator Shunt Wound	125		1950	

MISCELLANEOUS

1—No. 1 Quickwork Rotary Shear.
11—No. 3 Brown-Boggs Trimming Machines.
1—No. 3 Tinius Olsen Testing Machine, 10,000 lbs., capacity hand-operated.
1—No. 1 Brinell Hydraulic Testing Machine.
1—Sauveur-Boylston Photo-Micrographic Instrument.
1—Boland Special Sand Blast Machine.
1—No. 2X Garvin Vertical Tapping Machine.
1—Whitton Centering Machine.
3—No. 310 Simplex Lifting Jacks.
4—2½" x 18" Screw Jacks.
1—2¼" x 16" " "
3—1¼" x 4" " "
1—No. 873 Toledo Trimming Machine.
Bristol & Brown Indicating Pyromters.
" " Recording "
3—Shore Scleroscopes.
1—Motor-driven addressograph machine with stencil cutting machine and full equipment of special attachments.
2—Adding Machines (Listing)

CANADIAN CARTRIDGE COMPANY, LIMITED
HAMILTON, CANADA

PARTIAL LIST OF TOOLS

2—60" Bullard Vertical Boring Mills
1—60" Niles Vertical Boring Mill
No. 4—B. & S. Plain Miller
1—36" x 36" x 8' Gray Planer, two heads
No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
14" x 6' New Carroll-Jamieson Quick-Change Lathe
15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
15" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 17"
17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
25" x 14' New Sidney D.B.C. Quick-Change Lathe, swing 27"
33" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
5' Bickford Single Pulley Drive Radial
100-lb. New Little Giant Hammer
50-lb. New Little Giant Belt Hammer
25-lb. New Little Giant Belt Hammer
30-ton Watson & Stillman Hydraulic Press

FRANK TOOMEY INC.
27 North Third Street PHILADELPHIA, PA.

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BY simply mentioning CANADIAN MACHINERY when writing to our advertisers you will be doing something which will prove of three-fold benefit.

First—It will benefit you because it enables the advertiser to immediately associate your enquiry with the product advertised, resulting frequently in quicker service.

Second—It will benefit the advertiser because it enables him to identify and classify enquiries and to give credit where credit is due.

Third—It will benefit **your** paper because in the records of the advertiser it will receive the credit for your enquiry, instead, perhaps, of some less deserving medium.

We are always grateful for favors of this kind. It costs the reader nothing, and yet as we said before, it is of three-fold benefit.

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Toronto

IRON AND STEEL MERCHANTS

Bars, Angles, Channels, Beams.

Shafting, Screw Stock.

Cold Drawn Flats, Squares, Hexagons.

Black and Galvanized Sheets, Plates.

Box Strapping, Bolts, Nuts, Washers, etc.

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REINFORCING STEEL

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Modern equipment for Bending to shape ready for placing. Competent engineers employed.

EXPANDED METAL

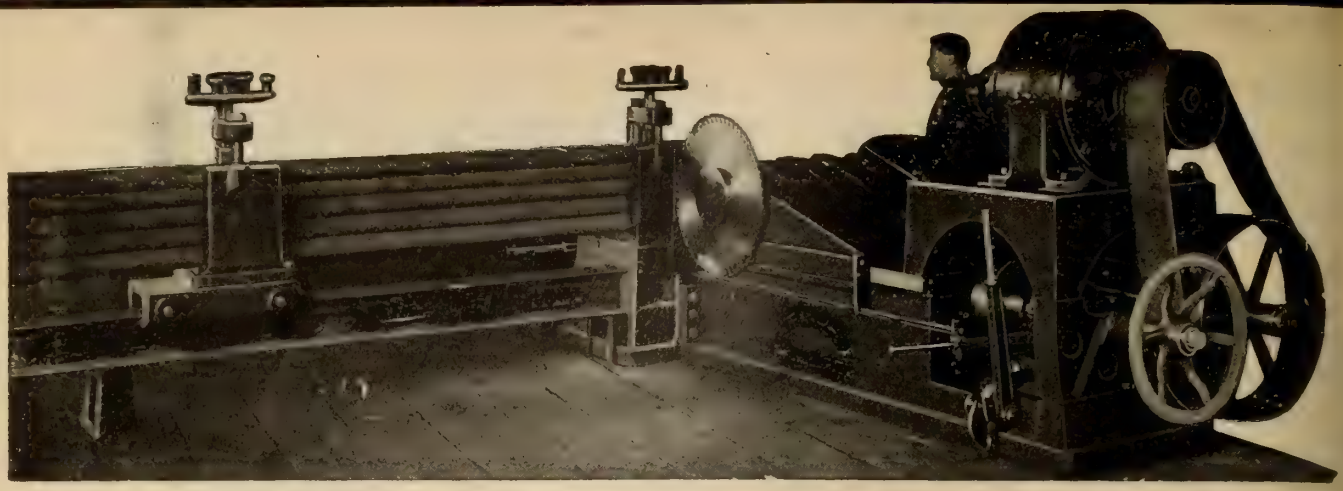
A full range of all sizes and sections carried in stock.

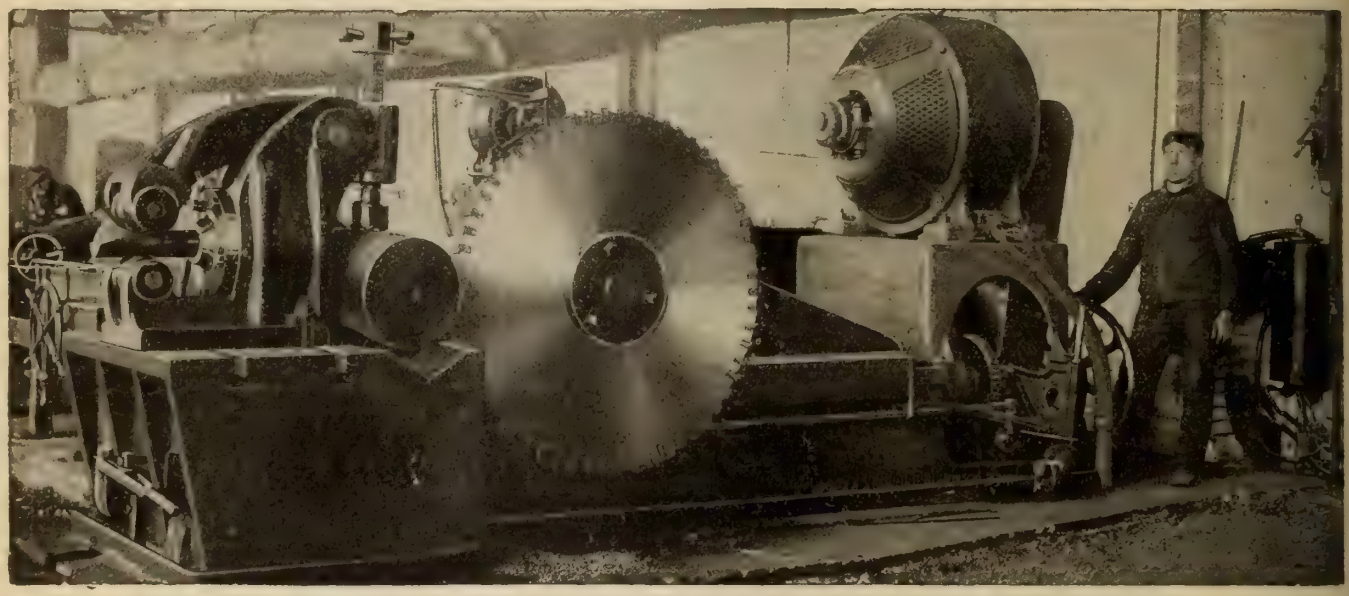
OFFICE:
98 Esplanade

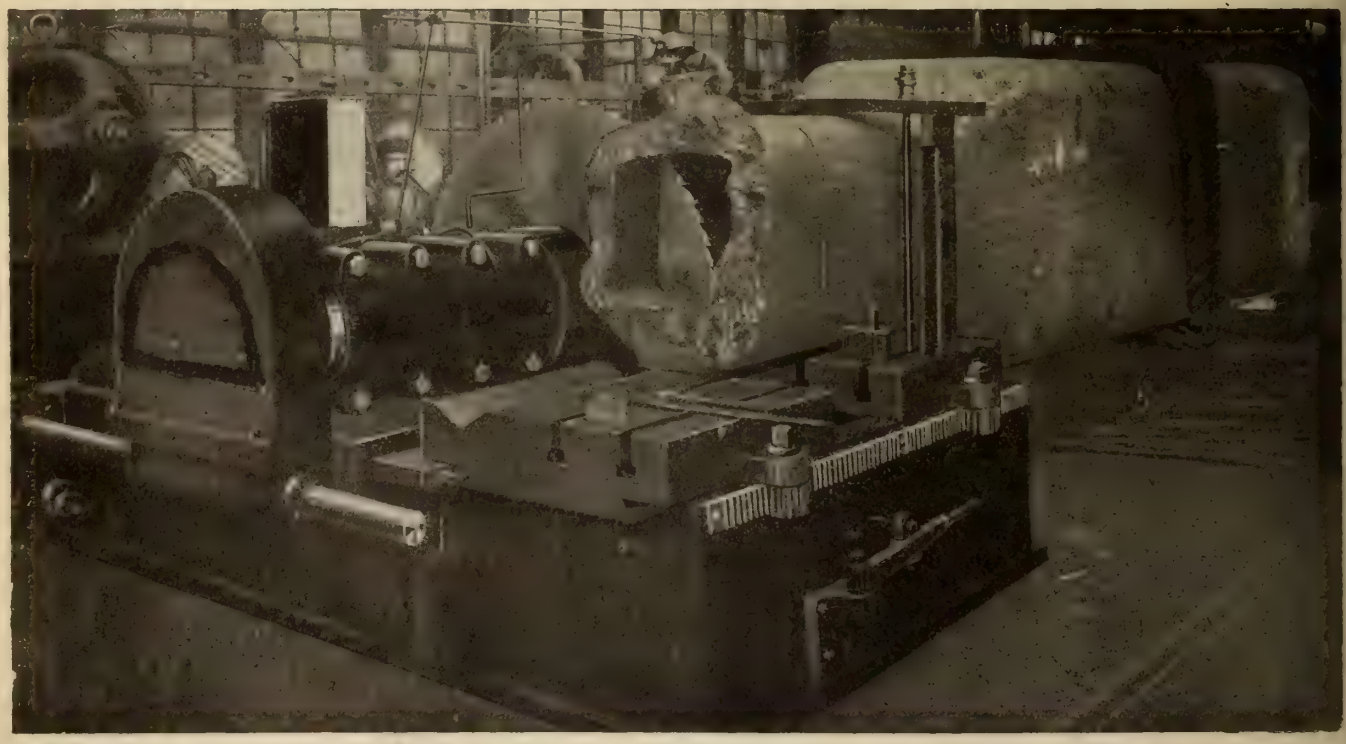
STEEL YARD:
Eastern Harbor Terminals

Telephone Adelaide 6540

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THE ESPEN-LUCAS MACHINE WORKS, FRONT & GIRARD AVENUE PHILADELPHIA, PENNA., U.S.A.

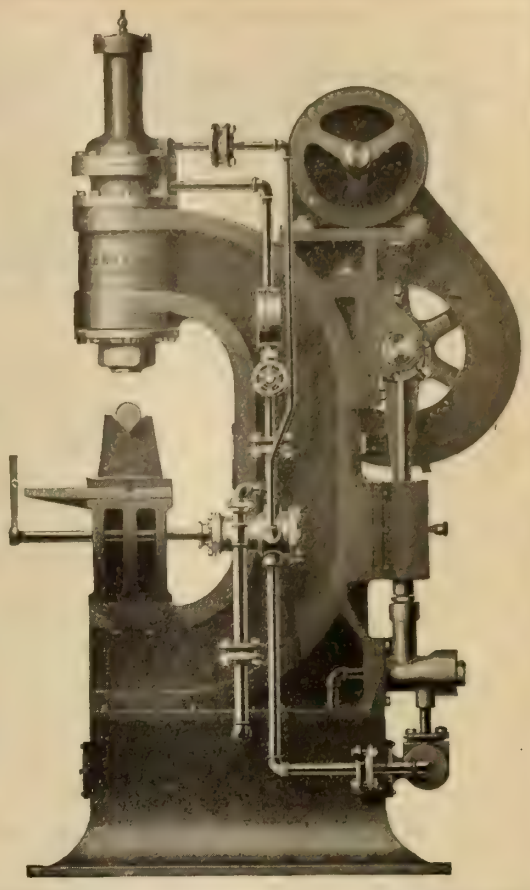
A SELF-CONTAINED HYDRAULIC UNIT

EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram delivering pressure instantly at a speed of 1½" per second return of ram 3" per second.

Length of Ram Travel ..... 6 in.
Depth of Throat ..... 10 in.
Length of Table ..... 8 ft.
Width of Table ..... 10 in.
Table to Ram .....10 to 14 in.

EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crank-shafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.

Write for details



EASTERN PRODUCTION COMPANY

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Canadian Representatives:
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Some of the Celebrated Line of Condulets



A Fitting for Every Purpose Imaginable

29,000 Types to choose from. Nothing to equal Crouse-Hinds, besides

Harvey-Hubbell Specialties
"McGill"—Line of Guards.
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A complete and full line of marine and vapor-proof fixtures, manufactured by ourselves, as illustrated.

PAXTON-MITCHELL, LTD.
Piston Rod and Valve Steam Packing.
For Super-heat and Saturated Steam.
"Packing that packs," manufactured in Canada.

DUNTLEY-DAYTON
Pneumatic Tools.
Tools that are guaranteed.
Ask for trials or tests and satisfy yourself.

THE "IMP" DROP-FORGED RIVET SET.
Made in Canada from steel made in Canada.
Conduct Break-down test.
Satisfy yourself.

"CULVER" BALL BEARING JACKS.
Once tried always used.
Convince yourself—ask for trial.
Apply and operate wherever jacks can be used.
Note results.

"INTERNATIONAL" PLASTIC METALLIC PACKING.
All that its name implies.
Good materials are only determined by results obtained in service.
Ask about it.
This is a Packing that overcomes the necessity for carrying many styles and sizes.
"INTERNATIONAL" PLASTIC METALLIC conforms to all sizes and shapes of stuffing boxes.

INTERNATIONAL "RAPID" HOSE COUPLERS.
Something simpler and better.
We carry in stock full line of Round House, Back Shop and Machine Shop Supplies.

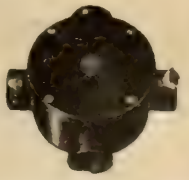
We are Canadian Distributors for QUAKER CITY RUBBER CO. Their complete line of Mechanical Rubber Goods Carried in Stock.



We respectfully solicit your valued inquiries.

International Machinery & Supply Co., Ltd.

421 St. James Street, Montreal, Que.



Western Representatives: Gordon & Belyea, Limited, 148 Alexander St., Vancouver, B.C., and Calgary Machinery & Manufacturing Co., 317 Alberta Corner, Calgary, Alta.

No. 32 Horizontal Boring, Drilling and Milling Machine—*for precision work*

No work too heavy or awkward for the G.&L.

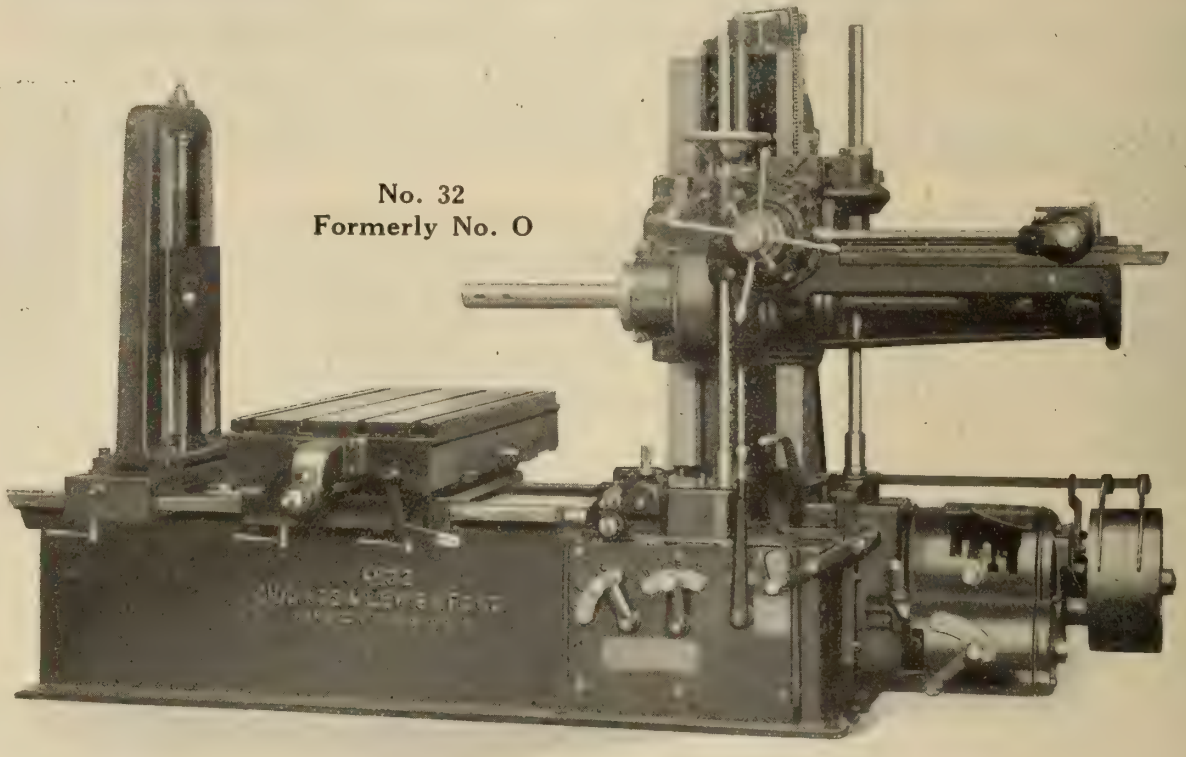
G. & L. Boring Machines make the heaviest, most awkward work look easy. They are strong, convenient and work to the closet limits of accuracy.

The work is placed on the platen and the balanced headstock is adjusted vertically, or the platen adjusted transversely or longitudinally as required.

CONSTRUCTION

All gears are of steel, generated from the solid and properly supported. All high-speed gears and cut jaw clutches are of hardened steel. All working surfaces are scraped to an exact dimension. All feed screws are of large diameter and absolutely true to pitch. Each is provided with a micrometer dial. Every piece is subject to inspection and the finished machines tested under action before leaving the shop.

There are four G. & L. machines for you to choose from, each one best adapted for a certain kind of boring. From the four you can get just the machine that will best handle your work. May we send our bulletins?



No. 32
Formerly No. O

BUILT BY

GIDDINGS & LEWIS MANUFACTURING CO.

FOND DU LAC, WISCONSIN

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The NAPIER Metal-Cutting Machine

Cuts More—Wastes Less

The NAPIER Metal-cutting Machine will do more work than any three power hack saws, and a battery of NAPIERS equalling one cold saw in cost will far outdo it in production.

Cutting clean and true, without vibration, the thin NAPIER blade takes out much less kerf than even a medium power blade, and only a fraction of the gash made by a cold saw. This saving of metal is important in any material, and in some steels means several dollars per cut.

Continuous cutting explains the extra speed of the Napier Metal-cutting Machine. There is no useless backstroke—no unused portion of the blade.

Roller Guides, set close to the work, hold the blade vertical and steady, guaranteeing a true, accurate cut.



Gravity Feed adjusts cutting speed to hardness of metal, and lengthens the life of the band saws.

NAPIER Specifications

Capacity 10″ x 10″.
Floor Space, 4′ x 6′.
Height, floor to table, 26¾″.
Length of band saw, 12′ 3″.
Size of band saw, 1″ x .035″.
Belt or motor driven.
Power required, 1 H. P.
Driving pulley, 12″ x 3″.

Saving time, metal and power, the NAPIER Metal-cutting Machine will PAY in any shop where much metal is cut. May we tell you more about it?

Power hack saws do their best work when equipped with NAPIER "Quality" Blades. For hand frames NAPIER "Quality" and "Expert" Blades give most satisfactory service. Write or phone us for prices.

Made by

Napier Saw Works, Inc.
Springfield, Mass.

Sole Canadian Distributors

LYMAN TUBE & SUPPLY CO., LIMITED

Montreal Toronto Winnipeg New York

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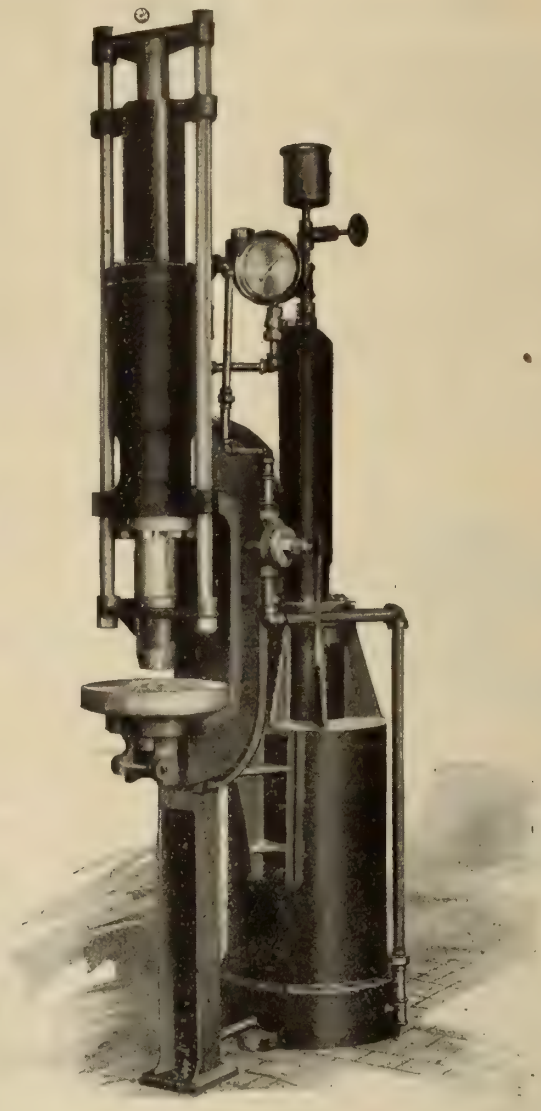
ORIGINALITY

is Characteristic Always of

"METALWOOD"

DESIGNS and

DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

METALWOOD MANUFACTURING CO.

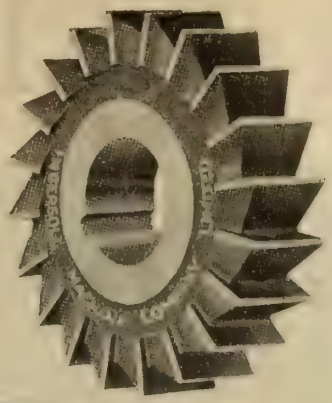
High Speed Hydraulic and Hydro-Pneumatic Machinery

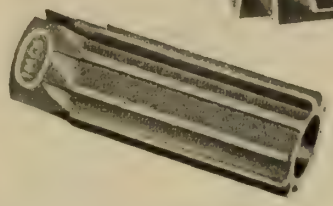
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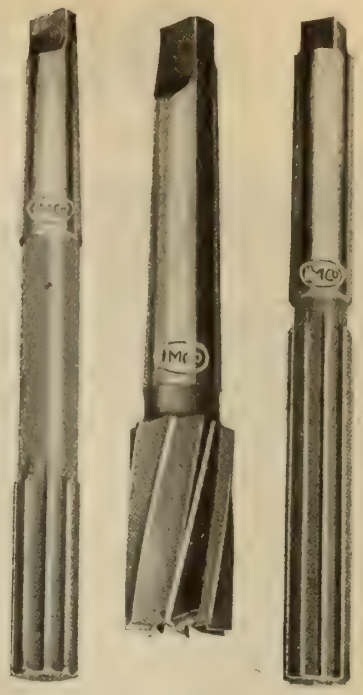
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Canadian Fairbanks-Morse Co., Ltd., Montreal and Toronto; R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago; Fairbanks-Morse & Co., Inc., 30 Church St., New York City; Sherritt & Stoer Co., Inc., Finance Bldg., Philadelphia, Pa.











TOOLS

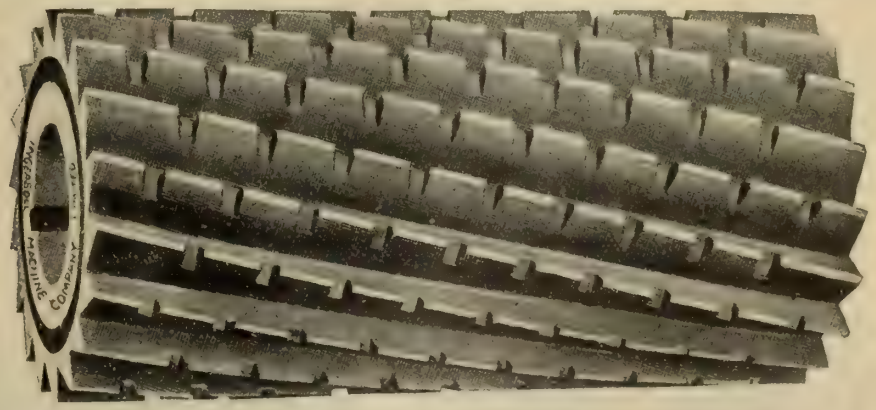
—and what depends on them

The tools that you use in your plant are the factors upon which depends the quality of your product.

Tools that stand up, tools that cost no more, yet last longer, hold the size, do their work properly—these are the kind that every manufacturer who is running his plant on a competitive basis will appreciate.

IMCO tools are good tools. Our three-lip drills and bridge reamers are used in many prominent plants and shipyards throughout the country, where they are rapidly building themselves a reputation for long-run economy.

Send for our catalog on Standard Milling Cutters, Reamers and Three Flute Drills. We carry a complete stock of standard sizes.



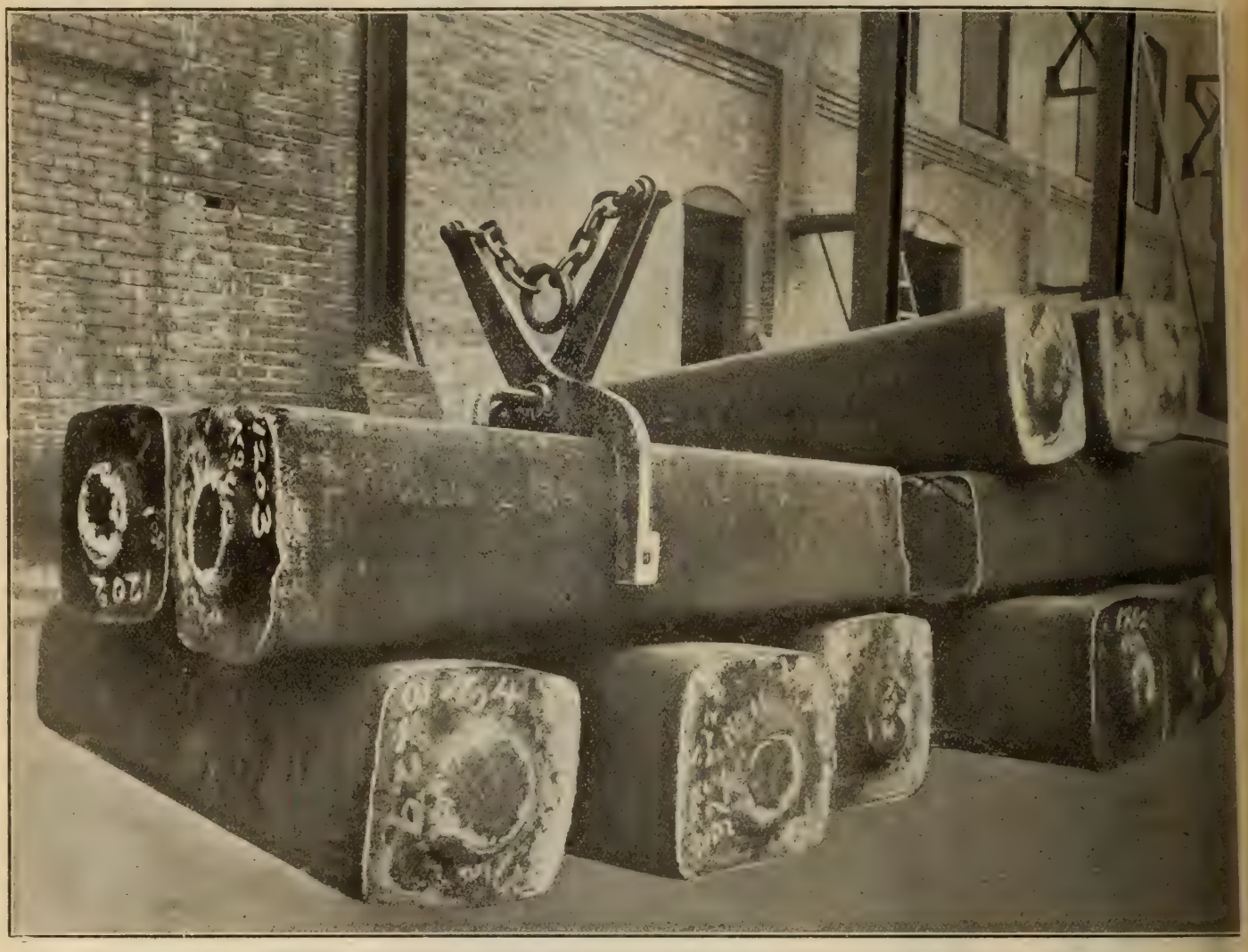
Ingersoll Machine Co., Limited

Ingersoll, Ontario

American Plant: American Machine Products Co., Inc.
DETROIT, Michigan

IMCO TOOLS

OUR FIELD IS THE



THREE AND ONE-HALF AND FIVE-TON "FLUID COMPRESSED" STEEL INGOTS

Fluid Compressed Steel Forgings

We manufacture Merchant Bars, Rounds, Flats, Squares, Ovals, Half Ovals, Tires, Sleigh Shoes, Plain or Twisted Concrete Bars, Agricultural Sections, Cold Drawn Shafting, Machinery Steel, Angle Bar Fish Plates, Track Spikes and Bolts.

Nova Scotia Steel & Coal Company Limited

General Sales Office:
WINDSOR HOTEL, MONTREAL

Head Office:
NEW GLASGOW, N.S.

WHOLE WORLD

COAL



STEEL

The Nova Scotia Steel & Coal Co., realizing the importance of "fluid compression" as a valuable aid in producing reliable and first-class products, procured by purchase the Canadian license from H. Harmet, of St. Etienne, France, whereby they own the sole rights in this country to use his process. This they considered in accordance with their policy of taking advantage of every important metallurgical development, thus advancing with modern progress, and particularly that their high reputation as manufacturers of the best marine, railway and machine forgings obtainable should be maintained.

The "fluid compression" plant laid down at Sydney Mines, N.S., consists of one group of four Harmet presses, each of 1,250 tons and capacity to handle 3½ to 5-ton ingots; and one of 4,000 tons to handle ingots up to 30 tons.

The product of this process is used in the manufacture of high-grade forgings, such as locomotive axles, crank shafts, marine forgings, artillery tubes and armor plate of the highest grade; in fact for all commodities in which maximum reliability and homogeneity of structure enter and are demanded.

Address All Correspondence to the Head Office

Nova Scotia Steel & Coal Company
Limited

General Sales Office:
WINDSOR HOTEL, MONTREAL

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MORRIS CRANES



THE HERBERT MORRIS CRANE & HOIST CO., LTD.

ENGINEERS AND MANUFACTURERS

OF ALL TYPES OF

Hand or Electric Traveling Cranes, Jib Cranes,
Overhead Runways, Chain Blocks,
Electric Hoists, Elevating Trucks, Storage Battery Trucks,

Head Office and Works:

NIAGARA FALLS, ONT.

STANDARD

Machinery & Supplies, Ltd.

261 Note Dame St. West, Montreal, Que.



Drills that withstand fatigue

Machine parts subjected to splintering shocks, wide variations and alternations in stress must be **forged** to stand up to the work.

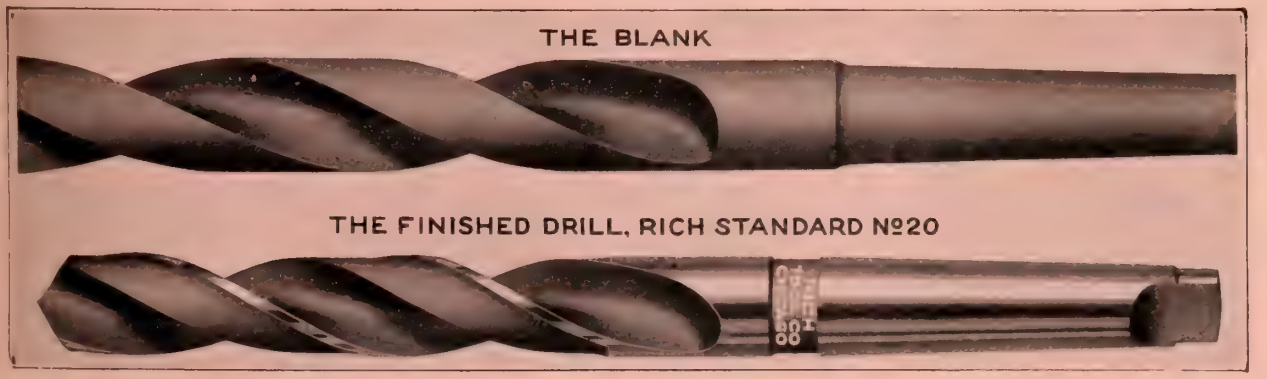
Drills and Reamers are tools that are subjected to exactly the stresses that cause fatigue. That is why the ordinary drill will snap sooner or later. The metal gets tired and lets go.

RICH High Speed Twist Drills, Reamers, Track Bits, Flat Drills, Drill and Reamer Chucks and Rivet Sets—all represent the highest quality in their line. Use them and you'll cut your production costs.

RICH DRILLS

are tools that don't get tired—won't lie down and quit. At the proper temperature they are **forged** from the solid and **twisted** to shape—not milled to shape from the solid.

Try them on your hardest job. They are built for it.



Machinery and Supplies

Everything for the factory and mill. Quality products. Quick and efficient service.

Write for the RICH Catalog.

Standard Machinery & Supplies, Limited

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STANDARD

Machinery & Supplies, Ltd.

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Waltham Grinding Wheels

For Every Need

FOR thirty-eight years Waltham Grinding Wheels have won the confidence of manufacturers in ever larger measure. To-day their uniform quality and performance in a wide range of grinding are nationally recognized.

Our constant aim is to supply each customer with the particular grinding wheel best suited to his own individual requirements.

Every wheel is rigidly inspected before leaving our plant to make sure it is correct in all specifications and carefully tested for balance and for safety. Every one is absolutely "right" for the job.

The uniform quality of our product is supplemented by an eagerness to serve, to give each manufacturer's grinding problems our personal attention. Customers once made remain with us year after year. Catalog and any desired information gladly furnished upon request.

Canadian Agents:
Standard Machinery & Supplies, Limited
Montreal



WALTHAM GRINDING WHEEL CO.
WALTHAM, MASS., U.S.A.

STANDARD

Machinery & Supplies. Ltd.

261 Notre Dame St. West, Montreal, Que.

CLINTON CEMENT

Did You Ever See Two Postage Stamps Stuck Back to Back?

Well, that's the way two bricks stick together when our cement is used.

The greatest loss in your furnace efficiency occurs as the result of leakage, cold air pouring in and interfering with proper combustion.

We Have Got This Licked!

Fireclay dries up and sifts out from between the bricks like powder.

But our cement sets and makes a surface like glass yet allowing for expansion and contraction. It sets hot or cold and stands a heat up to 3,000 degrees Fahrenheit.

This cement makes a joint that is stronger than the bricks themselves, and that is itself the strongest part of the whole furnace.

A five-pound tin of **Clinton Super-Heat Cement** will be sent to you free and all charges prepaid, if you write the

Standard Machinery & Supplies Limited

261 Notre Dame St. West **Montreal**

ATLAS CRUCIBLE STEEL CO.

DUNKIRK, N. Y.

Manufacturers of

TOOL STEELS

High Speed
Magnet
Hot Die
Chrome Vanadium
Carbon for all purposes
Wood Knife
Special Alloy
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Special Steels

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EXTRA
DANVILLE, QUE.

MANUFACTURERS OF
LEATHER BELTING
AND
LACE LEATHER

J. L. GOODHUE & CO.
STANDARD
DANVILLE, QUE.

DANVILLE, QUE.

A Good Belt Saves Money

THE money wasted in keeping a stretching belt taut amounts to a surprising figure. If you use "Goodhue Belts" in your factory or mill you can save most of this money because "Goodhue Belts" stretch less by 15 to 25 per cent. than any other belt.

They are made from skillfully selected hides with the stretch taken out of each section before it is made up into the belt. According to the conditions under which the belt is to run, we recommend "Extra," "Standard" or "Acme Waterproof" belts.

QUALITY
Not Price Our Aim

Canadian Manufacturers SHOULD USE Canadian Belting

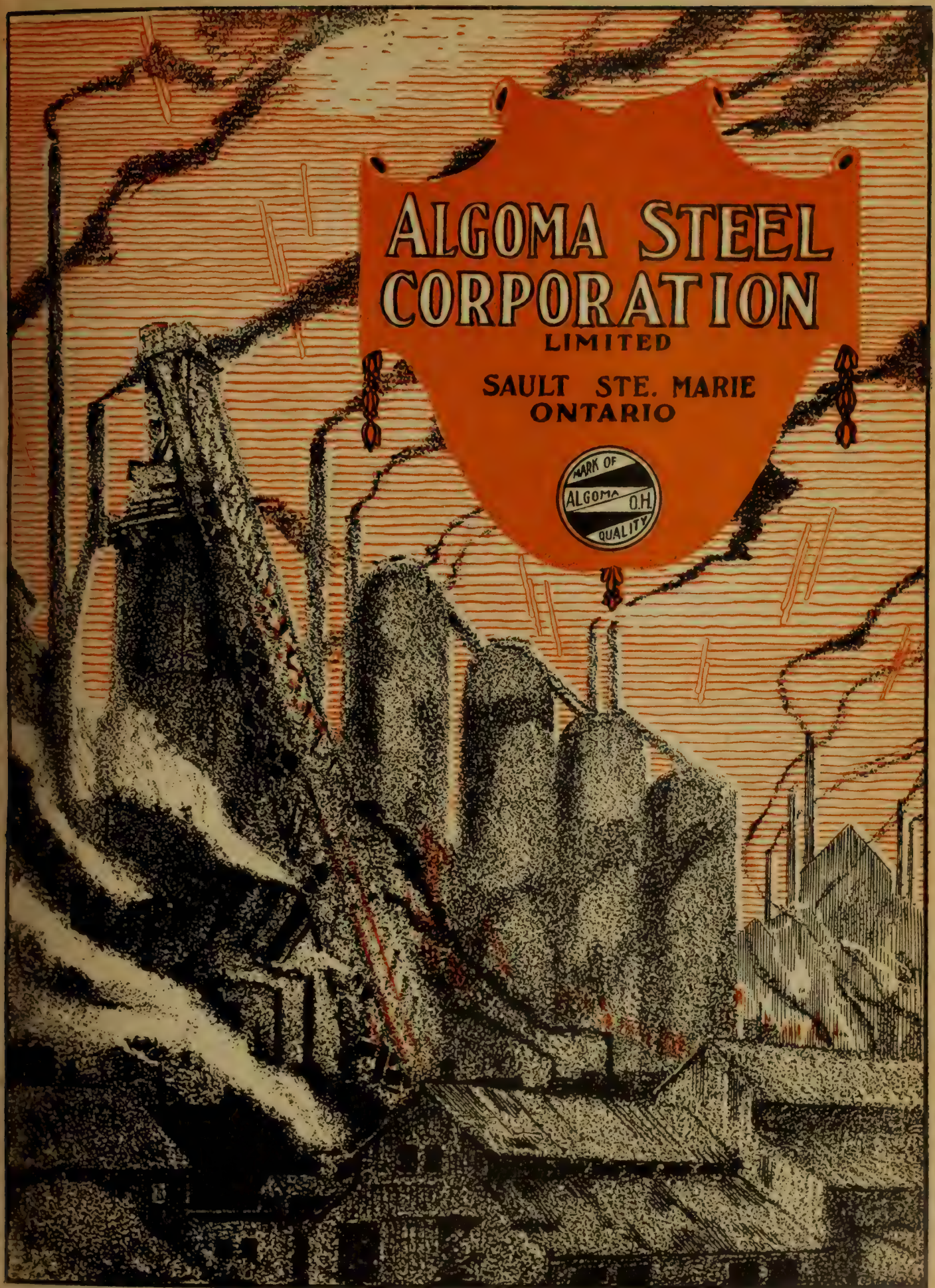
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Bissett & Webb, Limited
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Winnipeg

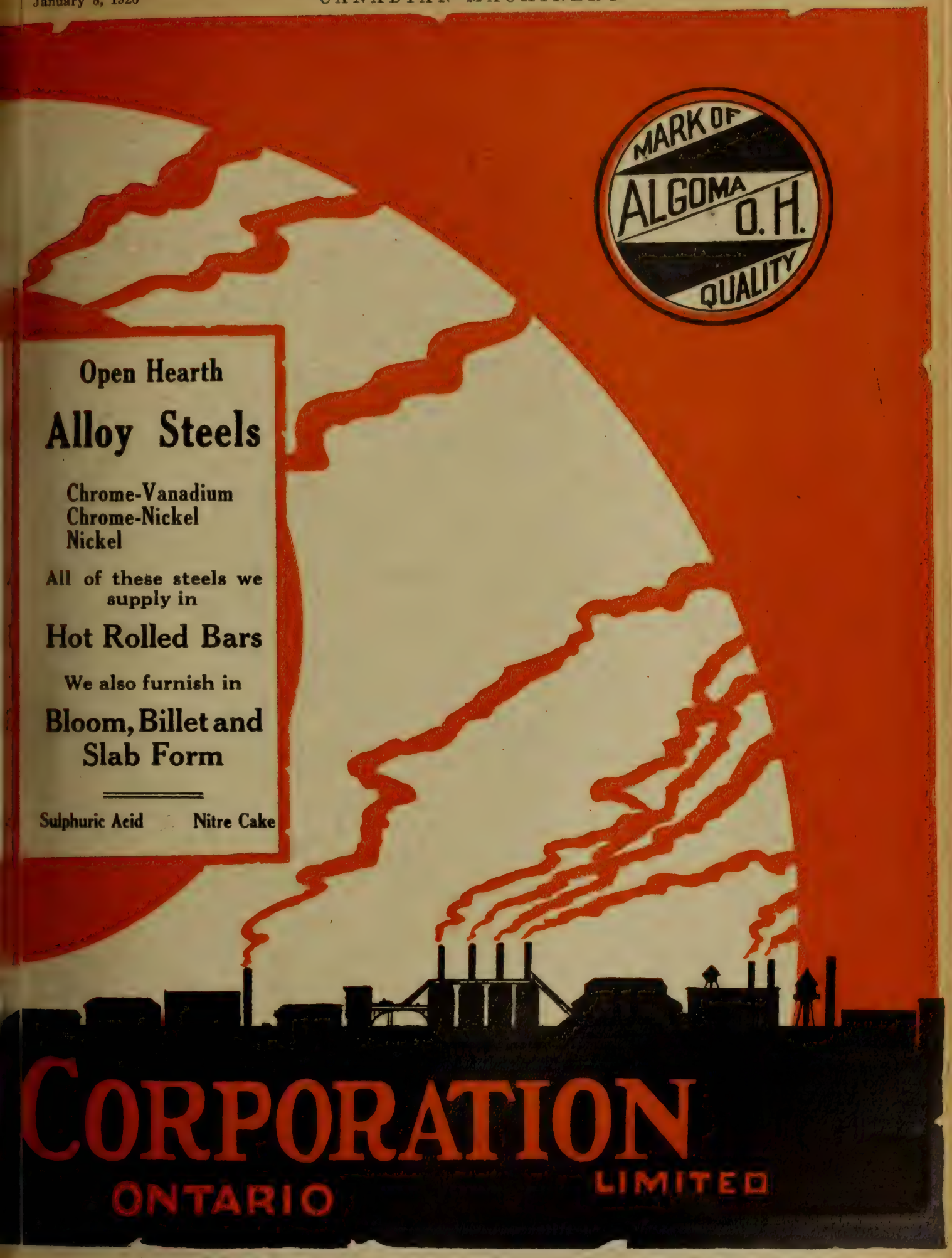
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ALGOMA STEEL
CORPORATION
LIMITED
SAULT STE. MARIE
ONTARIO
MARK OF
ALGOMA
O.H.
QUALITY



STEEL
RAILS
Open Hearth Quality
(All Sections from 12 lbs. to 100 lbs. per yard)
SPLICE
BARS
STEEL
TIE PLATES
PIG IRON
BASIC, FOUNDRY-MALLEABLE
SULPHATE OF
AMMONIA
BLOOMS
BILLETS
SLABS
STRUCTURAL
STEEL
MERCHANT
BARS
CONCRETE
REINFORCING
BARS
IRON, BRASS
AND BRONZE
CASTINGS

ALGOMA STEEL
SAULT STE. MARIE


MARK OF
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O. H.
QUALITY
Open Hearth
Alloy Steels
Chrome-Vanadium
Chrome-Nickel
Nickel
All of these steels we supply in
Hot Rolled Bars
We also furnish in
Bloom, Billet and Slab Form
Sulphuric Acid
Nitre Cake
CORPORATION
ONTARIO
LIMITED

ANNOUNCEMENT

THE ALGOMA STEEL CORPORATION, LIMITED, take pleasure in announcing to their customers and the Canadian trade that in accordance with the wide-spread desire throughout the Dominion that there should be obtained in Canada with Canadian labor, a much larger proportion of the requirements of this country in STEEL SECTIONS for STRUCTURAL PURPOSES, CAR CONSTRUCTION, SHIPBUILDERS' REQUIREMENTS, etc., they are just completing extensive alterations and additions to their rolling mills, and will soon be ready to produce and ship American Standard Sections of BEAMS and CHANNELS up to and including 15", all standard sections of ANGLES from 6" x 6" down to 1¼" x 1¼", ZEE BARS for car builders and general purposes, small and large ROUNDS and SQUARES, and FLAT BARS up to 14" wide. The quality of the product is already well known to the trade, and is exclusively steel made by the Open Hearth process, and can be furnished in all grades from the softest rivet stock to high carbon special spring material.

The following are the sections which will be rolled:

ANGLES—Equal Leg—
6 x 6"—5 x 5"—4 x 4"
3½ x 3½"—3 x 3"
2½ x 2½"—2¼ x 2¼"
2 x 2"—1¾ x 1¾"
1½ x 1½"—1¼ x 1¼".

ANGLES—Unequal Leg—
6 x 4"—6 x 3½"—5 x 4"
5 x 3½"—5 x 3"—4½ x 3"
4 x 3½"—4 x 3"—3½ x 3"
3½ x 2½"—3 x 2½"—3 x 2"
2½ x 2".

BEAMS—
15", 12", 10", 8", 6", 5", 4", 3".

CHANNELS—
15", 13", 12", 10", 8", 6", 5", 4", 3".

ZEES—
3¼ x 5 x 3¼ x 5/16
3 5/16 x 5 1/16 x 3 5/16 x ⅜"
3⅜ x 5⅛ x 3⅜ x 7/16"
3 1/16 x 4 x 3 1/16 x ¼"
3⅛ x 4 1/16 x 3⅛ x 5/16"
3 3/16 x 4⅛ x 3 3/16 x ⅜"
2 11/16 x 3 x 2 11/16 x ¼"
2¾ x 3 1/16 x 2¾ x 5/16"

ROUNDS—
All sizes from ½" up to and including 4".

SQUARES—
All sizes from ½" up to and including 3".

FLATS—
All sizes from 1 x ¼" up to and including 14" wide.

MINE RAILS—
All sections from 12 lbs. up to and including 45 lbs. per yard.

PIG IRON—
Machine cast FOUNDY MALLEABLE and BASIC.

SULPHATE OF AMMONIA.

NITRE CAKE.

For the better convenience of customers who may find it necessary to secure rush shipments of particular items, they contemplate keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared.

Your enquiries and business will be appreciated

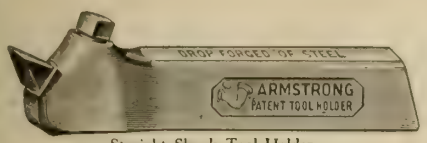
Algoma Steel Corporation

Limited

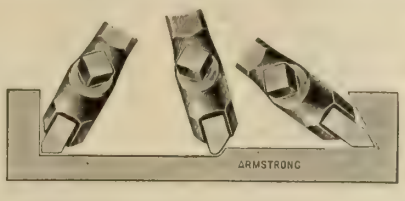
Sault Ste. Marie, Ontario

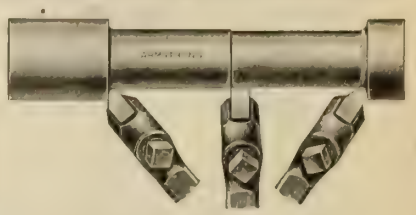
HIGH SPEED TOOL STEEL AND ARMSTRONG TOOL HOLDERS

A COMBINATION OF EFFICIENCY AND REAL ECONOMY



Straight Shank Tool Holder





One Armstrong Tool Holder with a few cutters which can be quickly and cheaply made from the bar by any machinist will do almost any job on the lathe or shaper; roughing, facing, finishing, corner and fillet work.



1	2	3	4	5	6	7	8	9
Left-Hand Turning Tool	Round-Nose Turning Tool	Right-Hand Turning Tool	Left-Hand Corner Tool	Threading Tool	Right-Hand Corner Tool	Left-Hand Side Tool	Square-Nose Tool	Right-Hand Side Tool

18 Ounces of Armstrong Tools

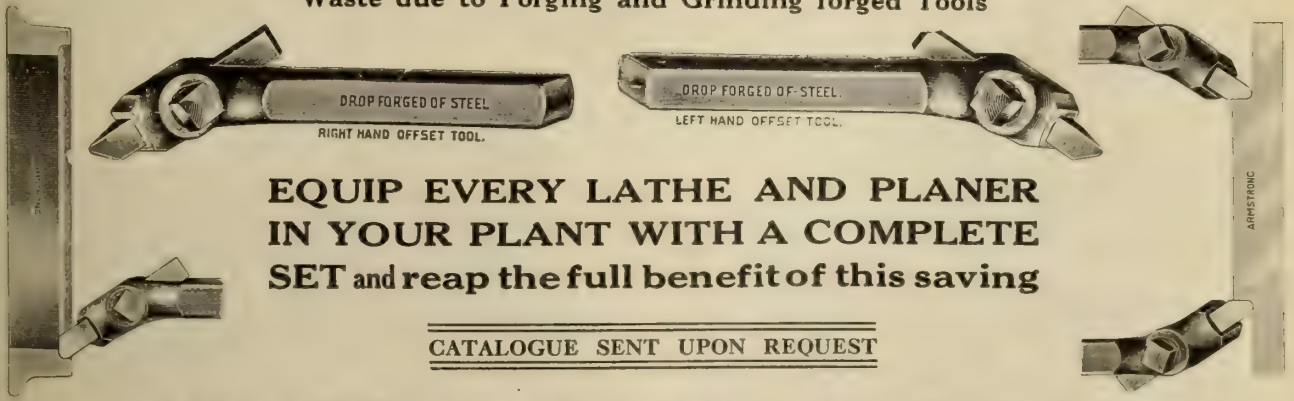
The set of nine cutters shown above weighs (⅜ in. square) 18 ounces and will do a wide range of work on the lathe and shaper when used in our No. 2 Tool Holder with ⅝ in. x 1⅜ in. shank.

Equal to 18 Pounds of Forged Tools

A set of nine Forged Tools ⅝ in. x 1¼ in. will weigh 18 pounds and each additional tool added to the set adds 2 pounds, while extra cutters for Tool Holder weigh but 2 ounces. This, at the present price of High Speed Steel, shows an extra

$20 Dead Investment in the Forged Tools

which ARMSTRONG TOOL HOLDERS will save for you as well as the enormous Waste due to Forging and Grinding forged Tools



EQUIP EVERY LATHE AND PLANER IN YOUR PLANT WITH A COMPLETE SET and reap the full benefit of this saving

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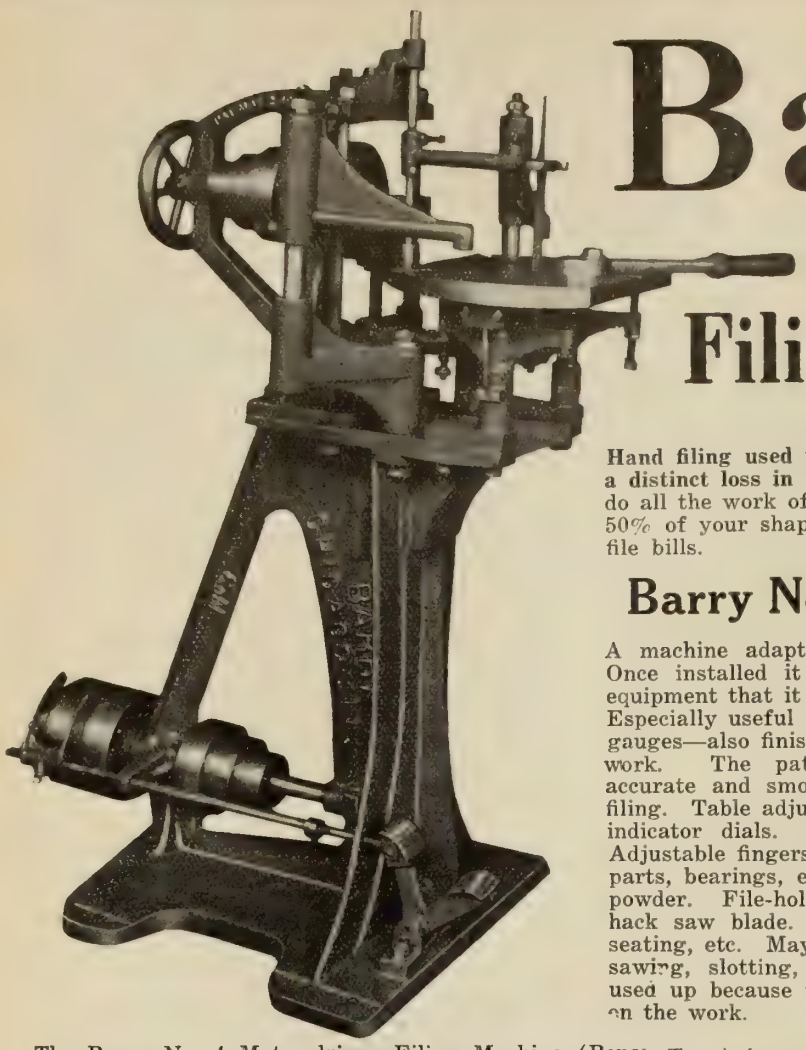
ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

306 N. FRANCISCO AVENUE - - CHICAGO, U.S.A.

Write for prices and full details, list of large Canadian users, etc., to our CANADIAN AGENTS: Williams & Wilson, Montreal; A. R. Williams Machinery Co., Toronto, Vancouver, Winnipeg, Halifax, St. John

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Barry

Filing Machines

(PATENTED)

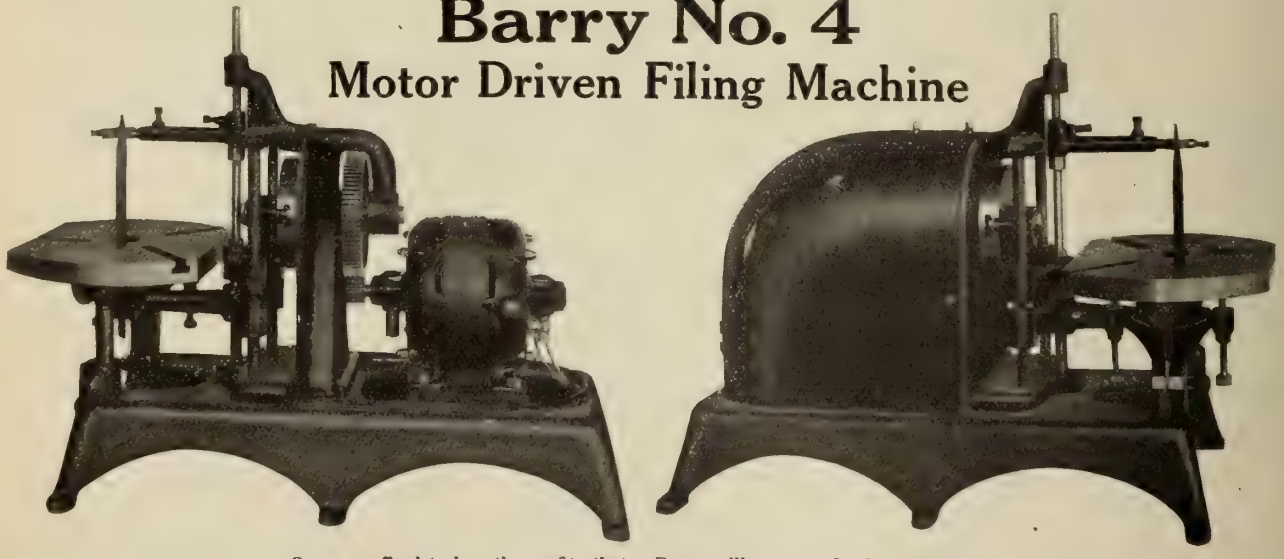
Hand filing used to be an expensive operation—now it's a distinct loss in profits, for a Barry filing machine will do all the work of three expert mechanics, will eliminate 50% of your shaper work, and save you money on your file bills.

Barry No. 3 Filing Machine

A machine adapted to many needs in the tool room. Once installed it becomes so naturally a part of the equipment that it is difficult to see how to do without it. Especially useful in making dies, punches, jigs, patterns, gauges—also finishing small parts on general production work. The patented features of the machine ensure accurate and smoother work than is possible by hand filing. Table adjustable in four directions, with accurate indicator dials. Roughing attachment with cam feed Adjustable fingers for holding work firmly. All moving parts, bearings, etc., out of the way of filing or emery powder. File-holders allow the use of any file, or a hack saw blade. Slotting tool may be fitted for key-seating, etc. May be used for filing, lapping, metal jig-sawing, slotting, shaping, etc. The files are entirely used up because they may be adjusted to use any part on the work.

The Barry No. 4 Motor-driven Filing Machine (Bench Type) is meant for the same sort of work as the No. 3 machine. If you have small work to handle, with even a moderate amount of filing, you will find the Barry No. 4 an invaluable piece of tool room equipment. May be rigged up with a hack saw blade or slotting tool. Well adapted to lapping, since the emery powder falling from a lap does not reach the working parts.

Barry No. 4
Motor Driven Filing Machine



Can you afford to lose the profits that a Barry will save you? Let us tell you more about these machines, send for our catalogue.

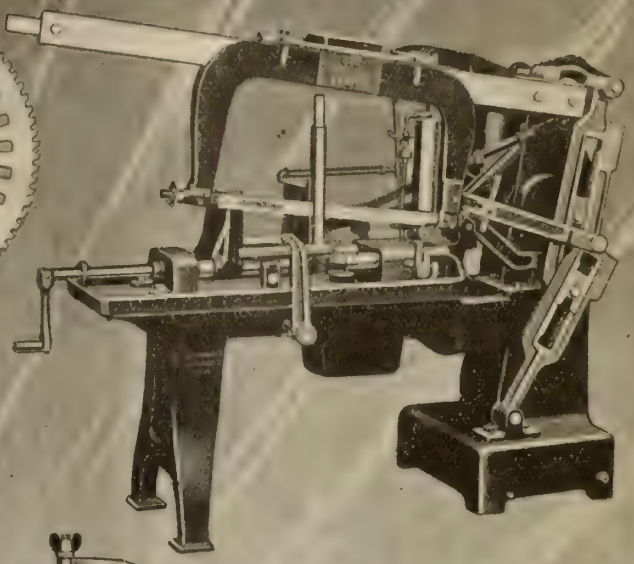
We also manufacture Barry No. 2 Bench Type Belt Drive Filing Machine.

Barry Manufacturing Co., 515 W. Monroe St., Chicago

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Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

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"A Better Saw For Every Use"

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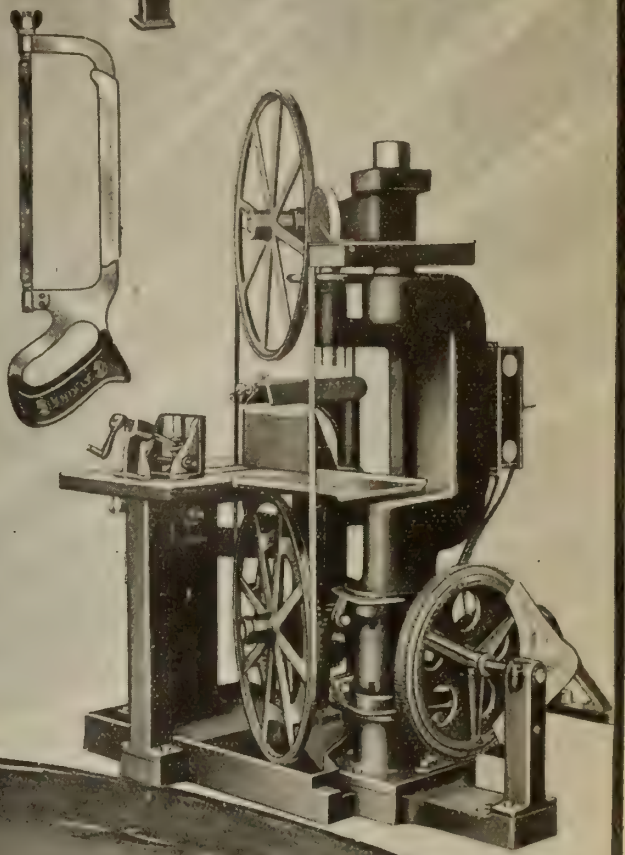
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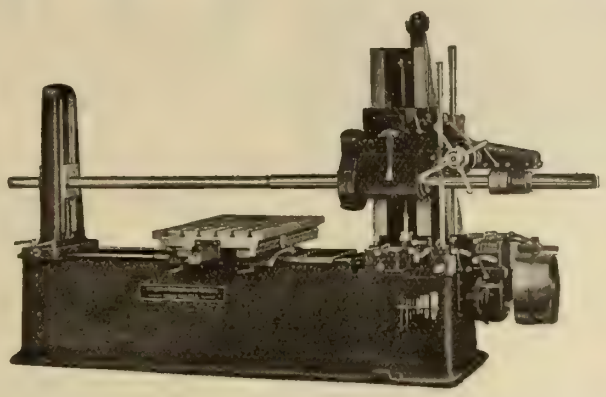
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"WHERE ACCURACY COUNTS, WE WIN"

HALF THOUSANDTH LIMITS ON HALF TON JIGS



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One of Many Tests Made by us on Every Machine

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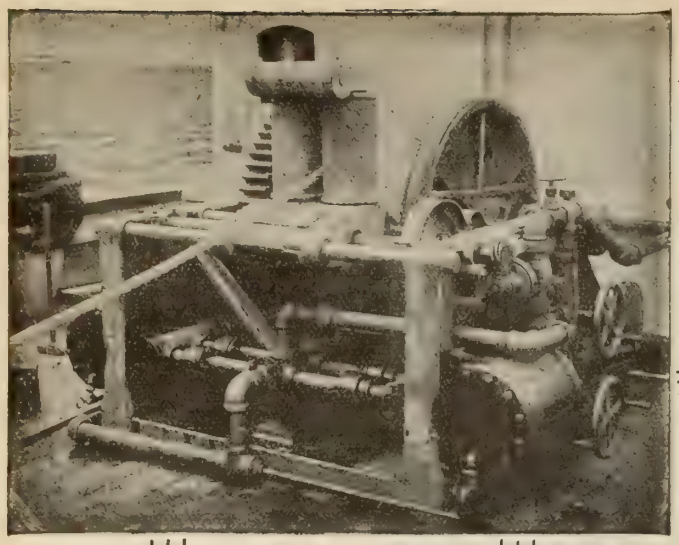
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4 King Street

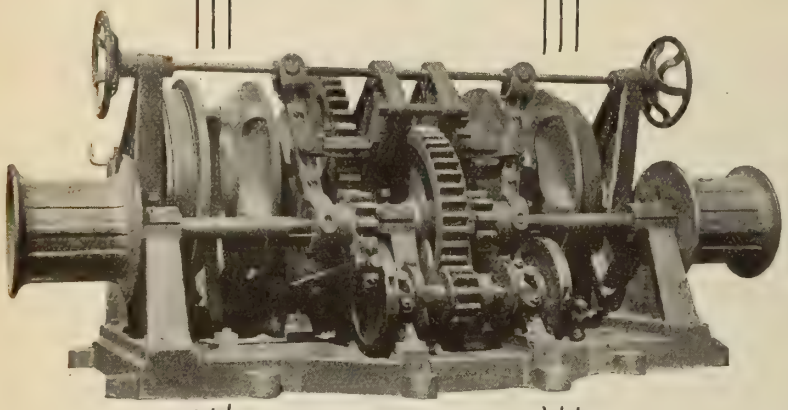
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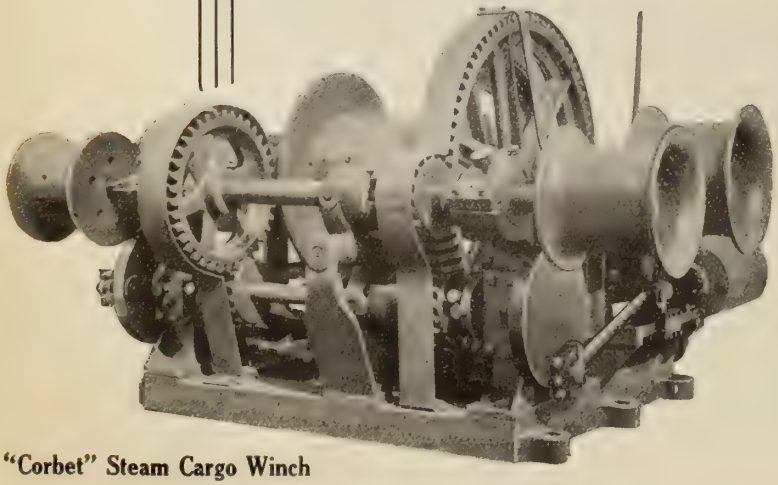
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The "Corbet" Automatic Steam Towing Machine
For Tugs and Barges



The "Corbet" Double Cylinder and Double Purchase Steam and Hand Power Anchor Windlass



"Corbet" Steam Cargo Winch

Corbet

Line of Marine Machinery

THE CORBET AUTOMATIC STEAM TOWING MACHINES are made in five sizes to accommodate Steel Flexible Hawsers from 5/8 in diameter up to 2″ in diameter.

The Most Modern Towing Machine on the Market—Saves its Cost in Three Seasons

These machines are in active operation on tugs and steamers on the Atlantic and Pacific coasts, and also on the Great Lakes.

The tug "Lorne," of the Grand Trunk Pacific, operating between Prince Rupert and Vancouver, is the largest craft of its kind on the Pacific coast. It is equipped with a No. 5 Corbet Towing Machine.

The Government tug "Lord Strathcona," the largest on the Atlantic coast, is also equipped with a No. 5 Corbet Towing Machine.

The tug "Lucknow," of the Midland Transportation Co., the largest tug on the Great Lakes, has Corbet equipment.

Five or six automatic steam towing machines have been placed by the Ferguson Steel and Iron Co., Buffalo (Shipbuilding Department) on U.S. navy tugs, and have all passed preliminary trials. One tug has been engaged in towing from Chicago to Buffalo. Others have been escorting Eagle boats via the St. Lawrence, from Buffalo to New York.

These facts prove as nothing else can that Corbet equipment is giving perfect satisfaction. We have many similar testimonials. Write us for copies of these and for other information.

THE CORBET DOUBLE CYLINDER AND DOUBLE PURCHASE STEAM AND HAND-POWER ANCHOR WINDLASSES are made in several sizes to accommodate Steel Chain Cable up to 2″ diameter. Reversible throttle. Modern in every respect.

Our Cargo and Deck Winches are modern in every respect, being built to pass Government Inspection, and are giving perfect satisfaction.

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Carries a full line of completely rebuilt machine tools and woodworking equipment.
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HAND SCREW MACHINES
SPECIAL TOOLING EQUIPMENT

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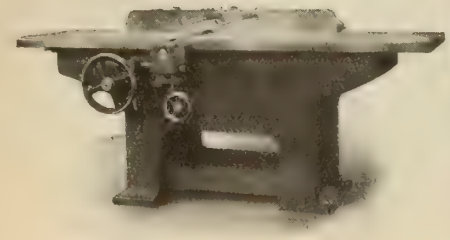
Literature sent upon request

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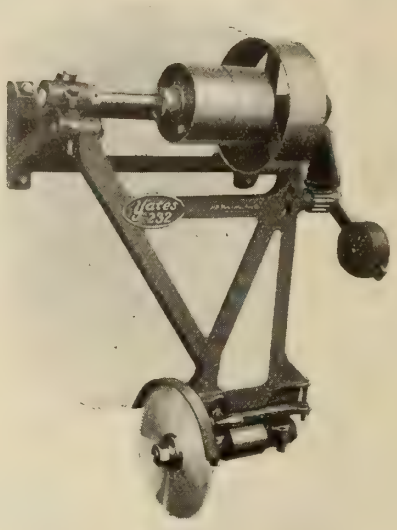
Yates

Yates

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No. 199—BUZZ PLANER



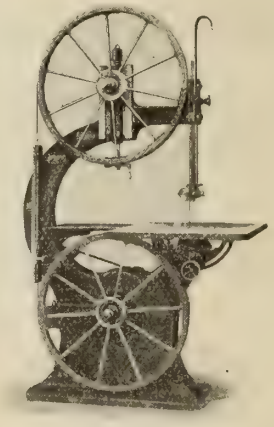
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No. 225—SAW TABLE

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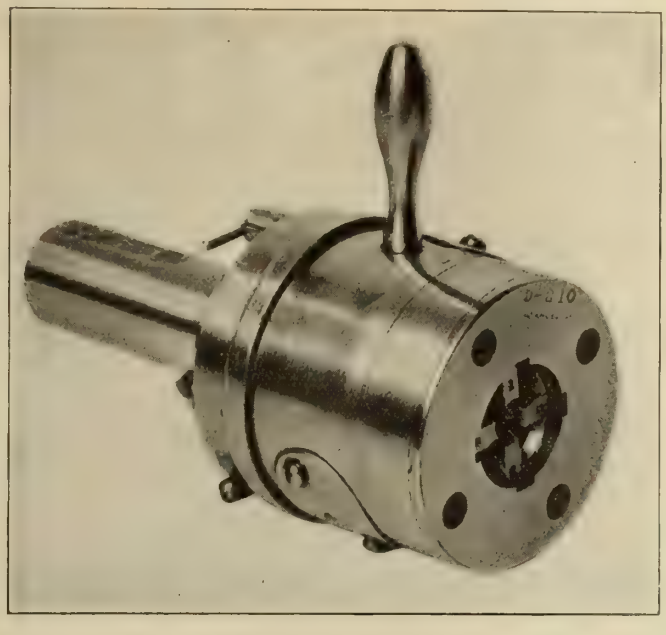
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Chasers are given support ENTIRE length.
Will positively not cut tapered threads.
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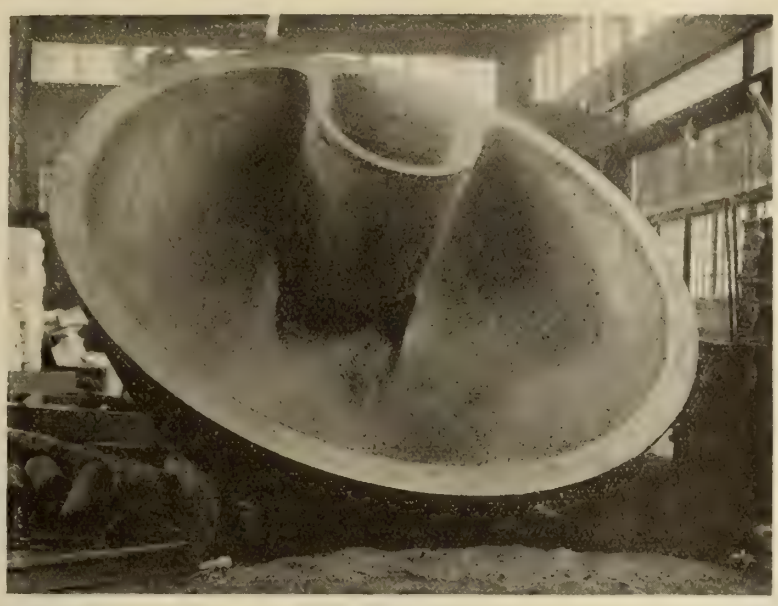
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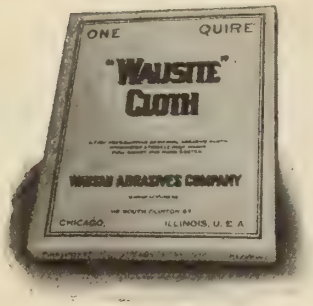
100% Efficient

"Wausite" wasteproof strips are put up in spools of 10 and 50 yards, in standard widths of ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in. and in all grits.



Specially selected abrasive, durable fabric, and a high-grade bond give them wearing qualities which mean actual economy.

The durability and grinding qualities of "Wausite" abrasives have made them popular among prominent machinists and manufacturers all over the world. They are indispensable on lathe work for an accurate, smooth finish, and in shops where highly polished surfaces are needed.



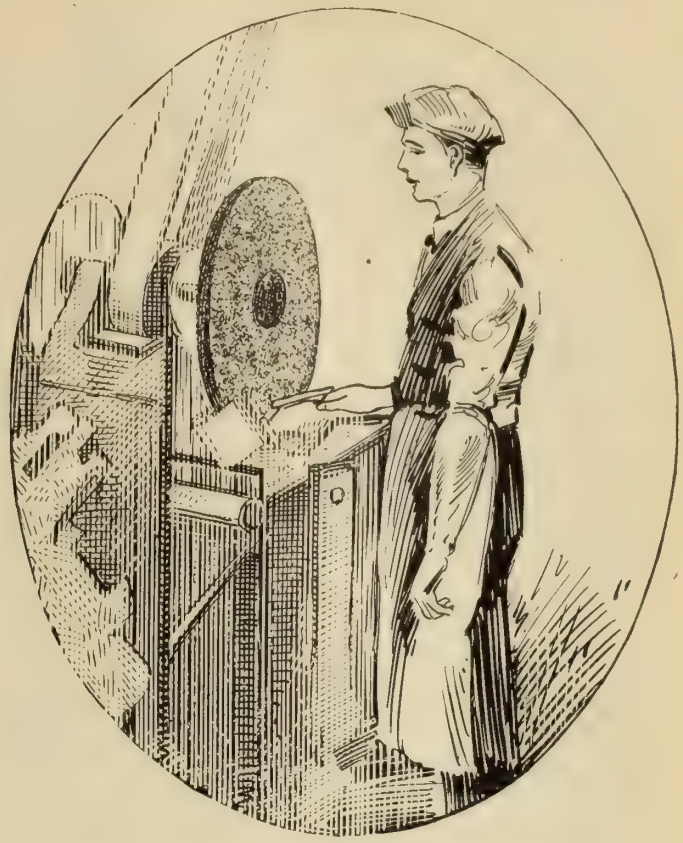
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"Wausite" Grinding Discs are of the best possible quality and are made with the same painstaking care as the other "Wausite" products.

"Wausite" Grinding Discs have an enviable record for fast cutting, due to the durability of the surfaces and its secure bond to the heavy fabric.

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It comes to you in a sealed wrapper.

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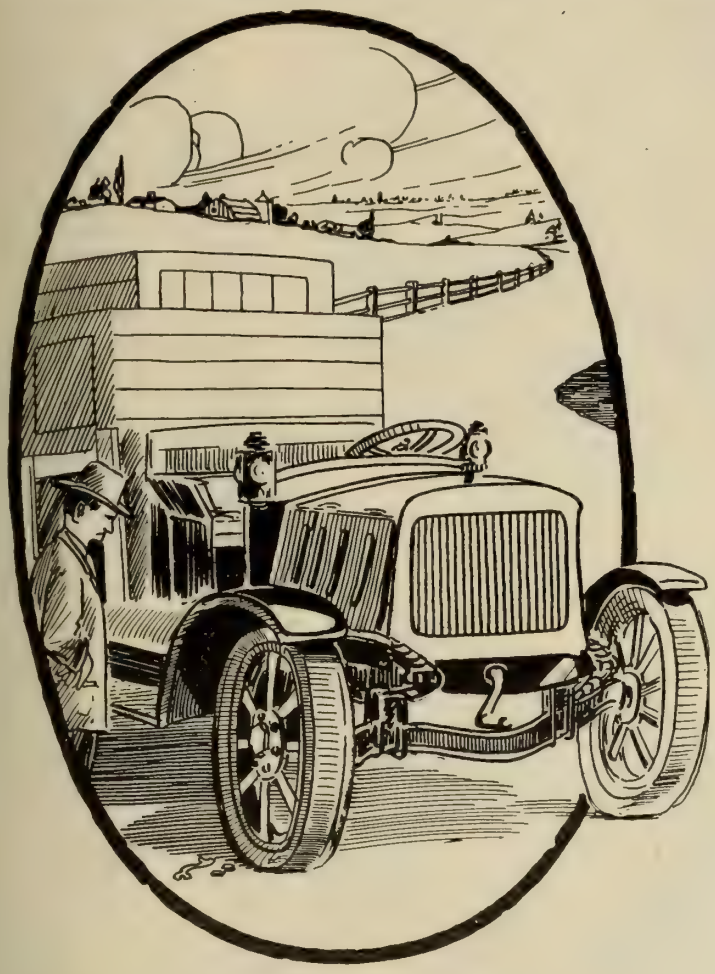
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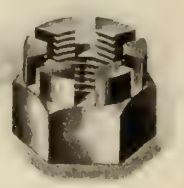
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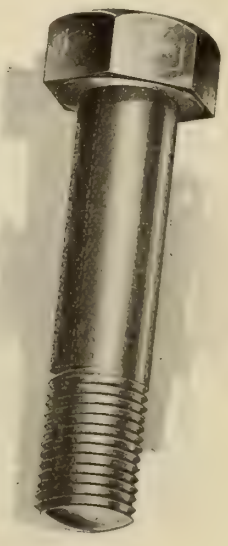




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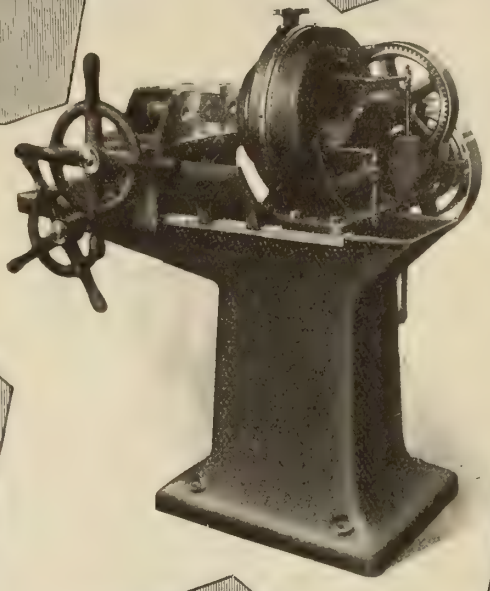
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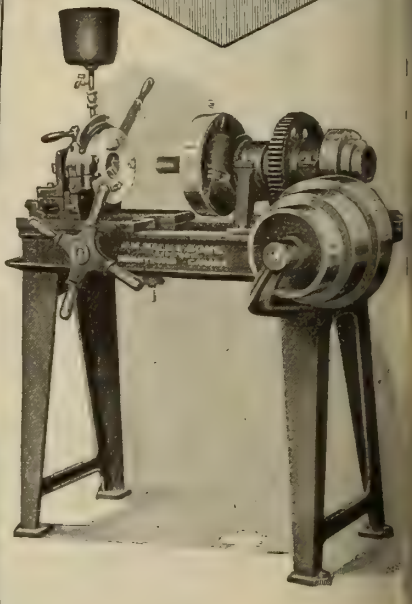
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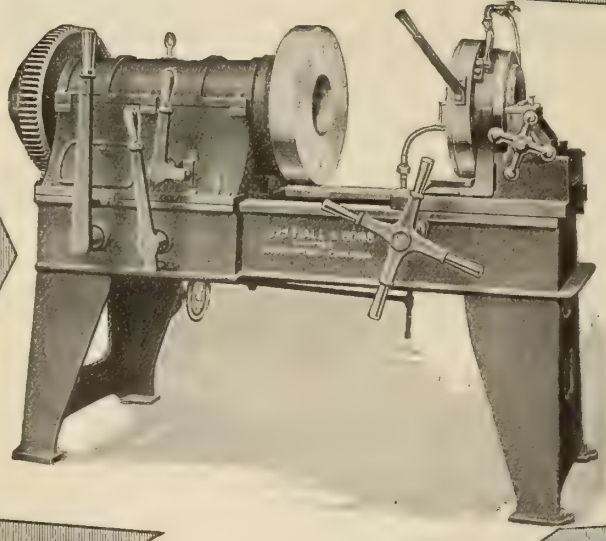
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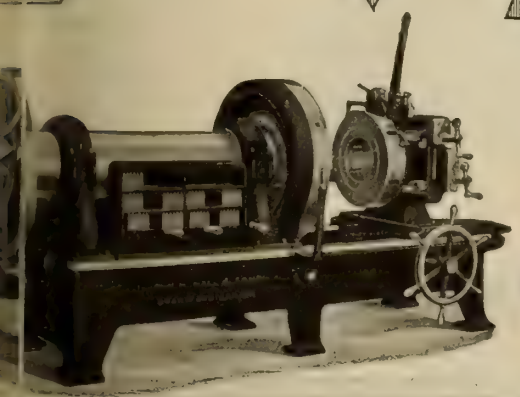
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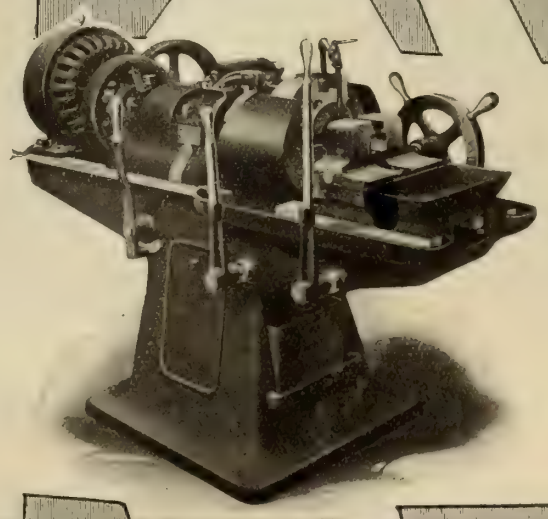
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LEHMANN LATHES

FEATURES OF "LEHMANN LATHES"

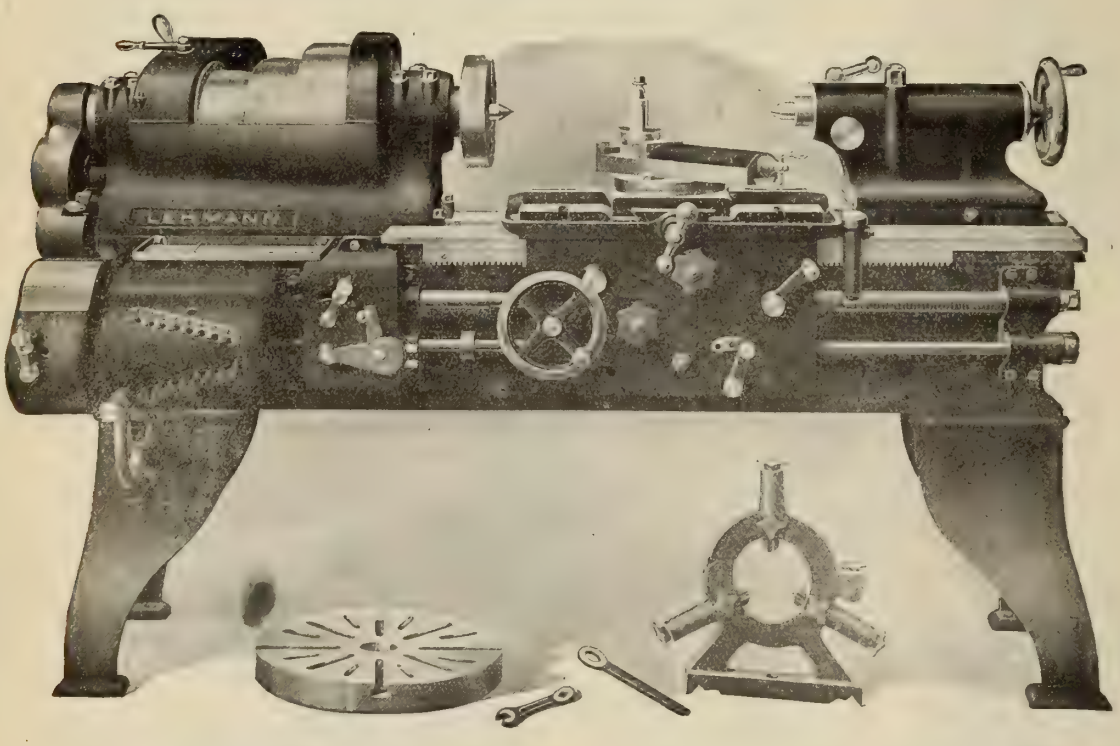
The features of **"LEHMANN LATHES"** embody the latest approved ideas in lathe construction and also some improvements which are exclusively a part of these machines.

THE BED is deep and wide, rigidly braced with cross ribs, and has chilled ways, insuring permanent alignment. The V's are large, with an angle of 90°, and the flat inside front way permits greater depth to the bridge.

THE HEADSTOCK is of the most modern design, in which the front and rear boxes are tied rigidly together by carrying through the casting in line with the centre of the spindle. One forward belt on the countershaft provides 9 spindle speeds in correct geometrical progression. The spindle is bored from high carbon steel and ground. The bearings, securely held in place are easily renewable. They are of phosphor bronze with positive lubrication. The thrust is taken by bronze in contact with steel washers hardened and ground.

THE TAILSTOCK is offset, has a spindle of large diameter, and is provided with a new and improved locking device, which secures the spindle by a very light pressure on the handle. The usual distortion caused by locking the spindle is absent in this type, since the barrel is not split. The tailstock is clamped to the bed by long bolts brought up to the top of the barrel, which adds to its strength and convenience of operation.

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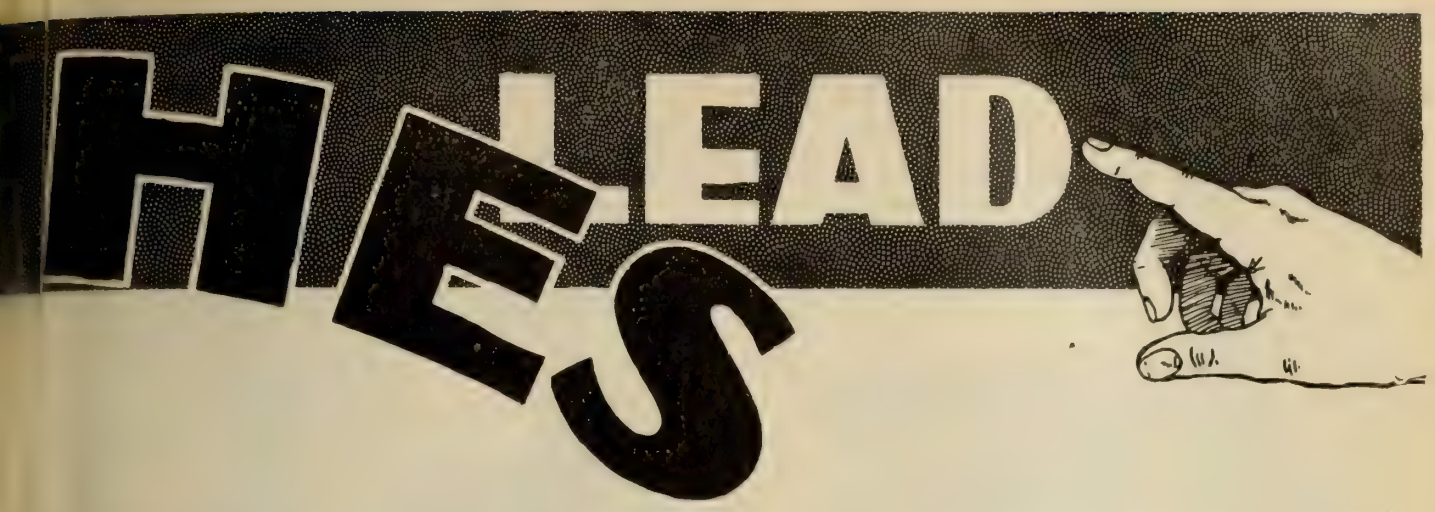


16-inch Three-Step Cone Double Back Geared Engine Lathe

Actual Swing 18¼"

LEHMANN MACHINE COMPANY,

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THE CARRIAGE has a wide bridge of good depth which is rigid under the heaviest cuts. It is provided with shear wipers, and troughs for collecting and returning the cutting lubricant.

THE APRON is tongued and grooved to the carriage. Each running shaft or stud is supported on double bearings. With the exception of the friction gears, all gears and pinions are steel, and the studs are hardened and ground. The half-nut parts are operated through a link motion. A safety device prevents the feed rod and lead screw being engaged at the same time.

THE COMPOUND REST is of large diameter, heavily built, graduated for any angle up to 90°, and secured to the carriage by accessible bolts at a large radius from the centre.

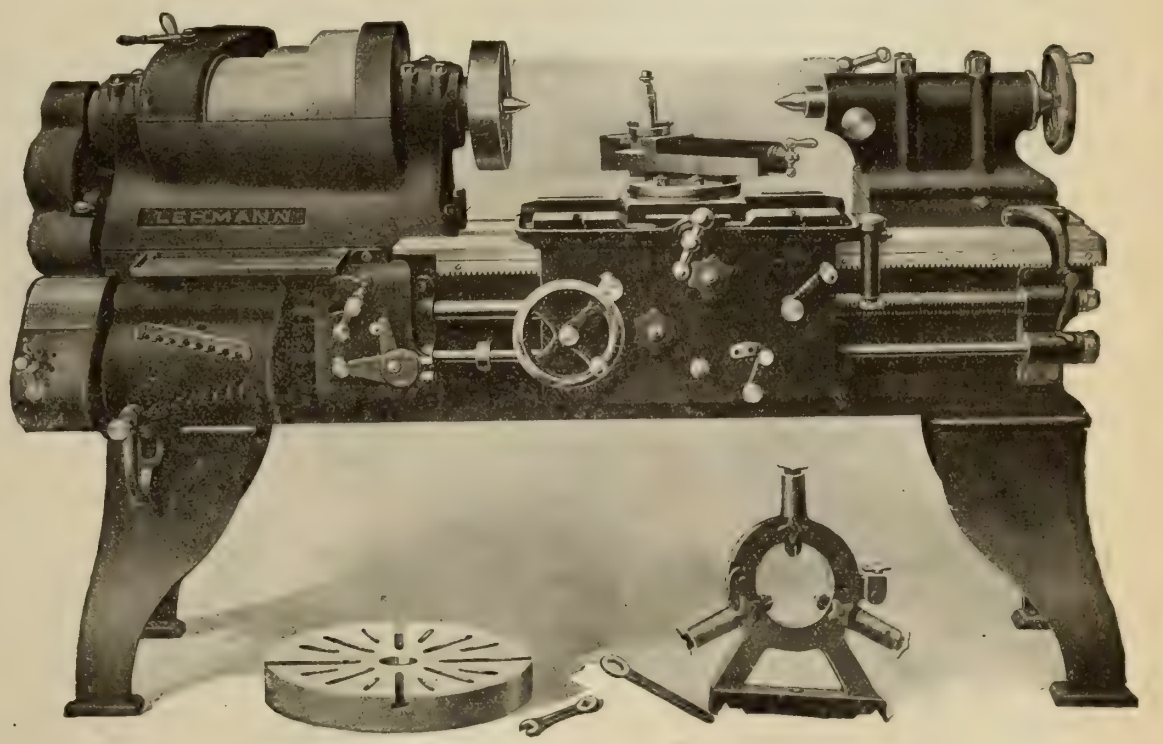
THE QUICK CHANGE MECHANISM simplifies the ordinary construction and yet doubles the range with the addition of only two gears to the rocker. All common gear changes are made by a movement of the rocker arm alone. Unusually fine or coarse feeds are obtained by throwing another handle to the right or left. In the usual design, with one intermediate gear, this gear takes all the wear. In the Lehmann design the wear is divided between two intermediate gears and their life is doubled.

THE FEED ROD is not running when thread cutting. Similarly the lead screw is not running when the feed rod is employed. An adjustable collar on the feed rod serves as an automatic or safety stop for the carriage.

There are many other features and details that are of paramount importance in the design of a modern lathe. Our catalogue describes these in detail. Shall we send you a copy?

18-inch Three-Step Cone Double Back Geared Engine Lathe

Actual Swing 20¼"

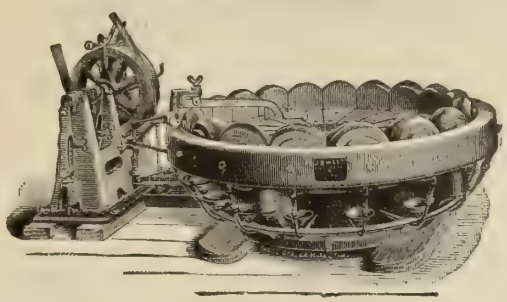


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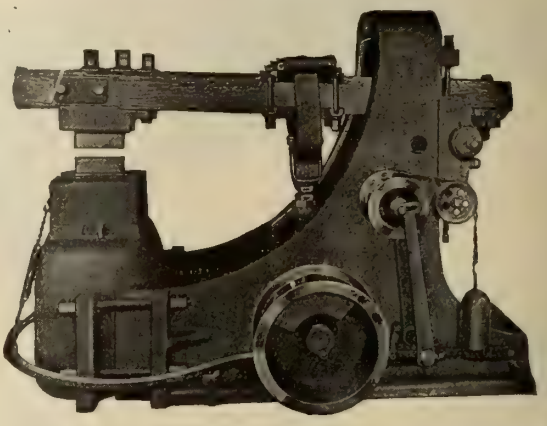
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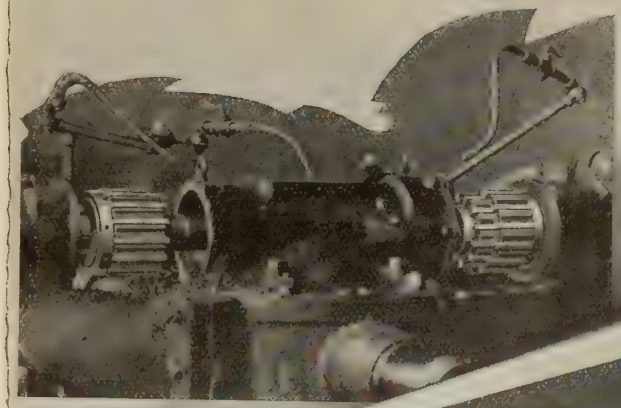
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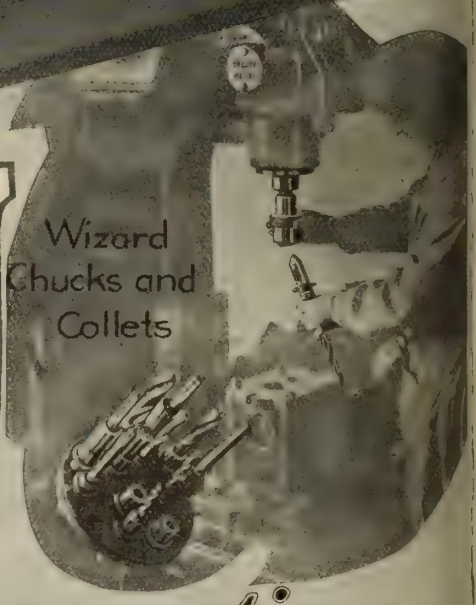


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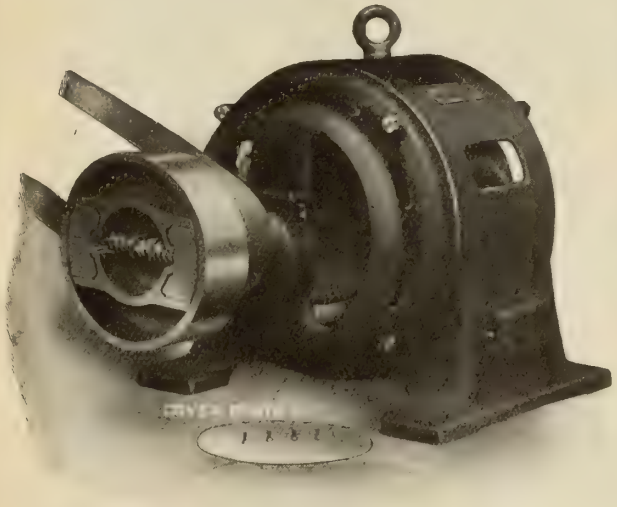
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The Clutch also Effects a Great Saving in Current Consumption and Reduces the Initial Cost of Motor and Switchgear.

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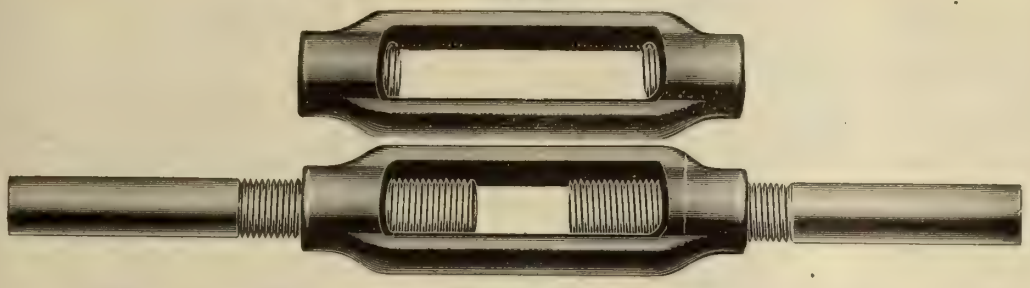
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It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

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Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

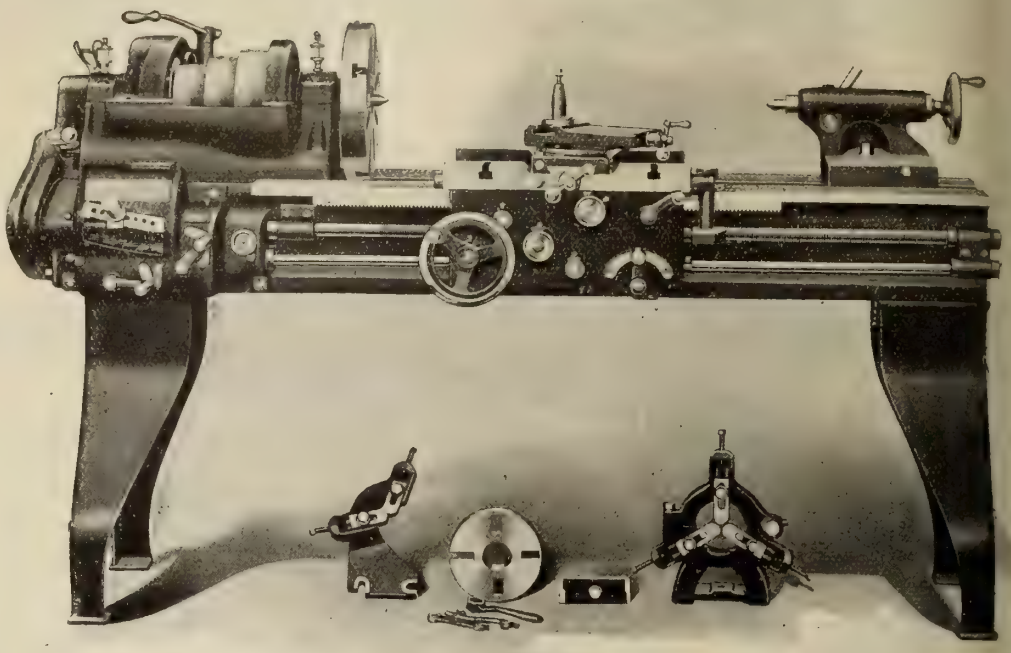
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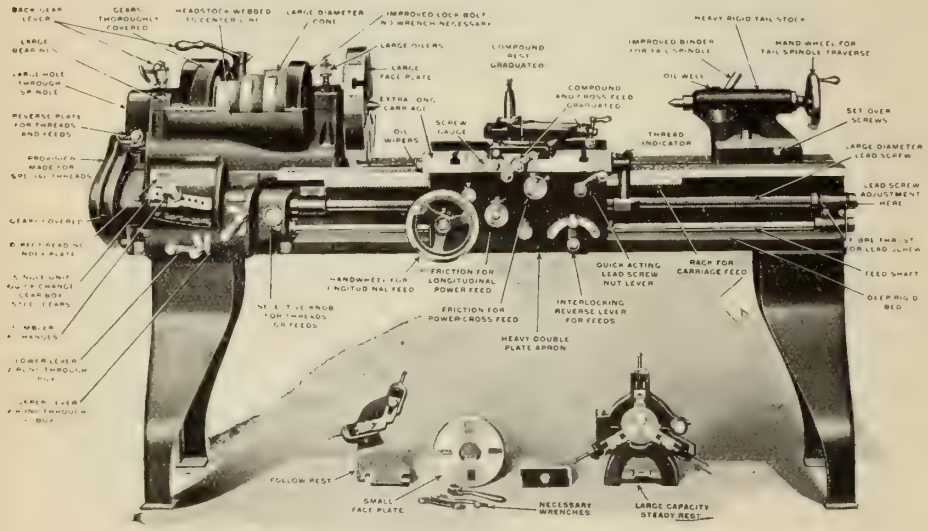
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A small heavy duty machine of universal application, adapted alike to the hard grind of rapid production and the fine precision of the tool room. There is no wasted metal in this heavy machine. Every ounce is there for its purpose and the deep, rigidly cross-braced bed, massive headstock and improved offset headstock hold the tool firmly its work under the heaviest cut. The heavy carriag with its wide bridge and large bearing on the way effectively prevents chattering.



Double back gears and a thre step cone pulley are embodie in the design, while the threa indicator obviates the necessit of reversing the lathe, so th both countershaft belts may b run forward, to give 18 spind speeds. The quick chang gear box gives directly 3 changes of threads and feed through sliding steel gears an hardened steel clutches. Extr gears may be substituted on th quadrant giving an almost univers range.

The apron has double bearing for a shafts, and all feeds are reversed i the apron, interlocking with the lea screw nut to prevent the operation o both at the same time.

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Builders of **Lathes and Drilling Machines**

Oliver

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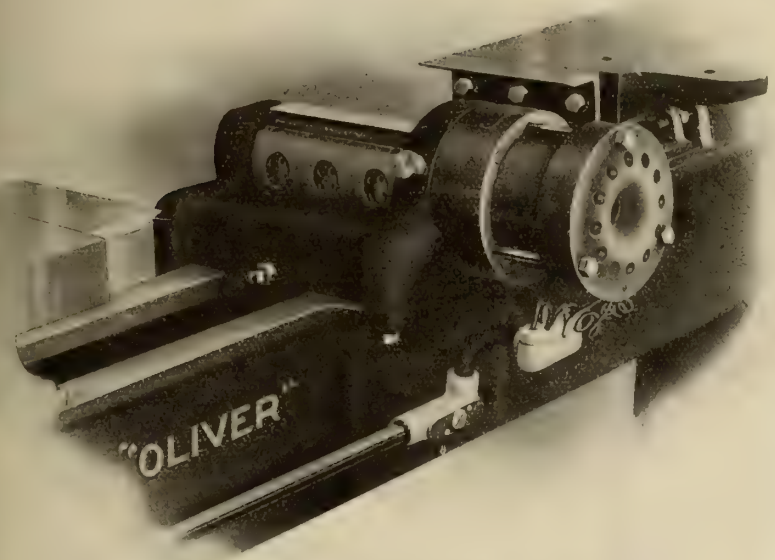


FIG. 2—CLOSE UP VIEW OF MOTOR AND CUTTER

This new machine is of rigid construction—and in every way the most up-to-date machine of its type.

Made in 6 sizes—widths of 9, 12, 16, 20, 24 and 30 inch.

The three-knife cylinder revolves on self-aligning ball bearings, and is direct driven at 3600 r.p.m. by a 3 phase induction motor operating on 220 volts. The stator of this motor is bolted directly to the frame of the machine. The utility and simplicity of this machine is apparent from illustrations. Let us send you the remaining details.

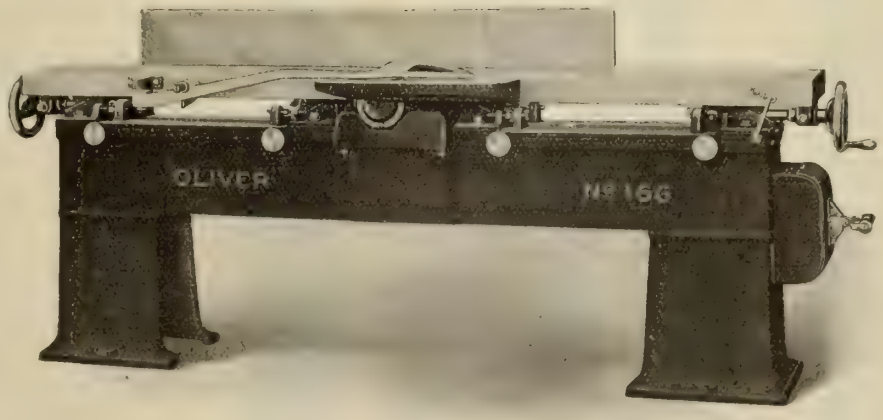


FIG. 1 GENERAL VIEW OF THE MACHINE

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PNEUMATIC HAMMER

RIVET SETS

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CHISEL BLANKS

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Faster if the work can be fed faster.
But at least 60 every minute.
And in tightest corners just as fast. Every head just as smooth. Not a bent shank; not a tool mark on either rivet head or casting.

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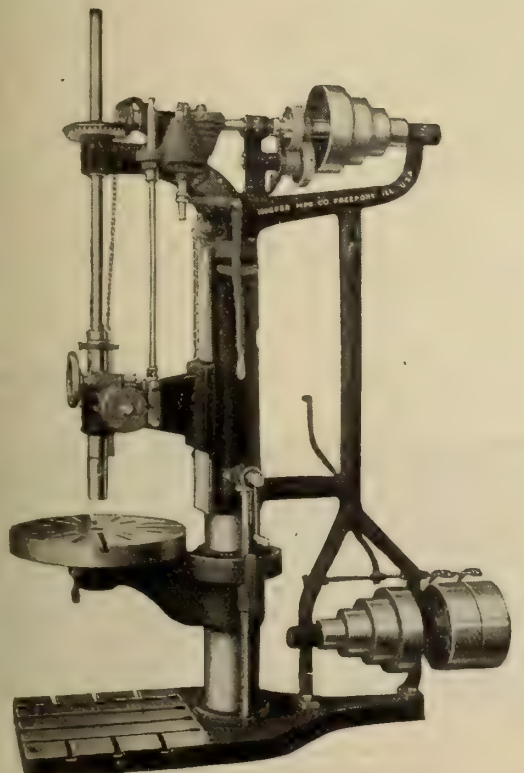
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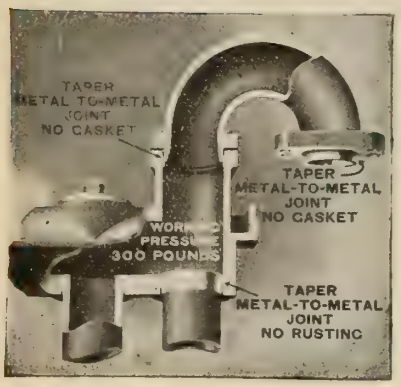
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Harness otherwise waste gas to heat boiler feed water; prolong life and increase capacity of boiler; minimize repair and upkeep costs; reduce soot nuisance and utilize heated feed water for all manufacturing purposes. Sturtevant Economizers are built to *any* requirement and are sold with a gurantee. Our engineers will gladly plan and estimate your requirements without obligation.

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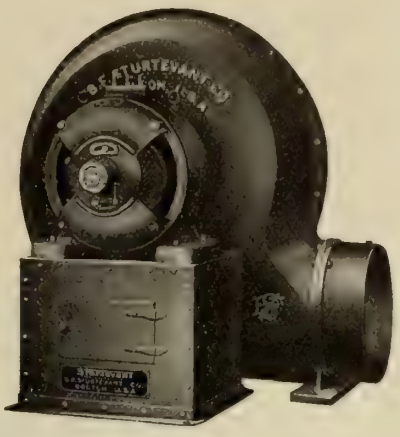
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"I suppose it's because I used them myself when I was at the bench, but it does seem as though the best men in the shop have a preference for Starrett Tools.

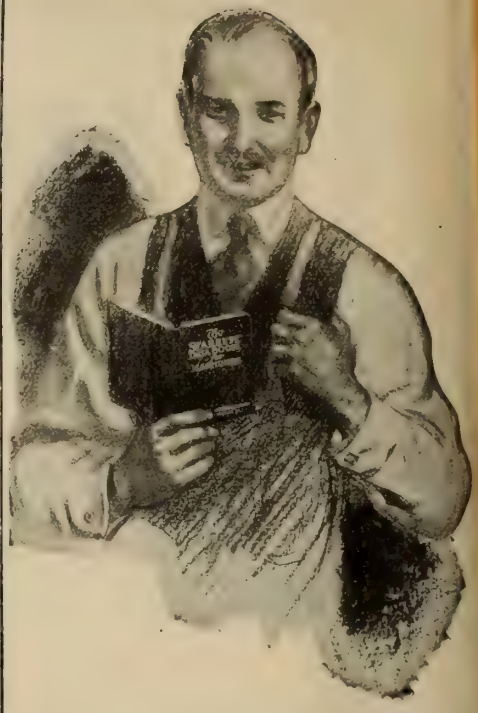
"Of course, most of them sort of got into the habit of relying on Starrett for fine work when they were apprentices and journeymen.

"Speaking of apprentices — that little red book there, 'The Starrett Book for Machinists' Apprentices,' has saved me more time and helped more young fellows to learn how to do things right than anything else in the shop.

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"Starrett gets out another book, 'The Machinists' Data Book,' that's just about as big a help to the experienced machinist. It's got all the tables and formulas and so on that he ever needs, and it isn't cluttered up with a lot of engineers' stuff that he doesn't use.

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All are agreed that Canada is on the threshold of a wonderful era, that the decade upon which we are just entering will see this country taking a premier position among the nations of the world. May it be that we shall measure up to the responsibilities that confront us, so that we exceed the best that is expected of us. May the year 1920 usher in the reign of the optimist and the co-operator and see the elimination of all elements that retard individual, industrial and national progress. May it be a successful year in the highest meaning of the term.

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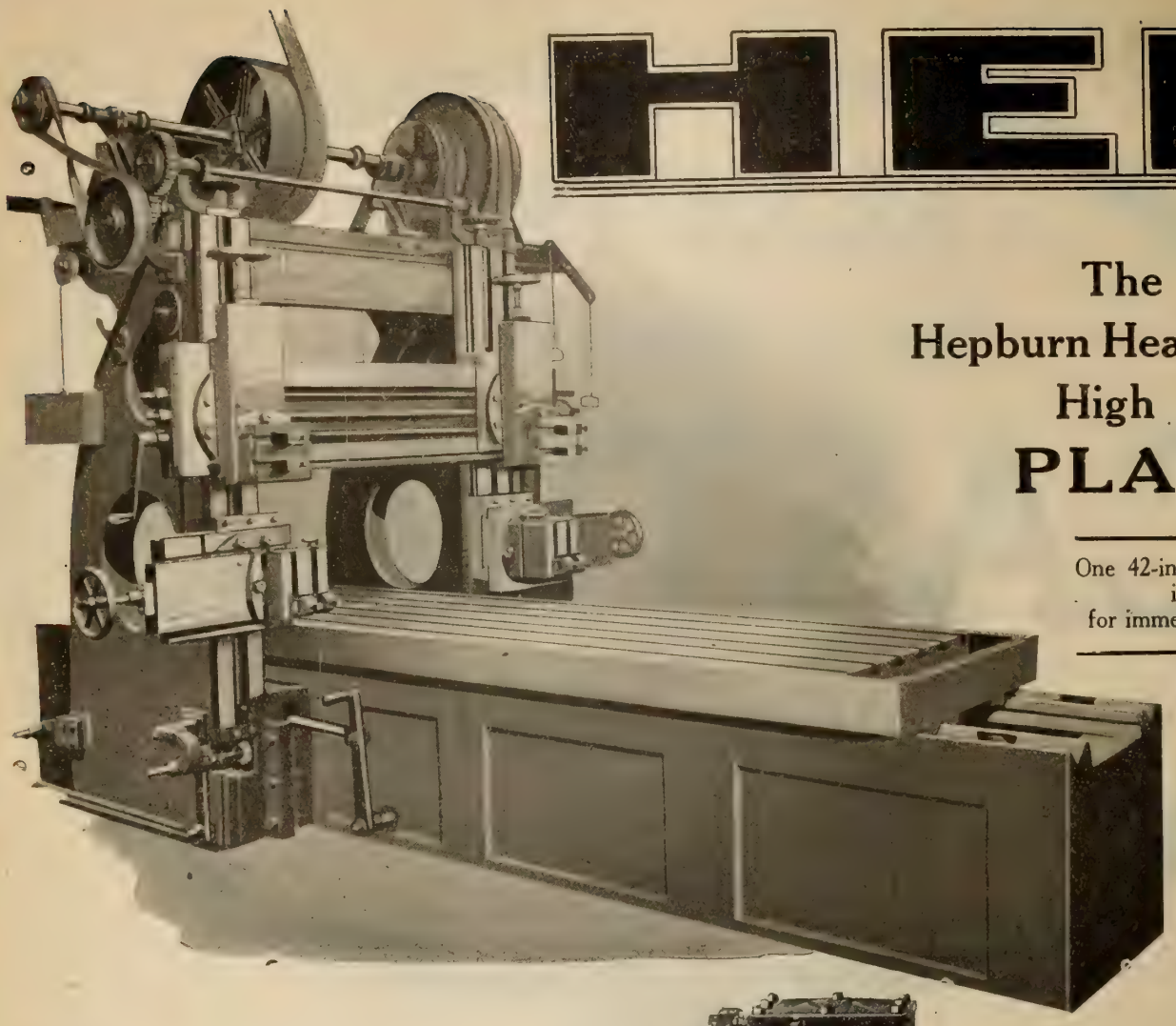
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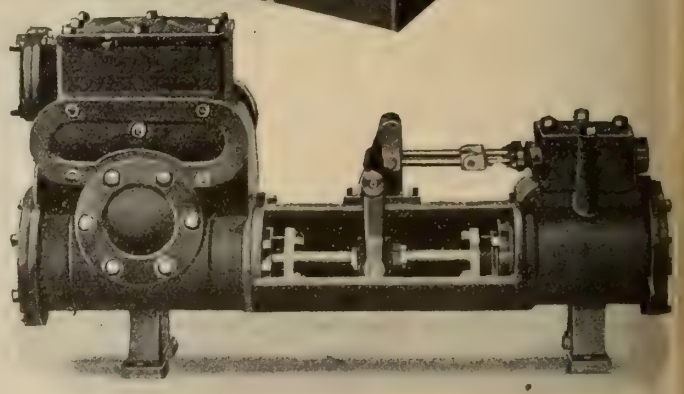


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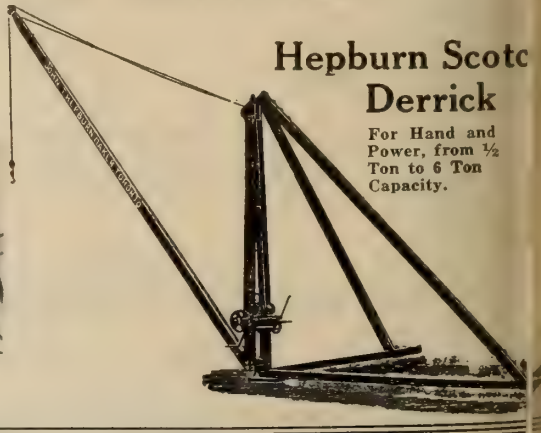
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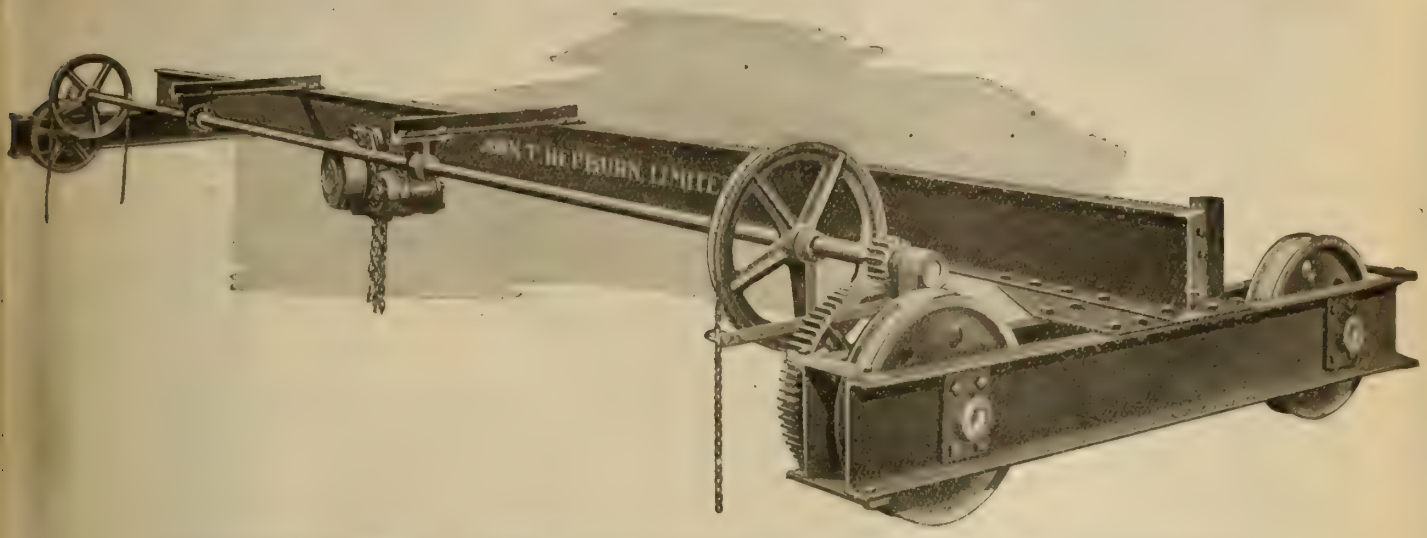


Hepburn Scotc Derrick

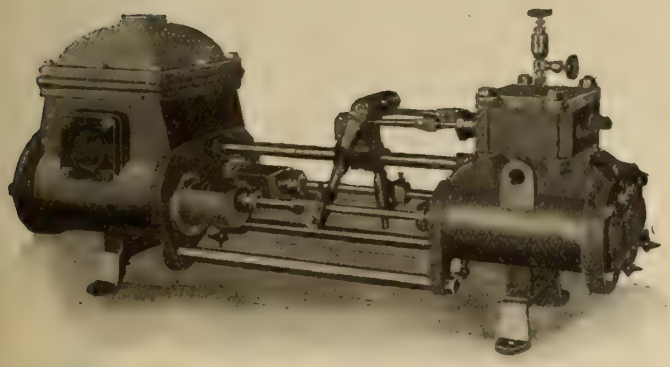
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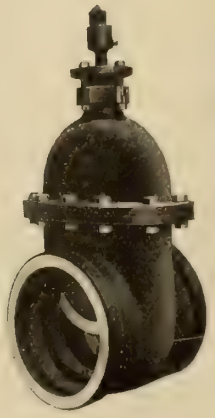


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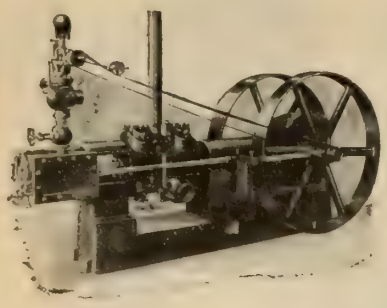
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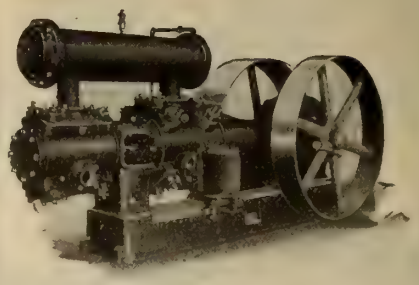
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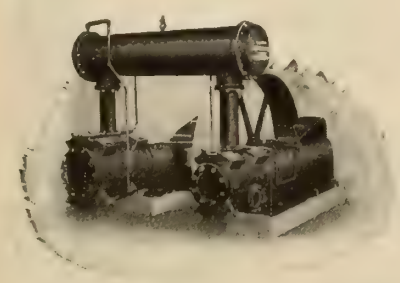
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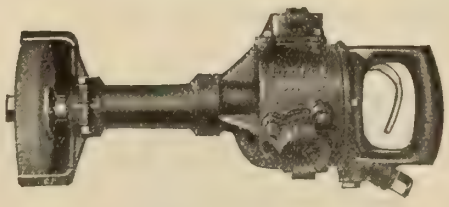
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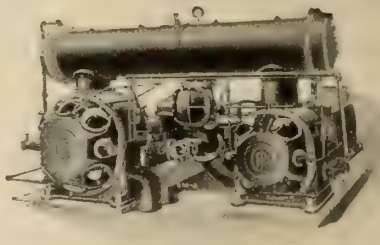
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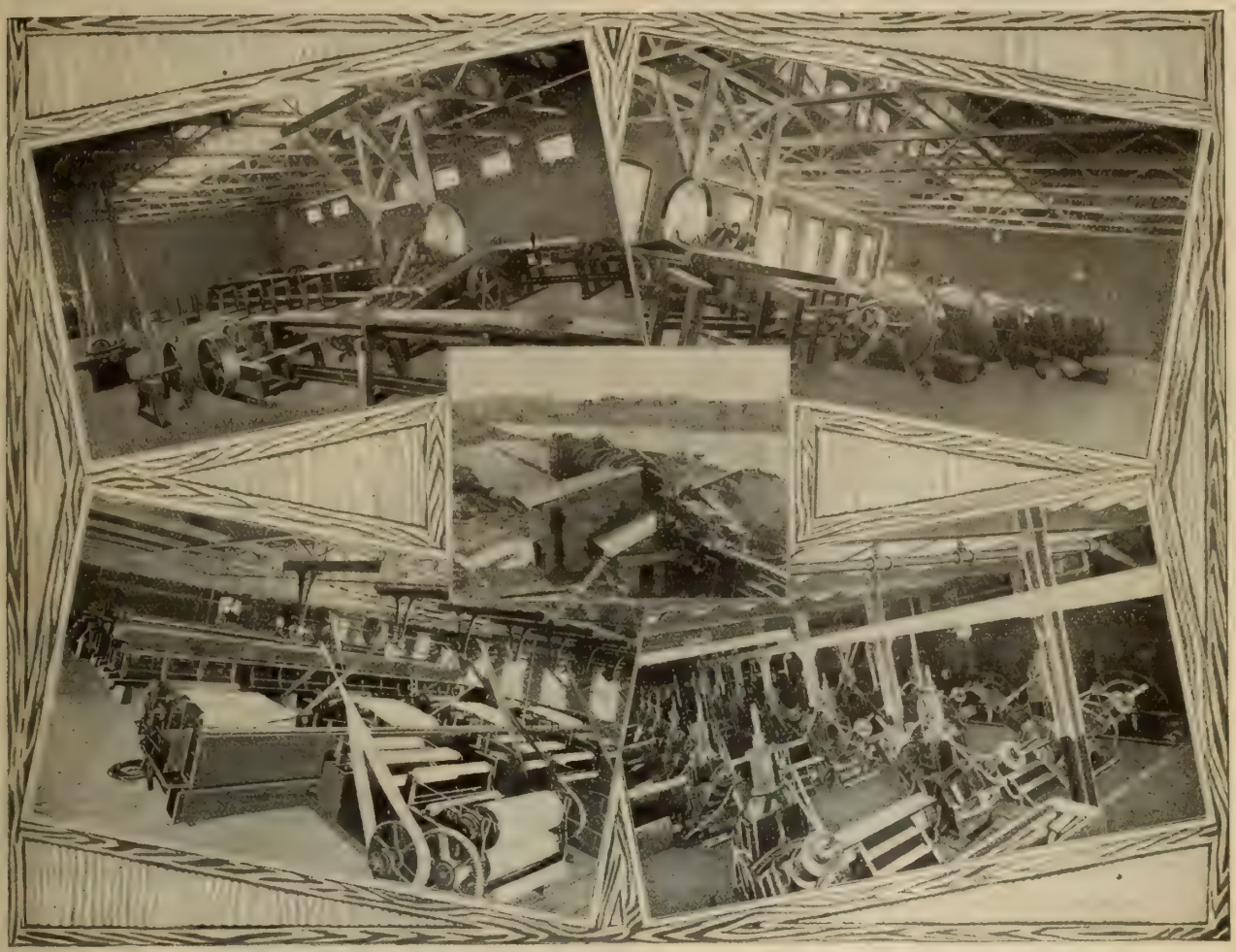
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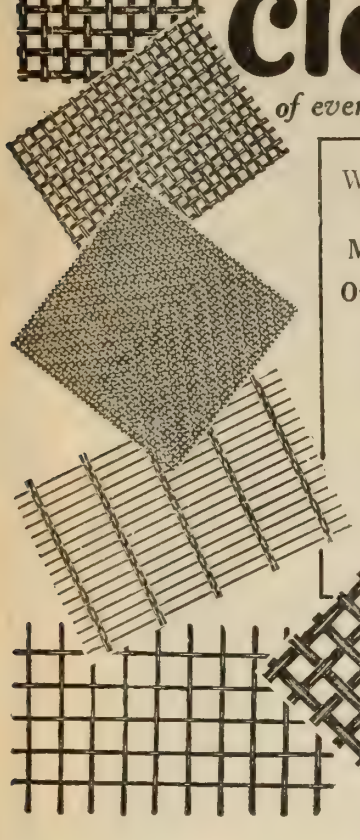
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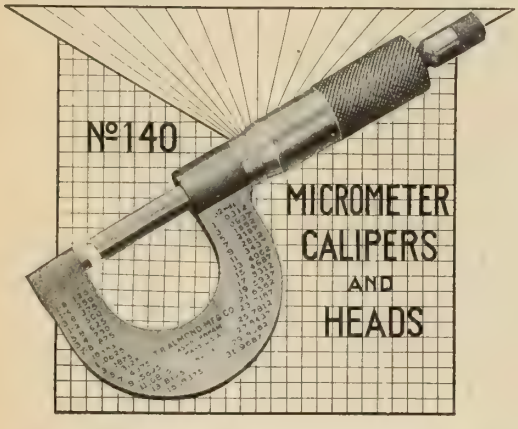
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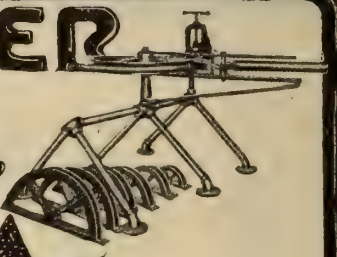
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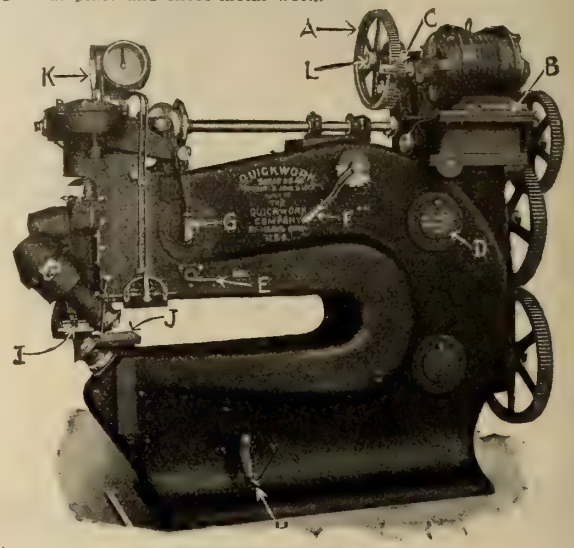
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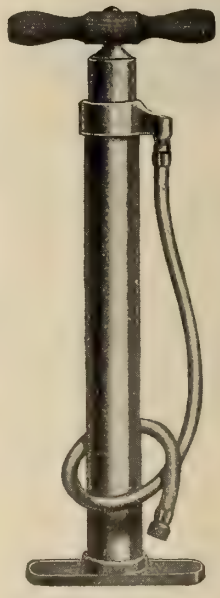
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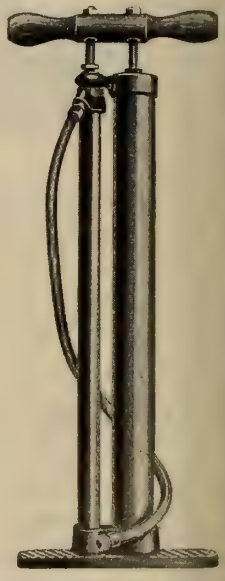
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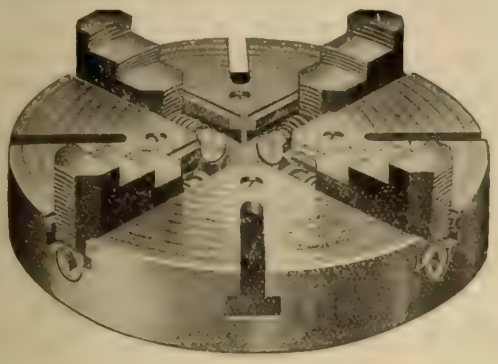
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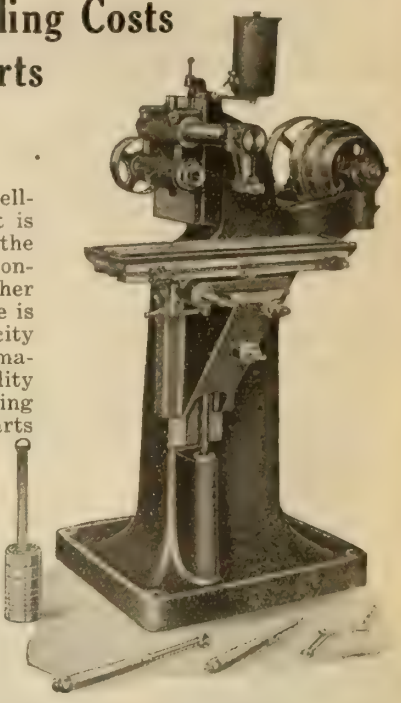
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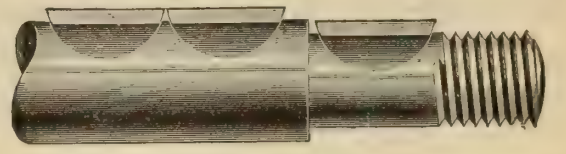
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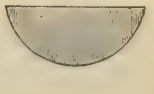
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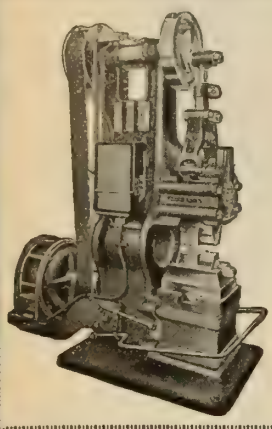
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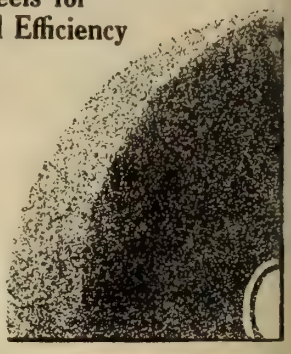
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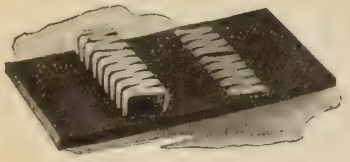
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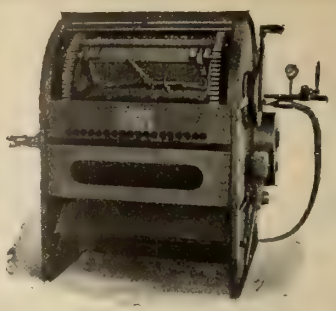
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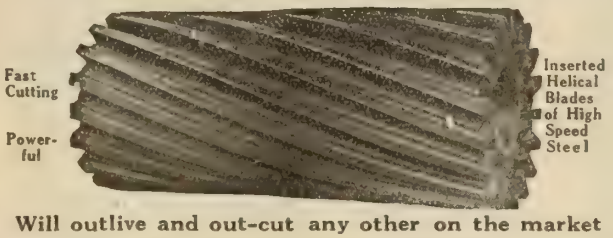
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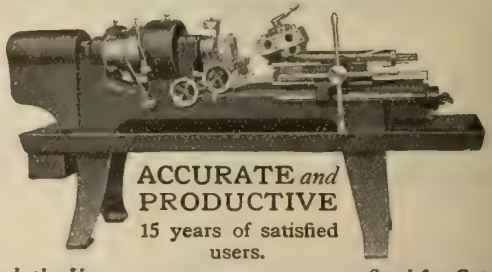
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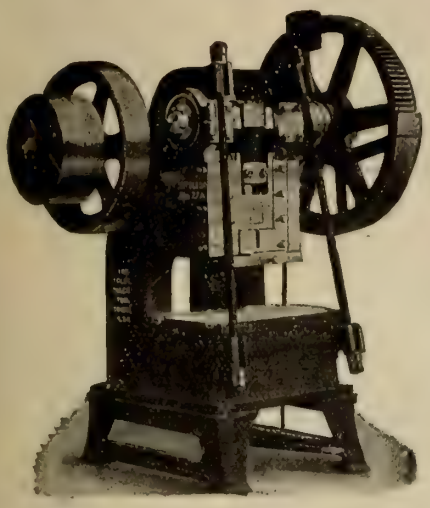
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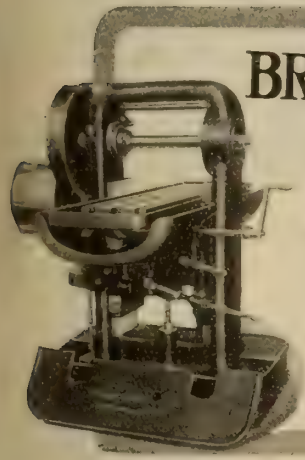
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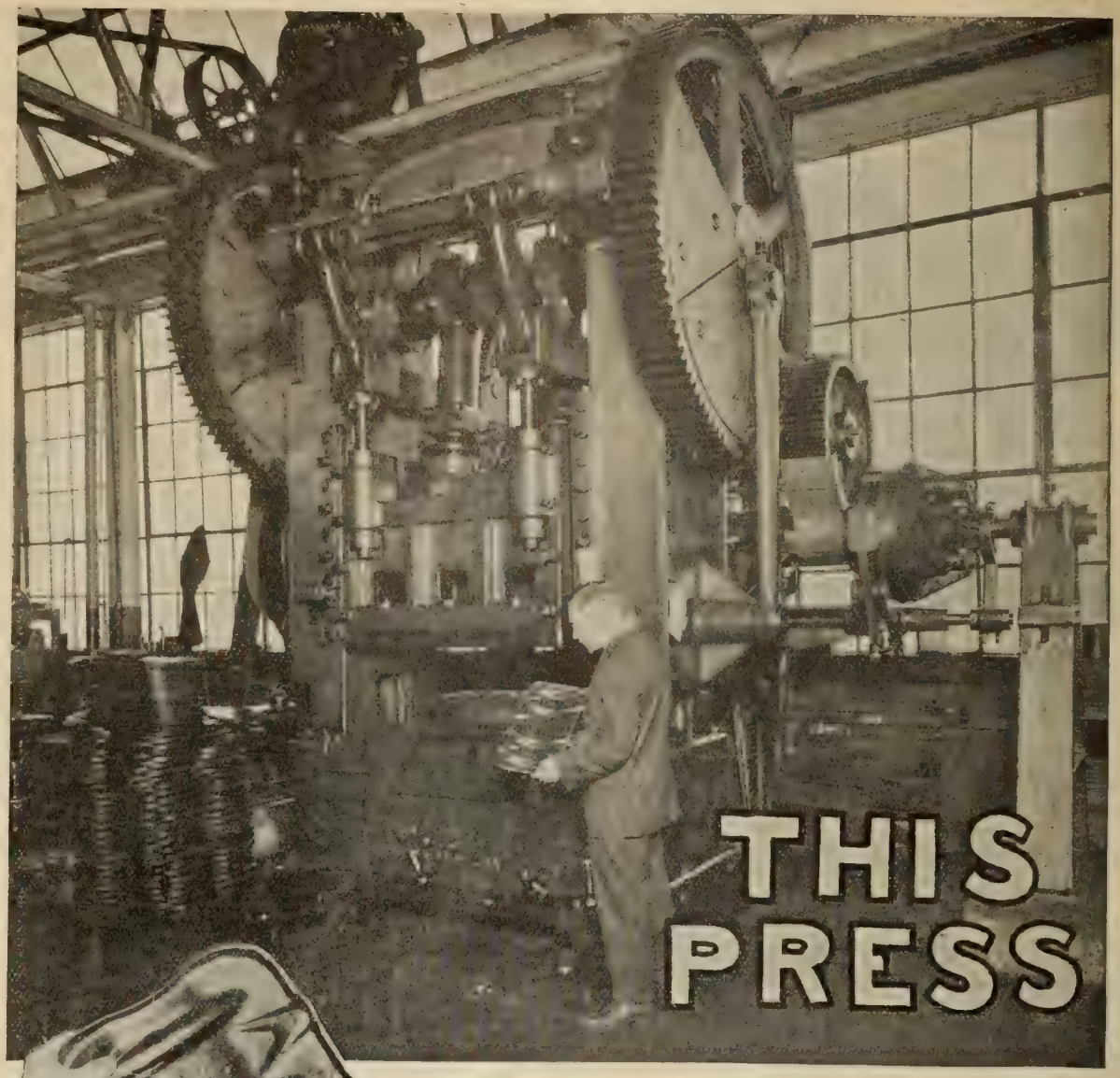
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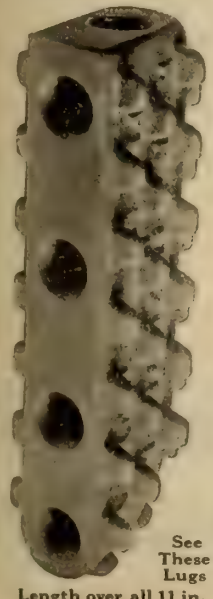


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Length over all 11 in.
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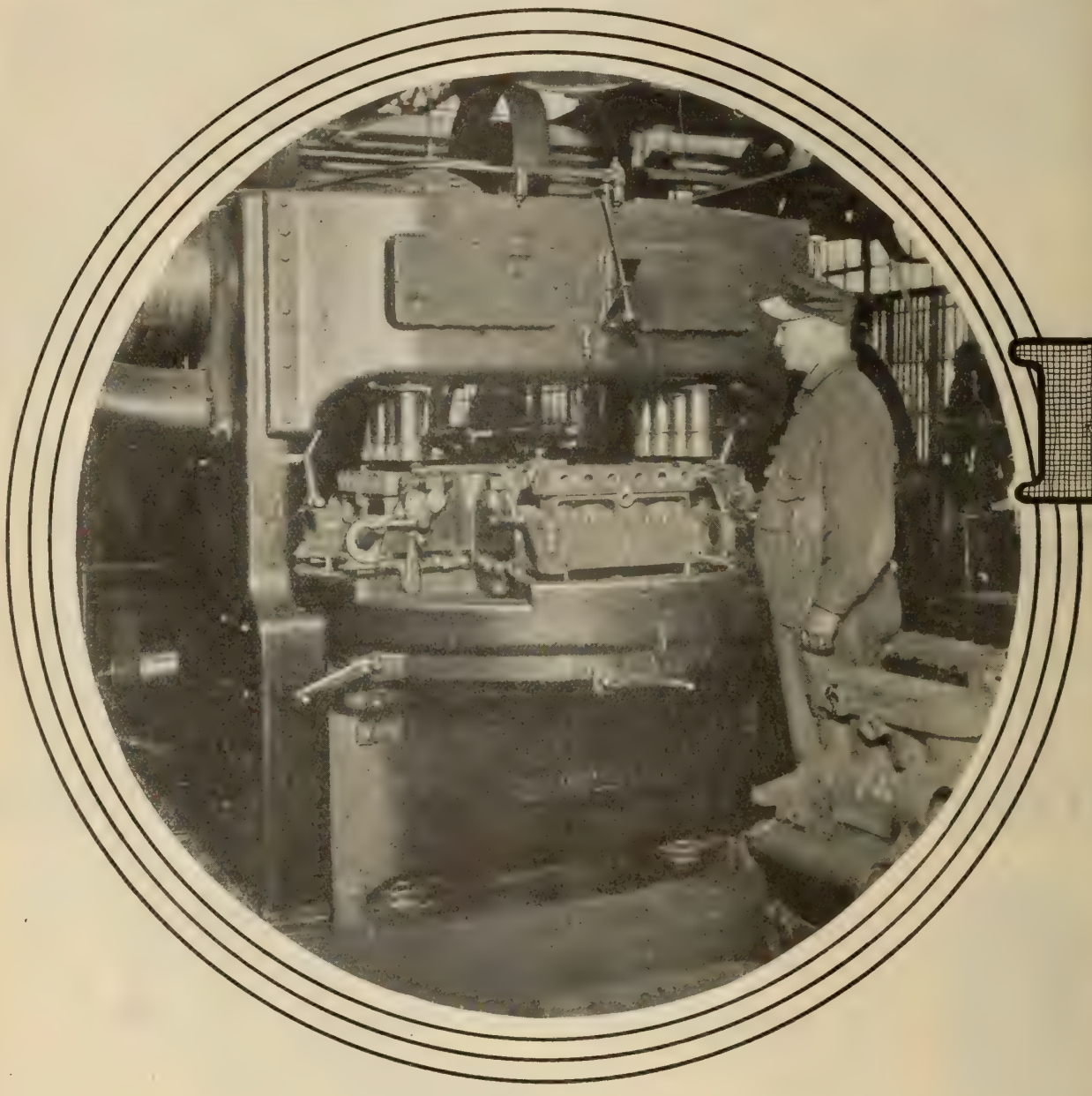
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The enclosed oiling system, the fast return to table and the screw feed to table are a few of the improved features which make our Cylinder Boring Machines the best on the market.

The Cylinder Boring Machine illustrated herewith is equipped with circular indexing table and two groups of spindles so that the rough boring and reaming operations are performed at the same time, while the loading is being done.

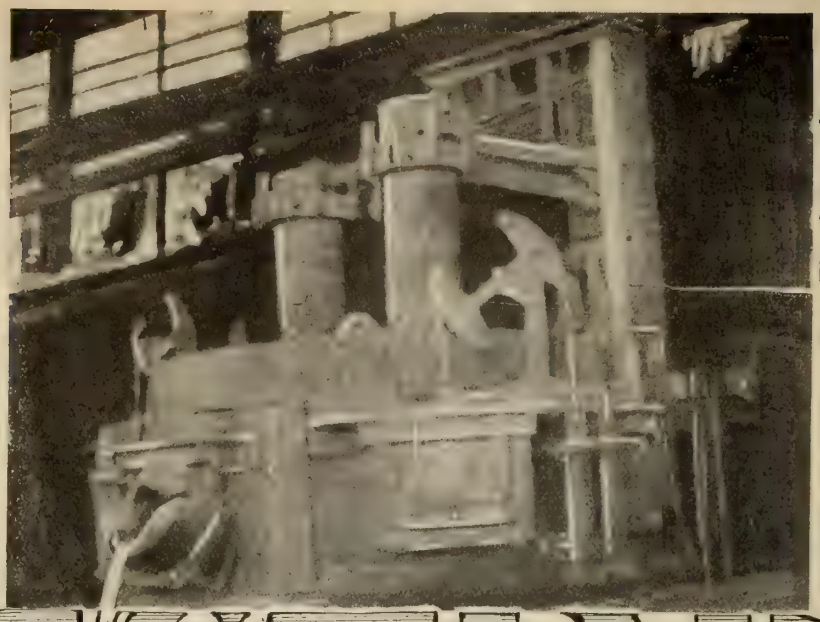
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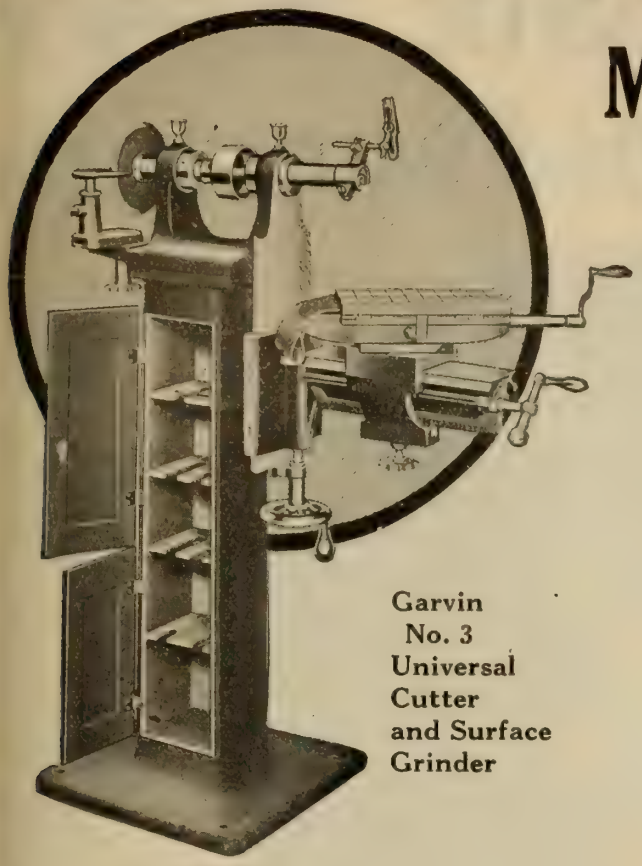
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Makes Your Toolroom Efficiently Equipped



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In the long run the care you take in your tool room pays dividends in the better service your tools render. Your tool makers should have the best equipment you can give them, for the extreme accuracy of their work measures the precision of that of your milling machines, drills and other tools.

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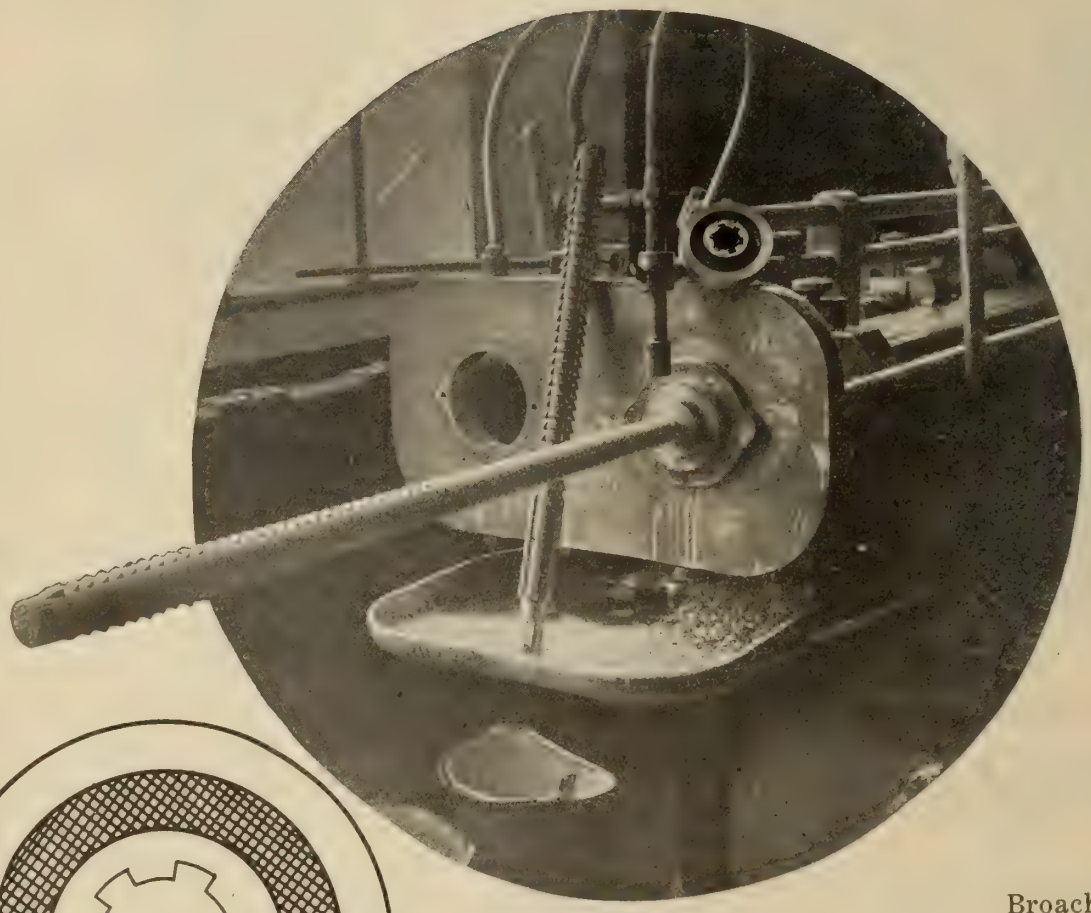
G-6

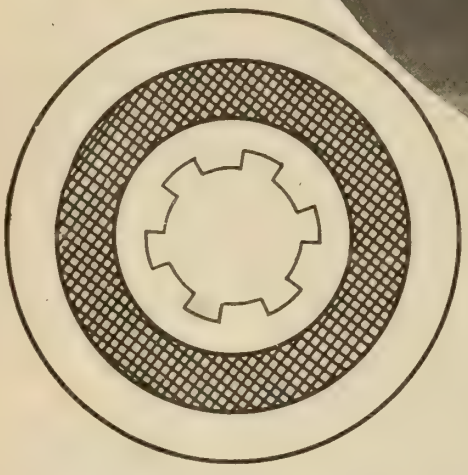
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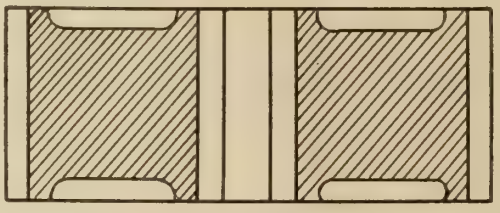
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Broaching Six Keyw on Overland







Broaching machines and modern broaching practice are interestingly discussed in the J. N. Lapointe Co. catalog—which will be mailed on request.

J.N. LAPOINTE CO.
of
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Makers of Broaching Machines and Broaches.

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J. N. Lapointe Co. Broaching Machine

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But broaching need not be confined to internal cuts. Many pieces that commonly are milled can be externally broached—with a correspondingly lower tool cost per piece and greater accuracy than hand finishing could attain. The human element is reduced to the manipulation of the broaching machine—with profit, from the standpoint of both production cost and interchangeability.

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This adaptability of a high-class broaching machine makes it possible to do practically every sort of broaching that any shop might require with some one of the eleven types, in five sizes, in which broaching machines are made by the

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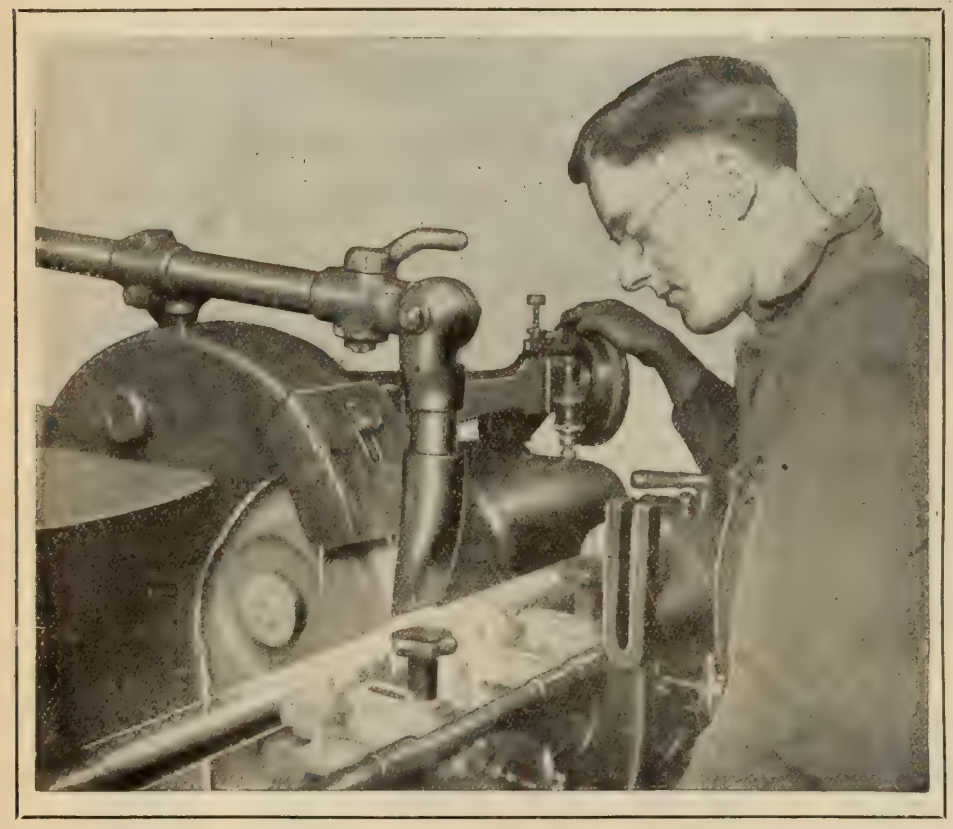
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The Landis has the endorsement of the powerful automobile industry, both in America and abroad. Some of the larger manufacturers have Landis installations totaling several hundred machines.
This is convincing evidence that Landis tools meet the tests demanded:—

Accuracy High Production Durability

There are seven distinct types of Landis Grinding Machines, as follows:

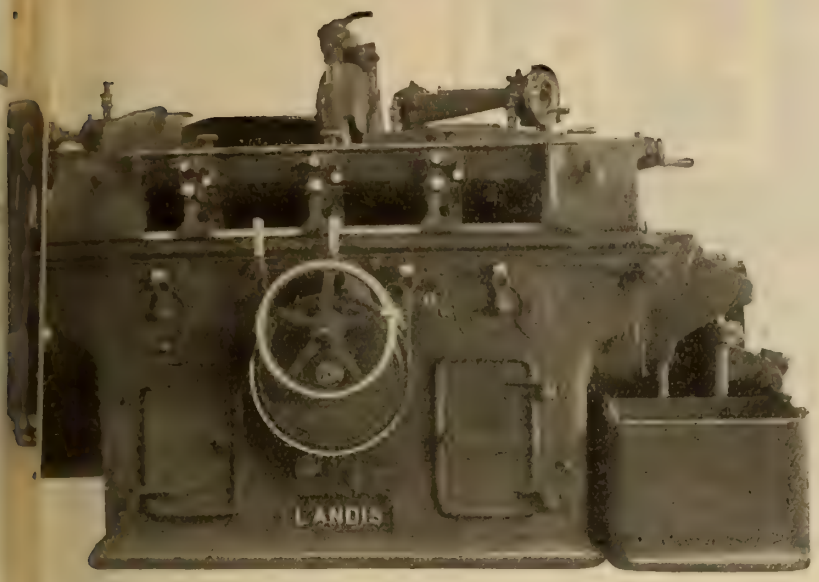


1. Plain Grinding
2. Universal Grinding
3. Crank Pin Grinding
4. Camshaft Grinding
5. Ball Race Grinding
6. Roll Grinding
7. Internal Grinding

The Landis line also includes horizontal boring machines and attachments.

LANDIS TOOL CO., Waynesboro,

New York Office: 50 Church St.



LANDIS Plain Grinding Machines

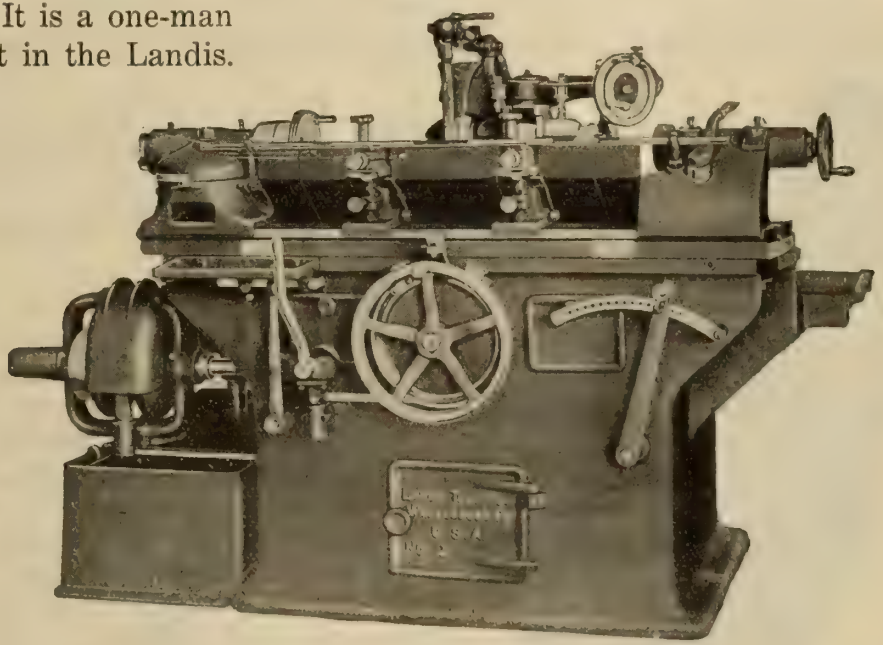
For pistons, crank shaft aligning bearings, and all other motor parts requiring cylindrical grinding, straight or taper. These machines have made great production records in hundreds of shops.

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The big principles of Landis standard design combined with special features fit these machines to their special work. The result is high production and accuracy.

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The Landis improved crank grinding machines have been designed for big output and greater accuracy. They present real economies in set-up time. It is a one-man job to set up a crank shaft in the Landis.



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er Landis tradition for accu- cy and speed is upheld in se producers. In manufactur- s well as tool room work, i great adaptability makes e the economical tool.

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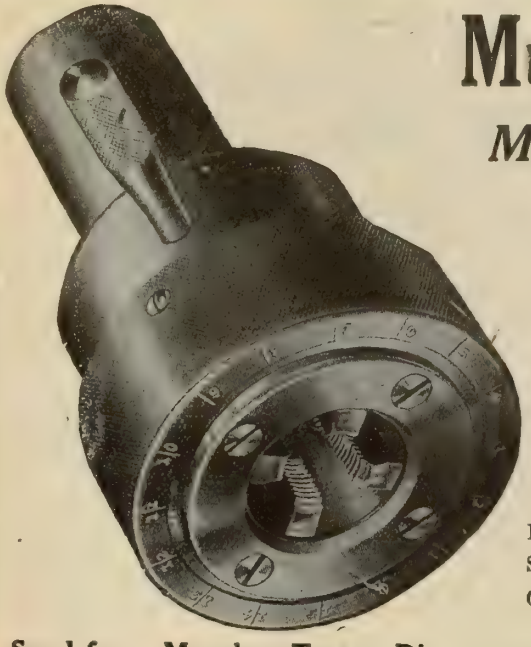
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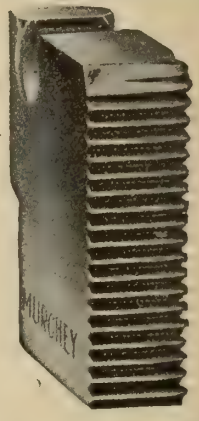
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ESTABLISHED 1860



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If it makes you irritable, think what effect it must have on a man who has to file all day long.

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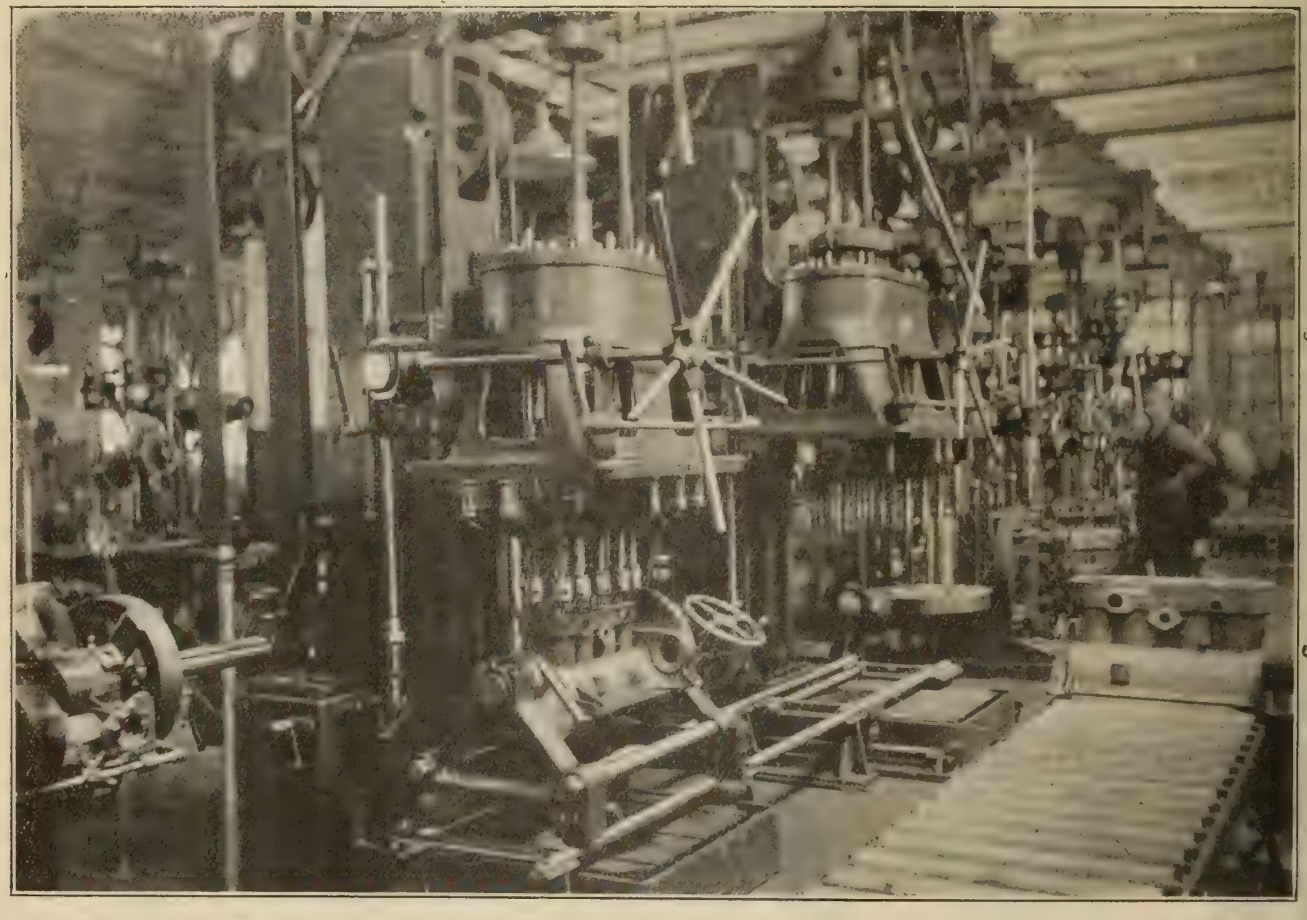
The "Hole" Story in One Word

Multi-Drillers NATCO Multi-Tappers

In the Plant of

The Willys-Overland Company

TORONTO, CANADA



The National Automatic Tool Co.

NATCO Foreign Agents: Burton, Griffiths & Co., British Isles
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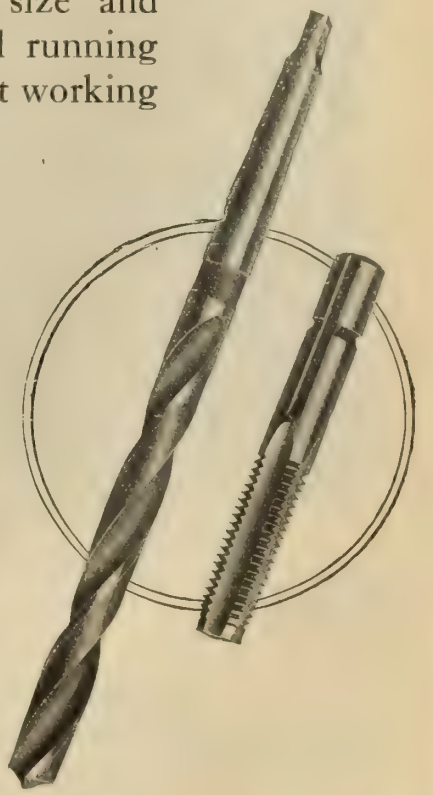
The "Hole" Story in One Word

Multi-Drillers NATCO Multi-Tappers

NATCO service is already too well known to require comment. But let us refer to the photograph on the opposite page.

This photograph was taken in the plant of the Willys-Overland Company and depicts two NATCO Machines so arranged as to work as one.

In this case the operation is that of tapping 38 holes in cylinder blocks of Overland motors. One machine taps 14 holes, when the work is revolved 180°, is pushed along the rails shown to the second machine and the remaining 24 holes are tapped. The NATCO is the only Multi-Driller on which you can drill large and small holes, perform different operations such as drilling, tapping, reaming, spot facing, counter-boring, etc., simultaneously and still have each size and type of tool running at its correct working speed.



NATCOS are built in eleven standard sizes with a wide range of drilling area and of spindle capacity. We specialize in Multiple Drilling Machinery and would be glad to have you put your drilling problems up to us. We can solve them.

We also design and build jigs and fixtures to be used in connection with NATCO Multi-Drillers.

Co., Richmond, Indiana, U.S.A.

NATCO Foreign Agents: Isbecque & Co., Belgium
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Investigate the Special Features of the

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View shows machine guarded with bottom iron doors open

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All steel wheels, covered with solid rubber bands ¼" thick; perfect tension device and style of guide that combined reduce saw-breakage to a minimum; universal alignment of wheels; convenient adjustments; smooth, steady operation; supplied with 3 H.P. electric motor for individual drive and SKF ball bearings in upper and lower wheels when desired.

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Will **save in wages $1.00 every hour the Sifter runs** at the most conservative estimate.

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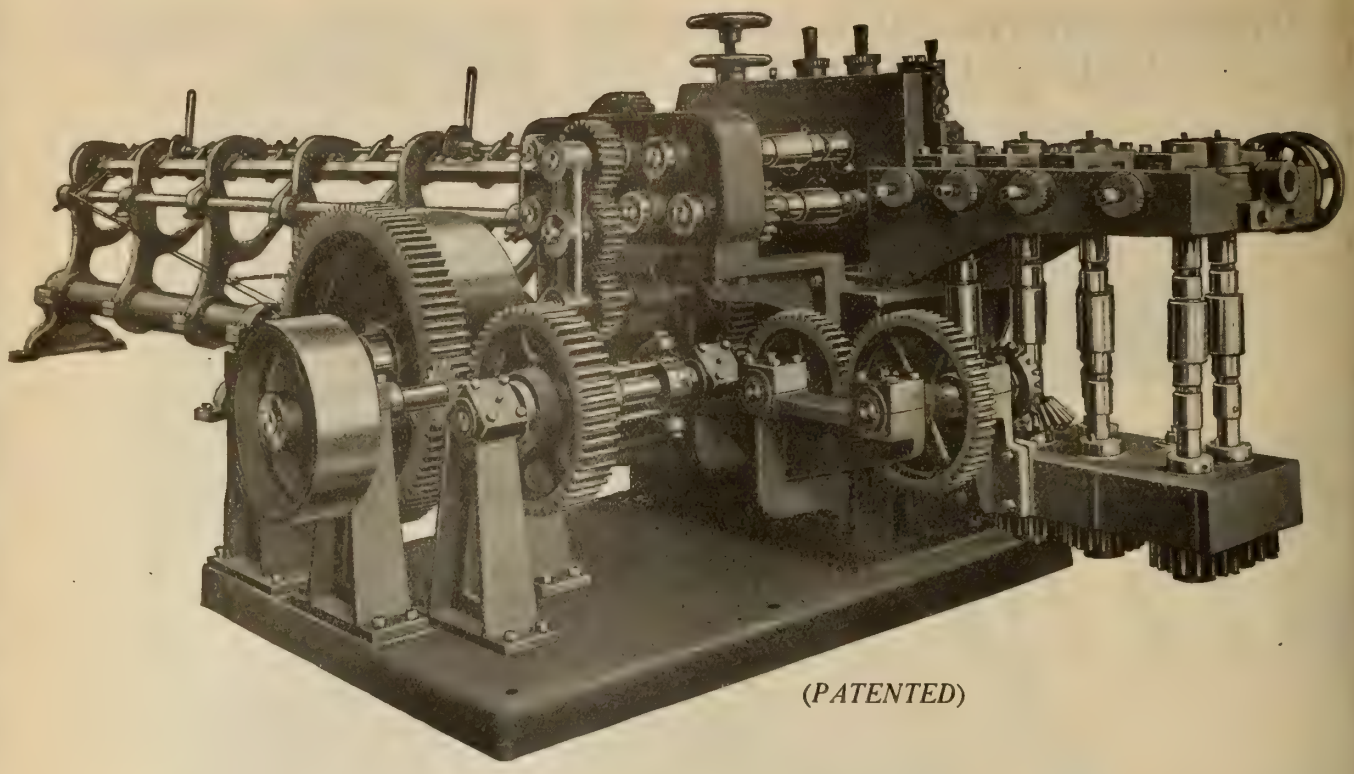
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This machine is arranged to be driven by one belt directly from the motor, doing away with the necessity for a countershaft.

It handles a number of sizes of stock in one set of rolls because every roll is adjustable independently by reason of the universal joints which connect the roll and roll gear shafts. The material is taken from the coil, straightened and cut to accurate lengths.

It will handle brass, steel, aluminum, or any kind of metal, and is made in several sizes and lengths.

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Superior Acid Electric Steel Castings

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Up to 15 Tons

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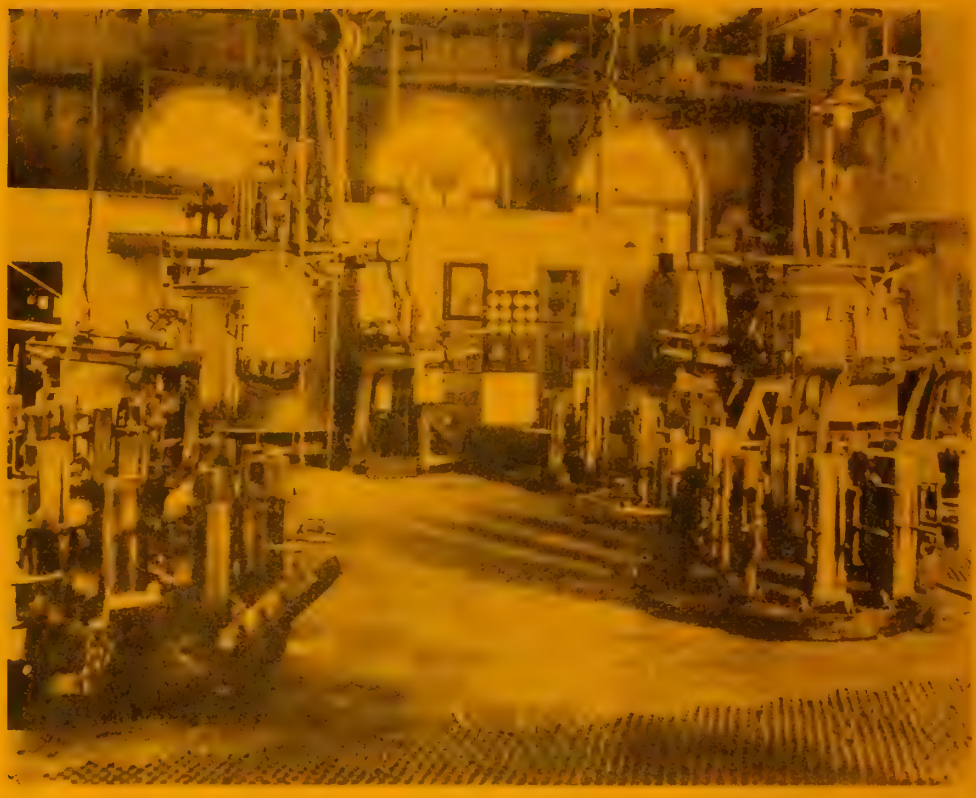
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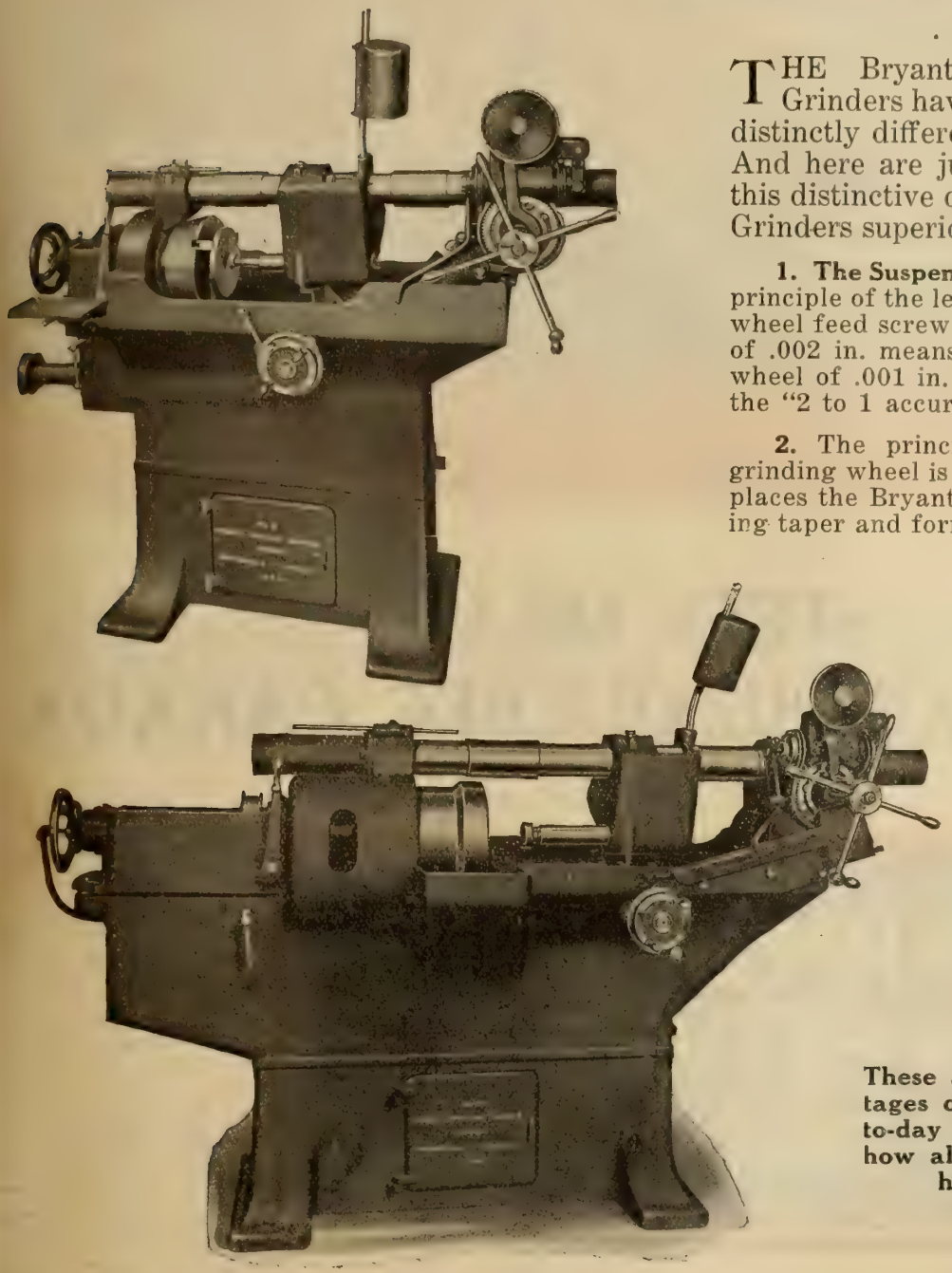


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These are only three of the advantages of the Bryant Design. Write to-day for full particulars and learn how all of them will simplify your hole grinding problems.

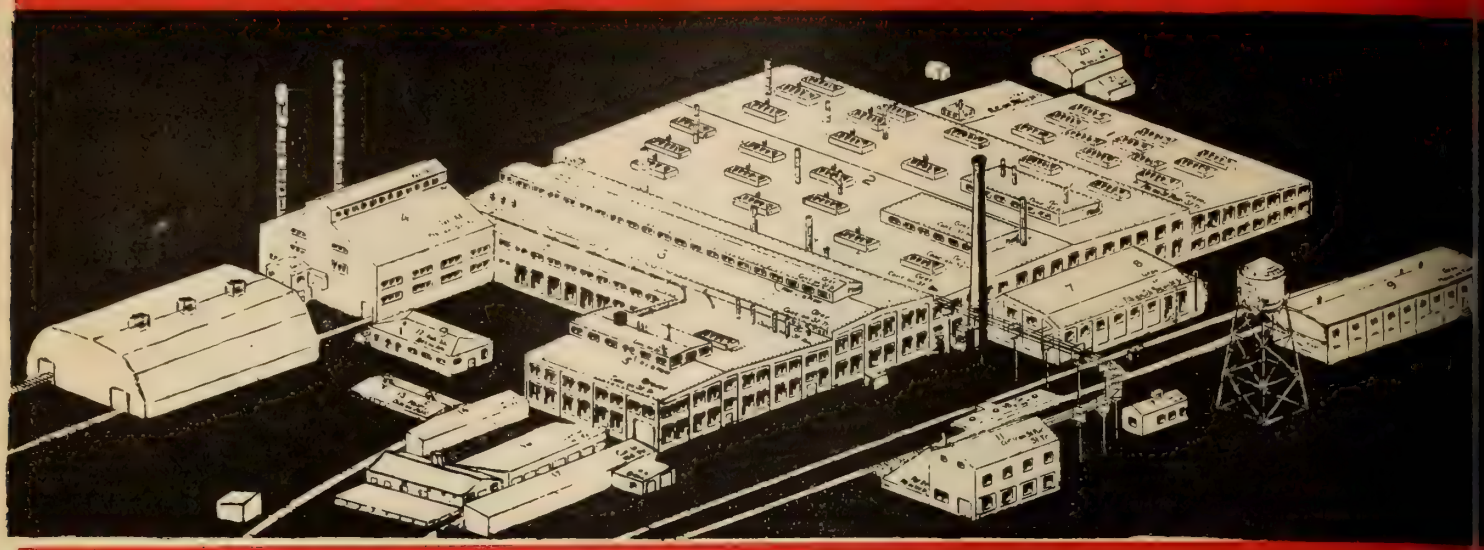
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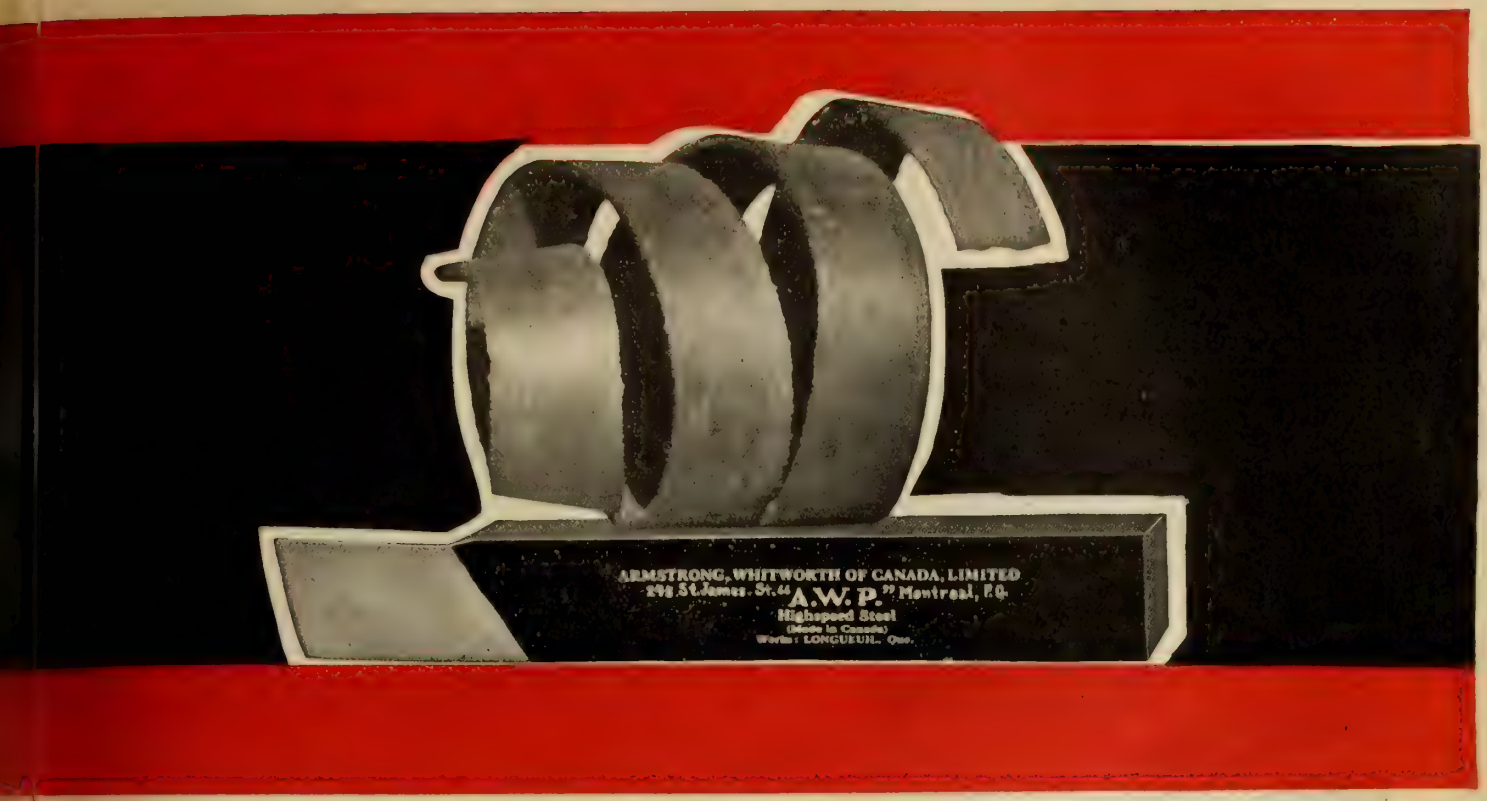
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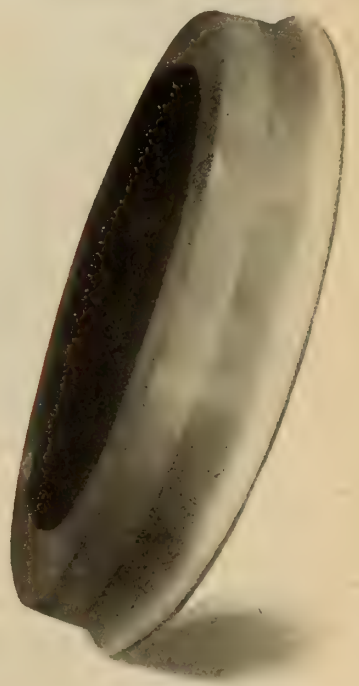
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For Inside Trucking

MADE IN CANADA

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A Typical Operation

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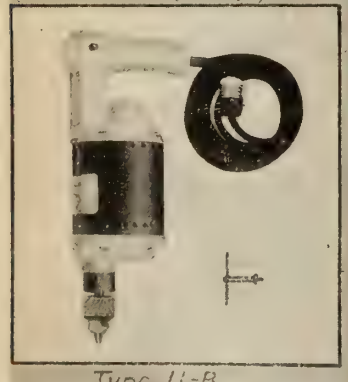
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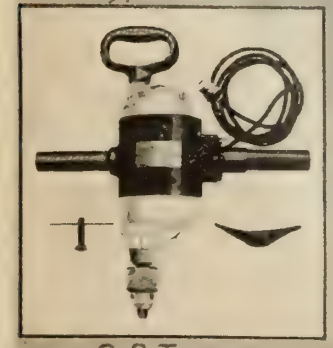
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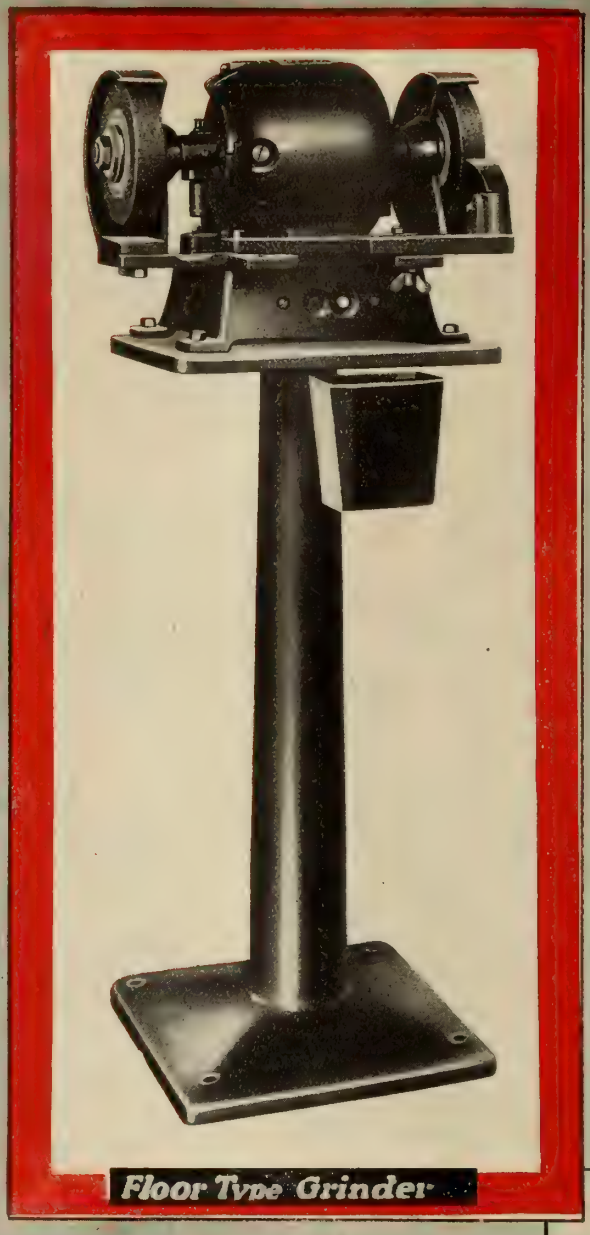
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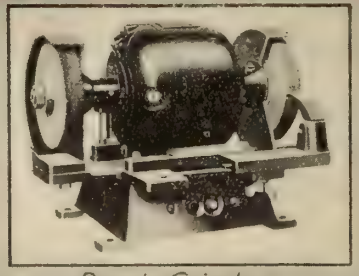
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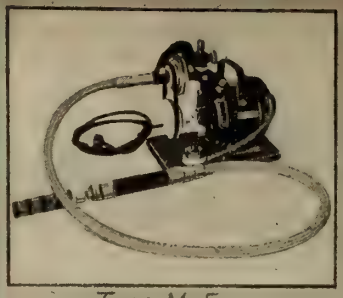
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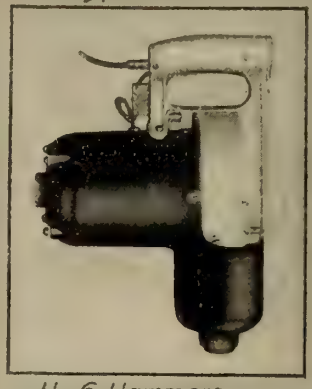
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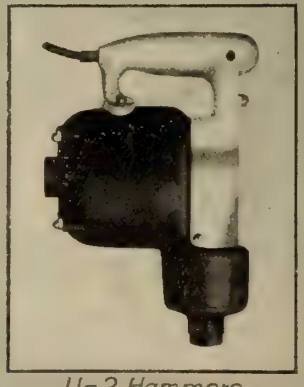
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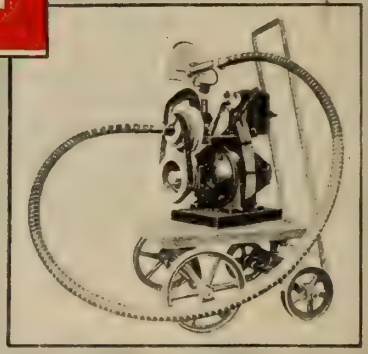
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U-6 Hammers



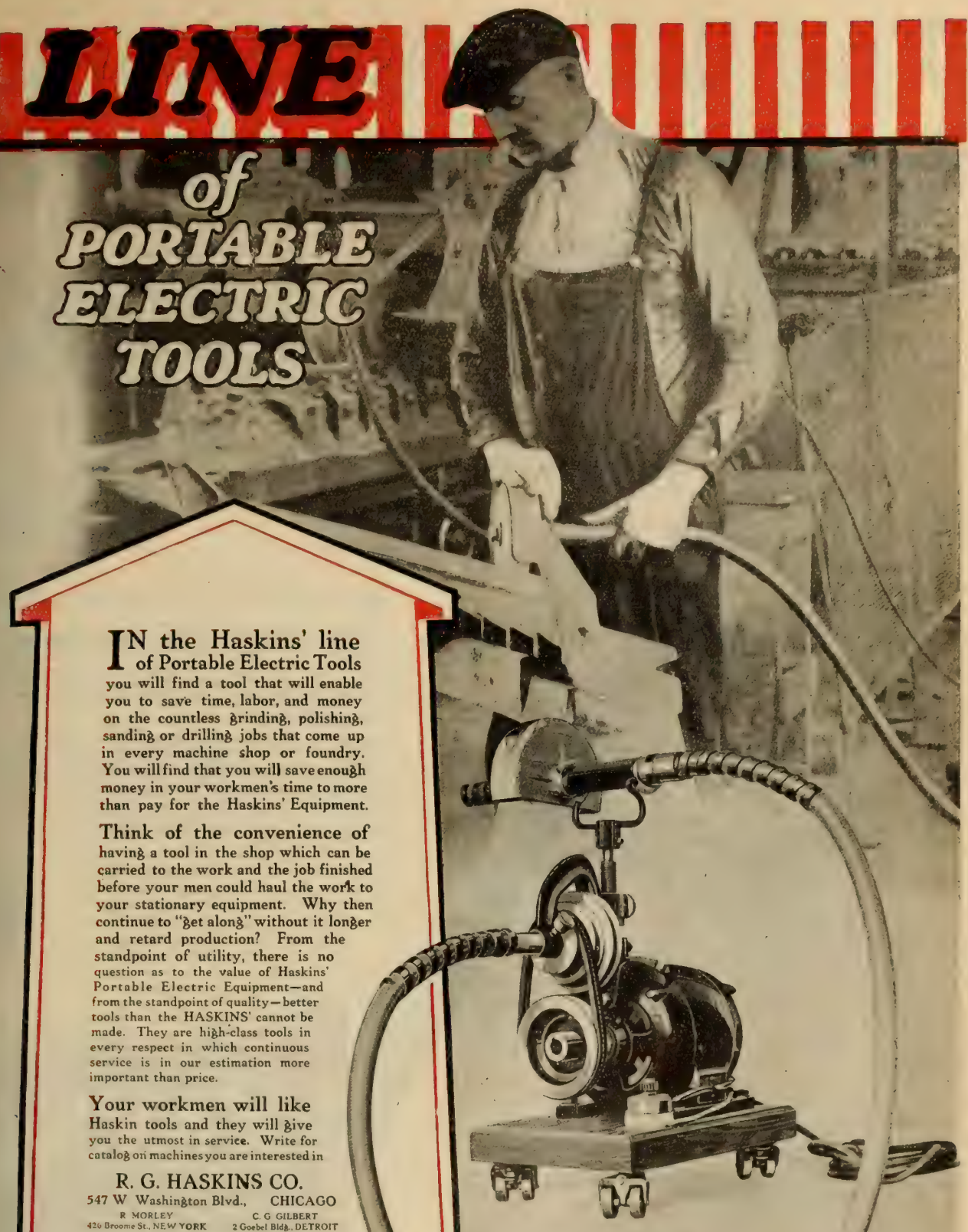
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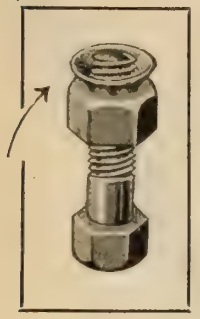
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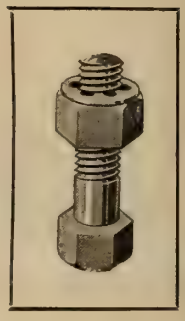
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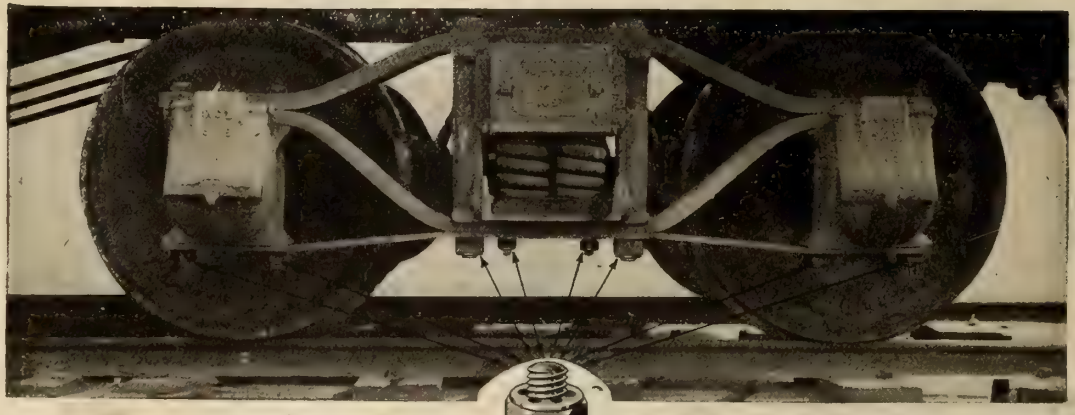




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Hold Tite Nut Lock



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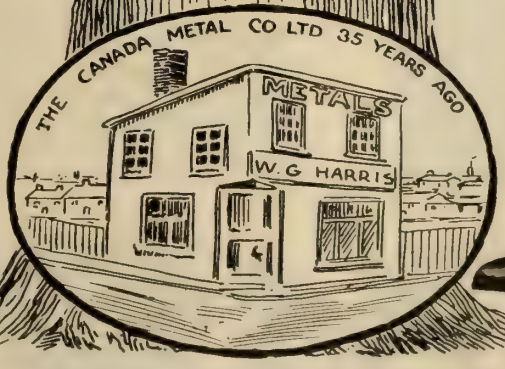
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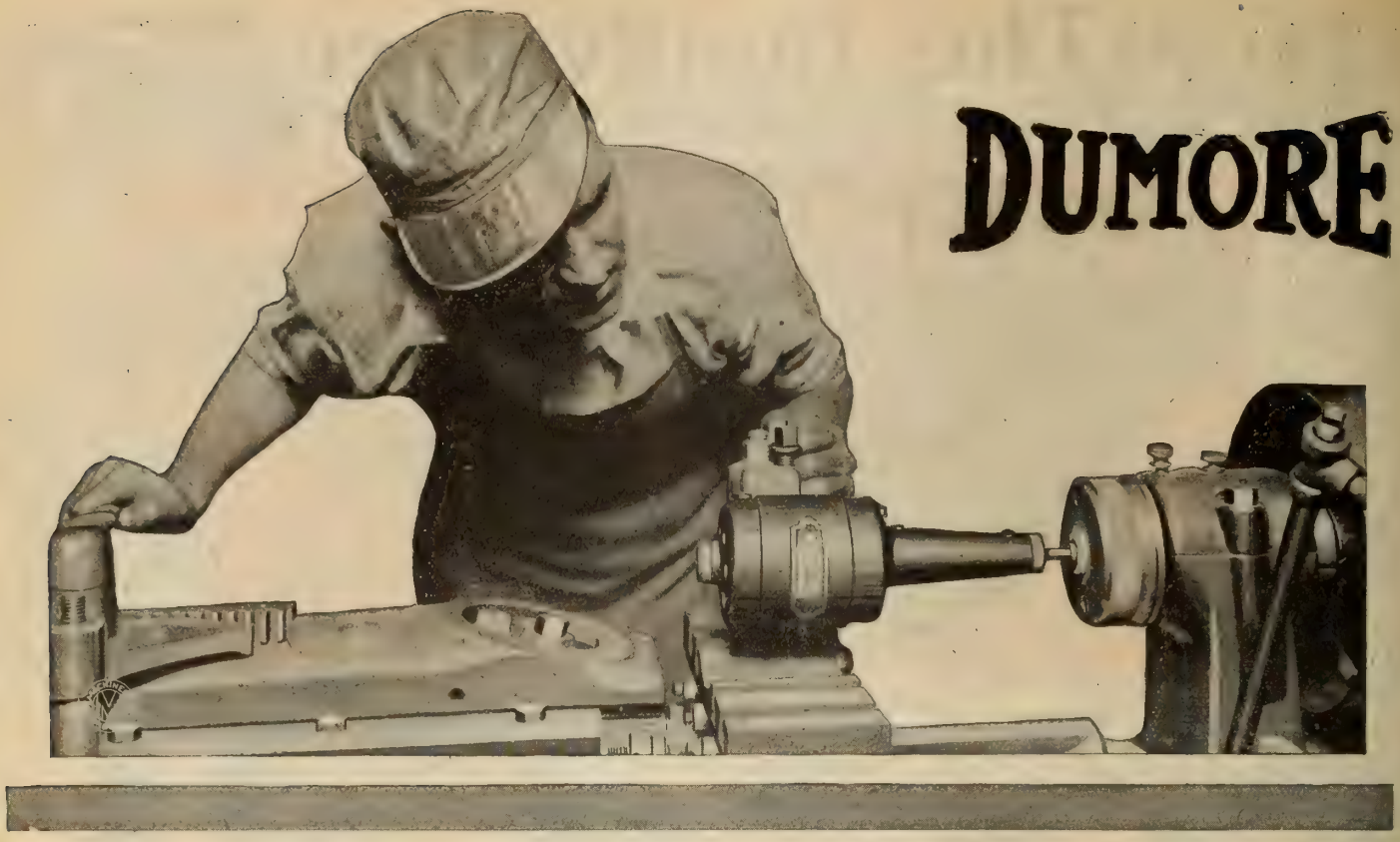
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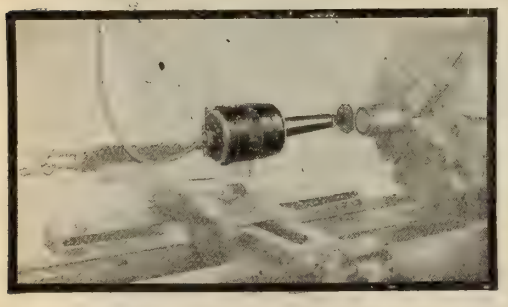
The Largest Manufacturers of WHITE METAL ALLOYS in the Dominion of Canada

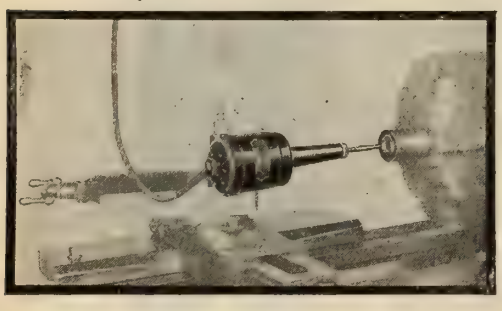
If interested tear out this page and place with letter s to be answered.



DUMORE

One Machine Tool Builder Who





THE Wood Turret Machine Company of Brazil, Indiana, uses the DUMORE High Speed Grinder in many ways which readily show its real merit—in grinding the index bushings in the turret head of the Wood Tilted Turret Lathes for example, and in finishing spindle ends, etc.—the high speed of the DUMORE giving a result much superior to that obtained from slow speed grinders.

These illustrations of horizontal and vertical grinding show how handily the DUMORE may be used under different conditions and on difficult jobs. Here is a tool in which perfect running balance is combined with correct cutting speed. On these two essentials, exclusive DUMORE features, do a high standard of accuracy and excellence of products depend.

DUMORE

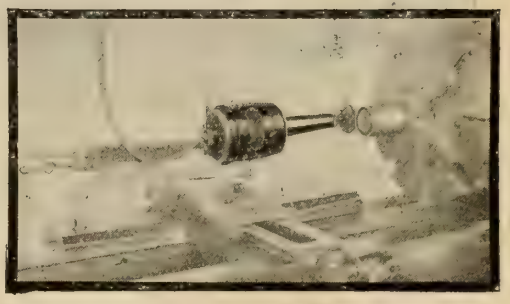
No.1 GRINDER



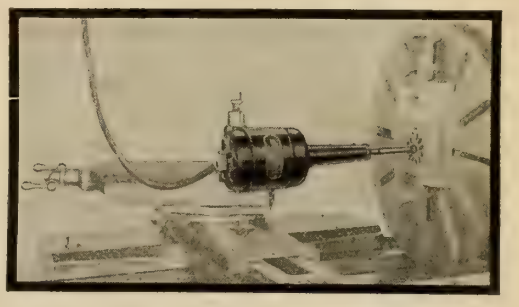
Finds Varied Uses for the DUMORE

Speed	20,000 R.P.M.
Reach of Arm	5½"
Extra Extension	2"
Bearings	SKF
Net Weight	8 lbs.

Motor operated on both direct and alternating currents.



With a DUMORE in the shop there is no costly tearing down of jobs—no wasteful delay. It is set up easily and quickly wherever it is needed. The DUMORE can solve **your** grinding problems. It is the only tool on which you may surely rely for speed and accuracy.

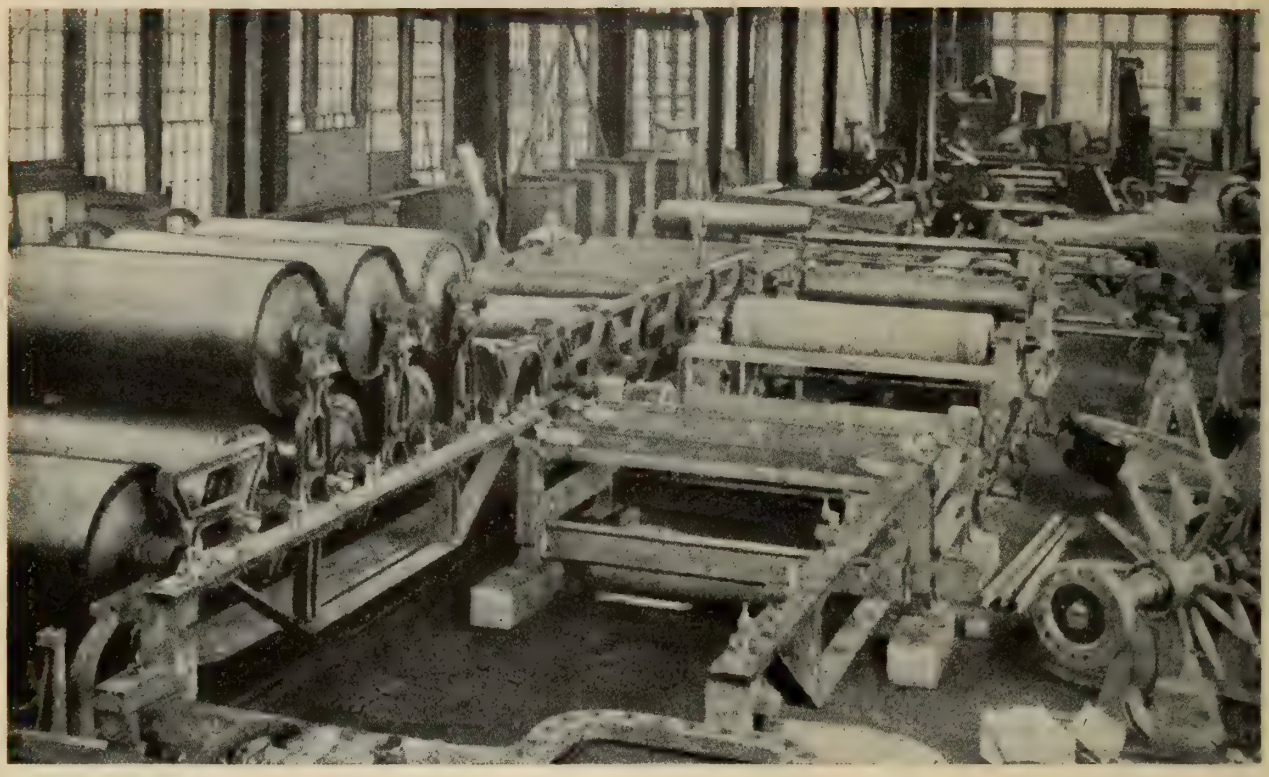


Your Dealer sells DUMORE Grinders.
Ask him for a demonstration.

Wisconsin Electric Company
2919 16th Street, Racine, Wis.

HIGH SPEED GRINDERS

Another Year



General View of Pulp and Paper Department of Dominion Bridge Co., Limited

THE

DOMINION BRIDGE CO., LIMITED

Announce the Organization of the

DOMINION ENGINEERING AND MACHINERY COMPANY, LIMITED

which has been formed to take over the Paper Machinery Department of the

DOMINION BRIDGE CO., LIMITED

The plant of the Dominion Engineering & Machinery Company, Limited, is located at Lachine, P.Q., and occupies the shops where the steel work for the Quebec Bridge was manufactured by the St. Lawrence Bridge Company, Limited. New and up-to-date machinery is being installed in these shops and a modern foundry has been constructed with special equipment for casting dryers.

Dominion Engineering & Machinery Co., Limited

Post Office Address, MONTREAL, P.Q., Canada

of Progress

Coal and Ore Handling Equipment

Electric and Hand Power Travelling Cranes Ship-building and Wharf Cranes



Tank and Plate Work of Every Description

Penstocks Stand Pipes Coal Tipples Head Frames and Equipment for Mining Plants

Coal Handling Bridge Built for Laurentide Co., Ltd., Grand Mere, P.Q.

STEEL STRUCTURES

Railway and Highway Bridges, Buildings, Turntables, Electric and Hand Power Travelling Cranes, Coal and Ore Handling Machinery, Lift Locks and Hydraulic Regulating Gates, Transmission Poles and Towers.

Tank and Plate Work of Every Description

FORGINGS

Gear Cutting and General Machine Work

GRAY IRON CASTINGS

We are prepared to build

Turbo-Blowers, Alternators and Generators

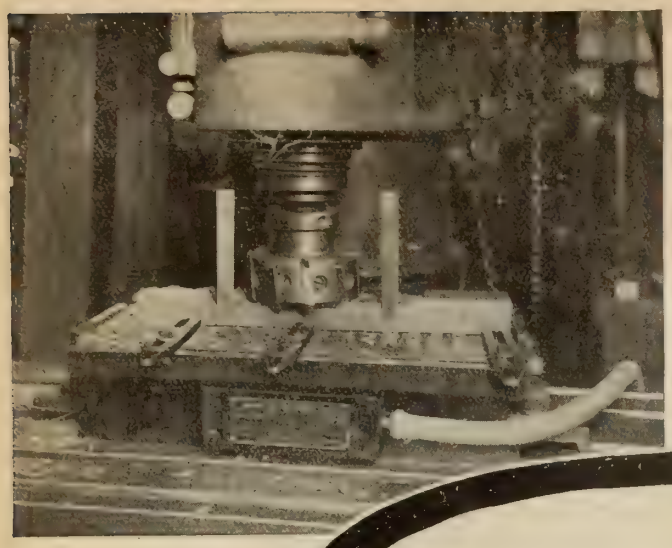
in Any Size to Meet Requirements

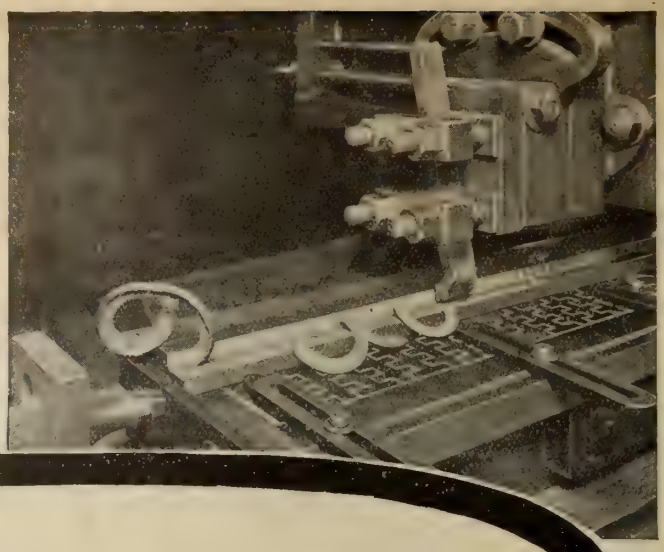
Price, deliveries and full information given upon request.

Dominion Bridge Co., Limited

Post Office Address, MONTREAL, P.Q., Canada

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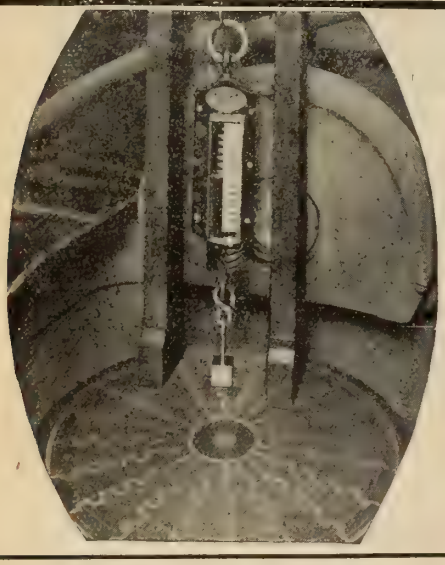




Simmons' Unit-pole Magnetic Chuck in use on Milling and Planing Machines.

As the "Pull" Grew Stronger the Range of Use Grew Greater

FROM 50 TO 100 PER CENT GREATER PULL



Test of 16-in. Rotary Chuck. Scale shows "pull" on one inch cube by 150 pounds which is from 50 to 100 per cent. greater than any other similar chuck. Power Watts 110.

Until the "pull" was strengthened the wonderful time-saving possibilities of the magnetic chuck were limited to comparatively light work. But when the designer of the

Simmons Unit-pole Magnetic Chuck

increased the "pull' to from 50 to 100 per cent. more than any other chuck, he made the production-boosting possibilities of the magnetic chuck available on countless machining operations of the heavier class. The two cuts shown above are illustrative of the holding power of the Simmons UNIT-POLE, but show only two of the many places where these chucks will facilitate chucking and increase production on the heavier class of machining. Write to-day for Bulletin No. 107E.

2093

TAFT-PEIRCE

Woonsocket, R.I., U.S.A.

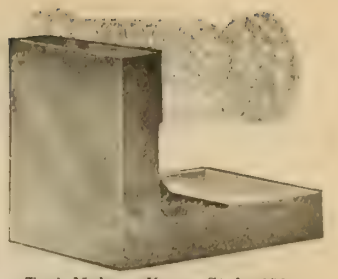
Taft-Peirce

Tool Room and Production Specialties

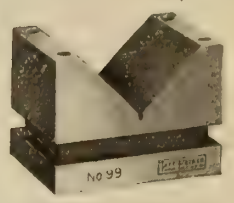
HOW much time is lost daily by your machine operators because of insufficient set-up equipment?

The Taft-Peirce Manufacturing Company offers an unexcelled line of specialties that have proven especially valuable in our own contract service work as well as in the machine shops of a number of prominent machine and tool plants.

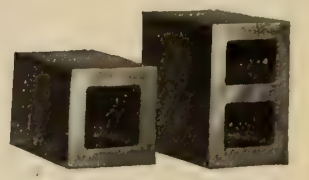
Taft-Peirce standard and special tool service will help your shop to efficiency in inspection and production. Send for Descriptive Bulletin 110 E.



Tool Makers Knee—Style 180



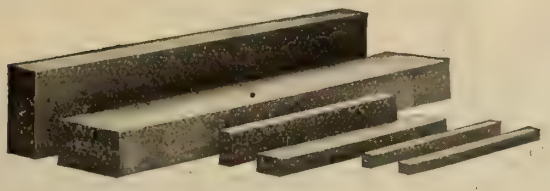
V Block—Style 130



Box Parallels—Style 160



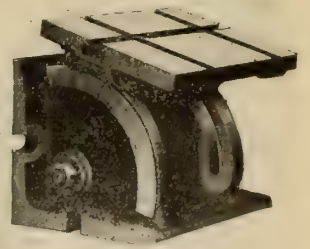
Angle Iron—Style 190



Hardened and Ground Steel Parallels—Style 150



Equalizing Jaw
Style 140

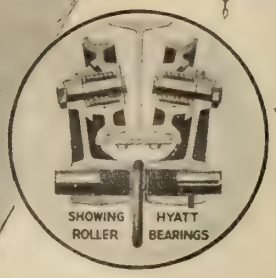


Tool Makers Adjustable Knee
Style 170

2089

TAFT-PEIRCE
Woonsocket, R.I., U.S.A.





Equipment of Proved Quality

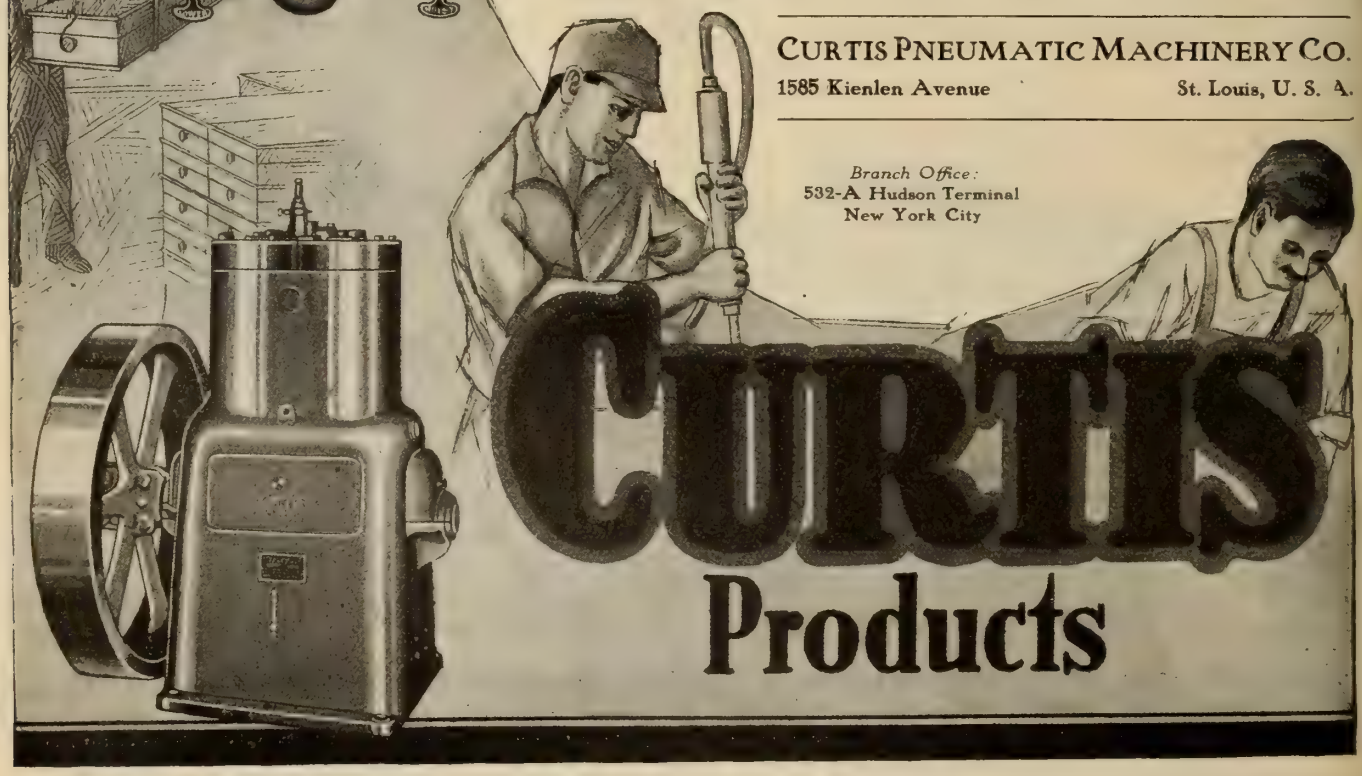
CURTIS Easy Rolling Cranes and Trolleys—Steel Air Hoists—and Controlled Splash Oiling Air Compressors—have proved their effectiveness during many years' actual operation. In leading foundries they have demonstrated their economy, dependability and freedom from trouble.

They are the result of over 25 years' experience in the manufacture of this particular kind of equipment. Good material, correct design and conscientious workmanship assure safe and dependable service under the most exacting operating conditions. Our engineering department is ready to study your problems and recommend equipment best suited to your needs.

Illustrated literature covering mechanical features and other details of Curtis equipment will be sent at your request.

CURTIS PNEUMATIC MACHINERY CO.
1585 Kienlen Avenue St. Louis, U. S. A.

Branch Office:
532-A Hudson Terminal
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CURTIS Products

From Ore to Finished Product



BLOOMS
BILLETS
SLABS

PLATES—The only plate mill in Canada is nearly completed.

RAILS—All sections 10 lbs. to 100 lbs. and up per lineal yard.

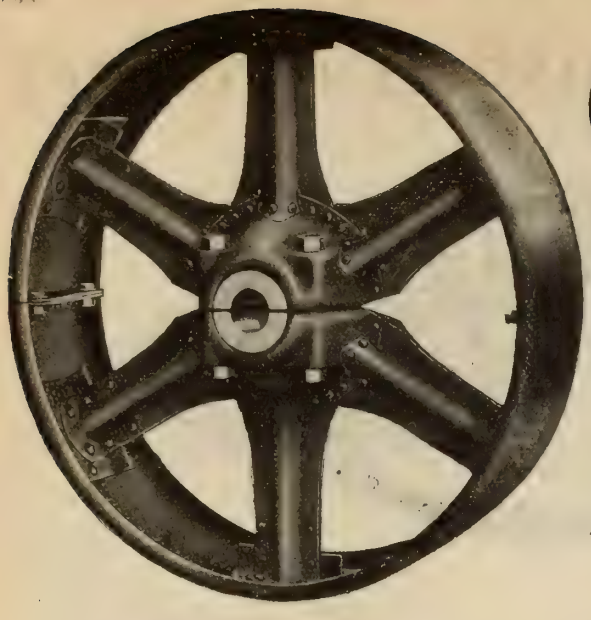
BARS—Rounds, Squares, Flats, etc., etc.

WIRE RODS, WIRE and **NAILS**

Dominion Iron & Steel Company, Limited

Sydney, Nova Scotia

Sales Offices: Montreal Sydney St. John, N. B. London, Eng. Paris

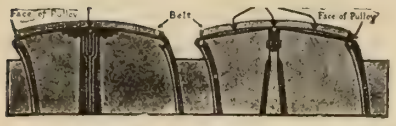


ONEIDA

A good steel pulley Dodge - built and guaranteed

There are probably several places in your factory where steel pulleys will give you better satisfaction and service than pulleys of either iron or wood.

Here are four reasons why you should put Oneida Steel pulleys in these places.



Belt contact on oval and angle crowns

First reason

The Oneida has a grooveless, oval crown. A belt naturally conforms to an oval surface. It requires tension to make it conform to an angle surface. A groove through the center of a pulley reduces the area of belt contact.

Oneida Steel Pulleys transmit power at lowest belt tension, therefore, at least bearing friction, lowest power cost and least strain on belts and equipment.



Strength from double arms

Second reason

Double arms are used in Oneida Pulleys beginning with 8" face in small sizes, 10" face in medium sizes, and 12" face in large sizes. Other steel pulleys use double arms only when the face width reaches 18 inches.



Interwoven hub and arms
Malleable iron yoke

Third reason

The stress at the hub of a pulley is from four to twenty times as great as it is at the rim. This is because the arms act as levers and the hub is at the short end of the lever.

Oneida hubs and arms are interwoven and in the larger sizes, a malleable iron reinforcing yoke is used.

Fourth reason

In all the larger sizes of Oneida Pulleys, a steel plate is used at the junction of arm and rim. This affords an extra rim reinforcement and allows for the use of larger and stronger rivets. All metals through which rivets pass are countersunk. This eliminates shearing strain.



Rim plates and
Interlocked metals

The Oneida dealer in your locality is a good man to know. He will give you service to the utmost of his ability. That's why he has the Oneida line. Ask us his name -- we prefer to receive your order through him.

Dodge Sales and Engineering Company

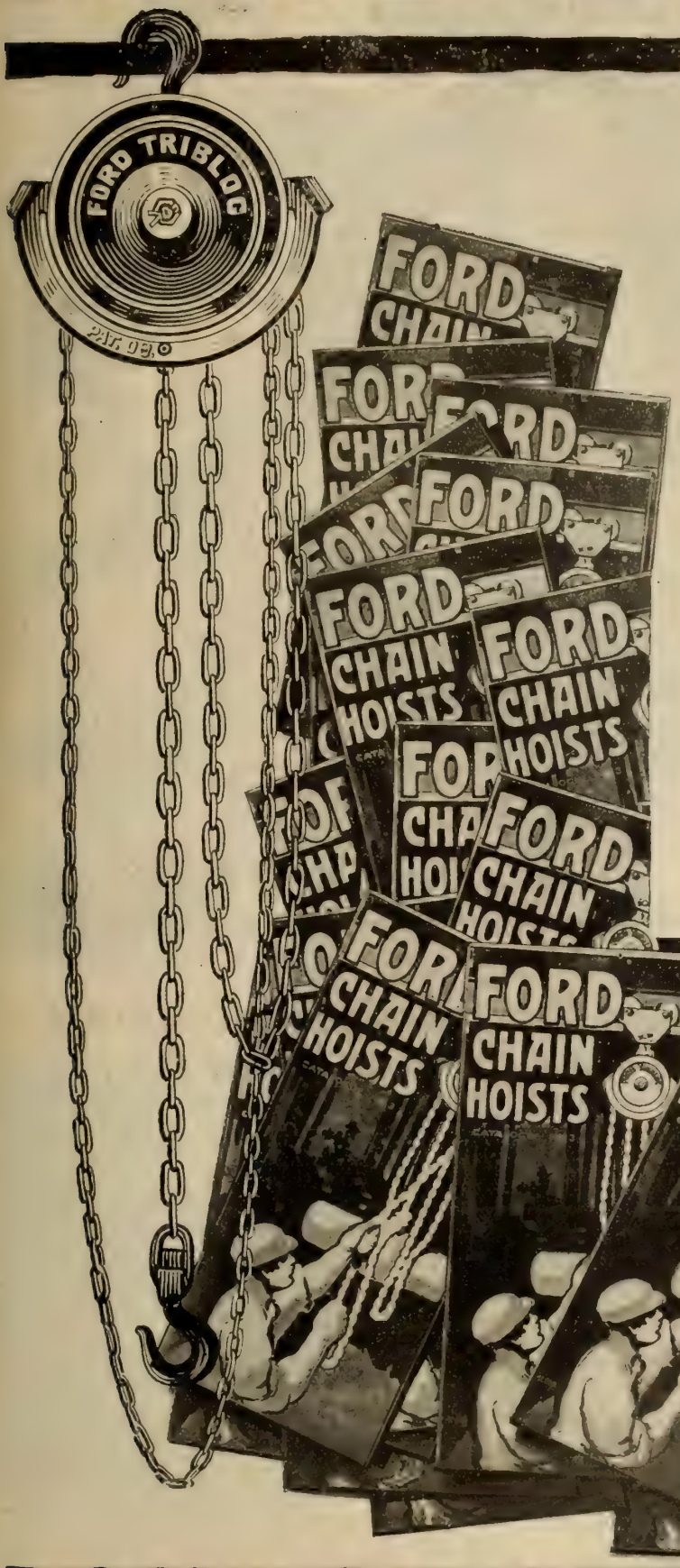
Distributor of the Products of the Dodge Manufacturing Company

General Offices and Works: Mishawaka, Indiana

Distributors in Canada:

Canadian Fairbanks-Morse Company, Limited

FORD TRIBLOC



—holds up its end!

Around the foundry, machine shop, warehouse — from the crucible to the mould, above, the turning lathes, at the stock piles, a frail chain tackle spells danger—but a

FORD TRIBLOC

spells safety

BECAUSE a man may operate the hoist from any angle without fouling the chain. The Loop Hand Chain Guide (patented) prevents the chain from "gagging" or overriding the flange.

BECAUSE of the Enclosed Planetary Gearing, which is of steel.

BECAUSE the Chains and Hooks are made from carefully selected steel stock and subjected to most rigid inspection and test before they are installed.

A FORD TRIBLOC will "hold up its end" on the job. Anything that can be hung from a hook may be moved—TRIBLOCS to lift any weight from one-quarter to forty tons may be furnished.

A FORD TRIBLOC booklet tells the story in an interesting way, and gives the facts in a few words.

Ask for Catalog No. 3

FORD CHAIN BLOCK CO.
2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK U.S.A.

PARIS BRUSSELS TURIN BARCELONA RIO DE JANEIRO

2160-0



Solve Factory Problems for Farm Implements

THE Franklin Die-Casting Process can help solve the post-war problems of labor scarcity and lack of equipment.

Many parts which Canadian Manufacturers are now machining could be die-cast with greater speed and at less cost. Producers can also save themselves heavy investments in new equipment and overhead by planning to make use of Franklin Die-Castings in their new products or increased output. In the farm implement field their use in incubators, milkers, separators, stationary and tractor engines has improved these products and helped to widen their distribution.

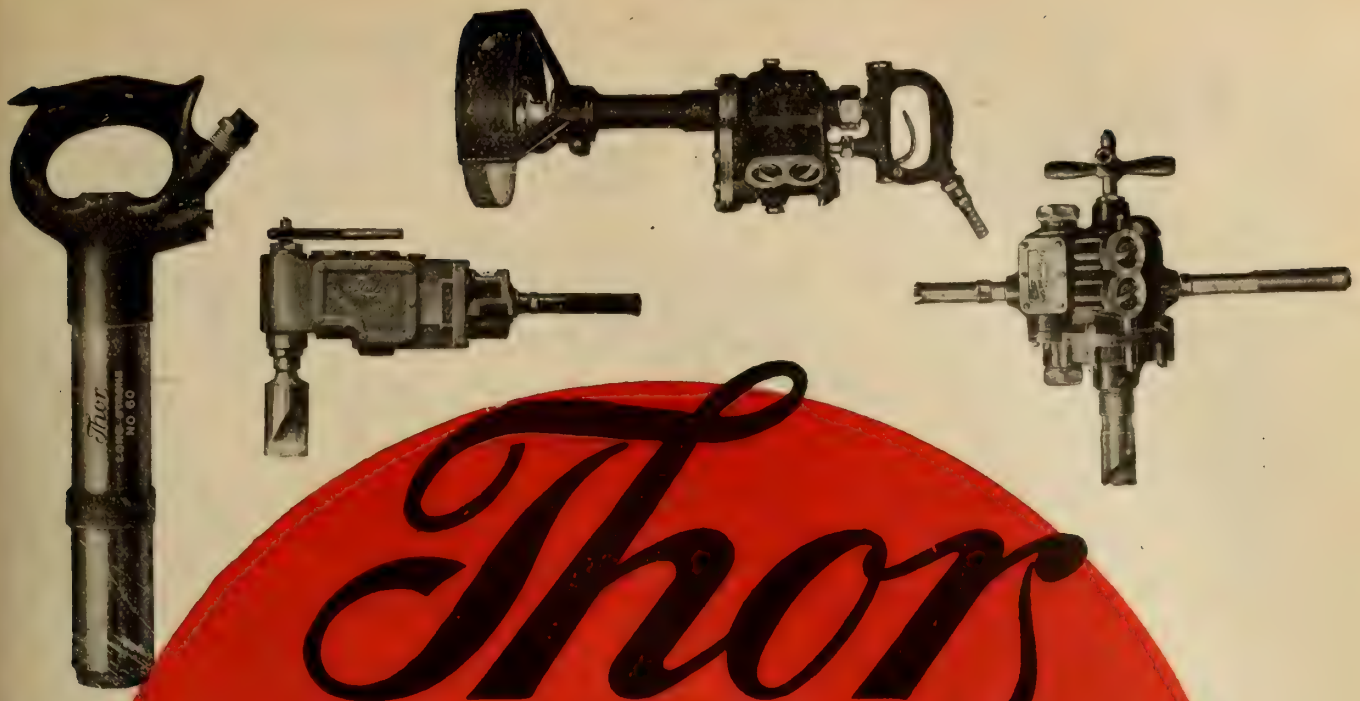
Accurate die-castings, made from Aluminum, Tin, Lead and Zinc base alloys are turned out with greater speed and uniformity than machined parts, and cut the costs in time, labor and equipment. Often intricate shapes can be successfully die-cast which have hitherto been impractical to make at all or at least impossible to machine in one piece.

Our engineers, from 28 years' experience, can advise on the practical application of die-castings to special cases, suggest simplifications and recommend the right alloy.

Estimates made from samples, drawings or blue prints.
Send for booklet.

Franklin Die-Casting Corporation

Gifford and Magnolia Streets **Syracuse, N.Y., U. S. A.**



Thor

There is a THOR tool built especially for your work

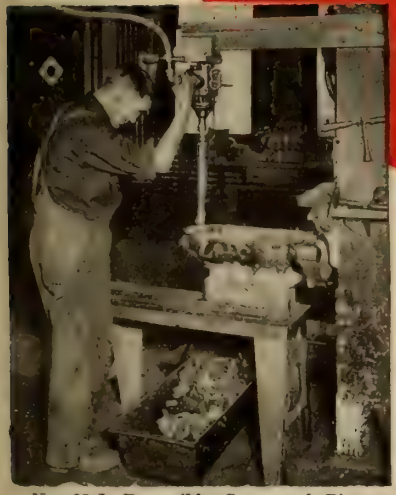


Try it—and watch it save you time and labor and increase your production.

Thor are the only air drills made in America having Corliss valves, roller bearings and one-piece pressed Vanadium steel connecting rods. Also equipped with telescopic screw-feed and removable crank chamber plate.

Independent Pneumatic Tool Company
334 St. James St., Montreal

Toronto: 32 Front St. W.
Winnipeg: 123 Bannatyne Ave. E.
Vancouver: 1142 Homer St.



No. 32-L Reversible Compound Piston Air Drill driving ¾-inch studs in Motor Crank case.

Pneumatic Drills, Grinders and Hammers

If interested tear out this page and place with letter s to be answered.

Manufacturers of
EXTRUDED BRASS and BRONZE RODS and SECTIONS.

HOT BRASS and BRONZE STAMPINGS and PRESSINGS.

GUN METAL, PHOSPHOR BRONZE, BRASS and WHITE METAL INGOTS.

CHILL CAST PHOSPHOR BRONZE BARS.

PHOSPHOR COPPER and PHOSPHOR TIN.

ANTI-FRICTION METALS.

ON THE LISTS OF ADMIRALTY, WAR OFFICE, CROWN AGENTS FOR COLONIES, ETC.

McKECHNIE BROTHERS, LTD.

COPPER SMELTERS
BRASS ROD, STAMPINGS AND METAL MANUFACTURERS

ROTTON PARK STREET
BIRMINGHAM, ENGLAND

Smelting Works: WIDNES, LANCS.

Have pleasure in announcing that they have appointed

Thomas Moore & Son
224 Lemoine Street, Montreal

Their Sole Canadian Agents

We guarantee to manufacture according to your own analysis and specifications.

Send us your Blue Prints, Sketch or Samples for quotation.

We excel in quantity production.

TRADE MARK



TRADE MARK

FOR BAND SAW MACHINES

WESTERN PINE MFG. CO.
Manufacturers
Lumber, Sash and Doors
Spokane, Wash.

Magnolia Metal Co. May 28, 1919.

Gentlemen:—As nearly as I can recall, I began using MAGNOLIA METAL twenty-seven years ago. I have, from time to time, used other babbitts, but have always come back to using Magnolia.

The most important machines around this plant are babbitted with MAGNOLIA METAL. The MAGNOLIA lined bearings on one American Band Resaw, doing extra heavy work, show no particular wear after seven years of continuous service.

I have always given particular attention to the melting and pouring of babbitt metal, preparing the boxes to be babbitted, cleaning well and heating the box. I never mix the scrap babbitt from the old box with the new metal. Always heat the metal only enough that it browns a white pine stick easily and pour while hot.

Yours very truly,
WESTERN PINE MFG. CO.
John Pfeffer, Supt.

SOLD BY LEADING DEALERS EVERYWHERE OR
MAGNOLIA METAL CO.
OFFICE AND FACTORY
225 St. Ambroise St., MONTREAL

(ALLOYED UNDER THE STANLEY PROCESS)

LIONROYAL BABBITT

for your bearings

BRITISH SMELTING & REFINING CO. LIMITED

BABBITTS
SOLDERS
PHOSPHOR TIN
PHOSPHOR COPPER
ETC.
LEAD, COPPER, TIN,
SPELTER, ALUMINUM,
& OTHER METALS

BRITISH SMELTING & REFINING Co. LIMITED.
DRUMMOND BUILDING MONTREAL

SPECIAL MACHINERY

LET US BE YOUR TOOL ROOM

BROWN ENGINEERING SERVICE means up-to-the-minute equipment and highly skilled workmen which enables us to build high quality and long service into all the special machinery and tools we make.

We have one of the best equipped plants in Canada with superior quality machine tools of every description, including a complete line of millers, grinding machinery, Johannsen blocks, etc.

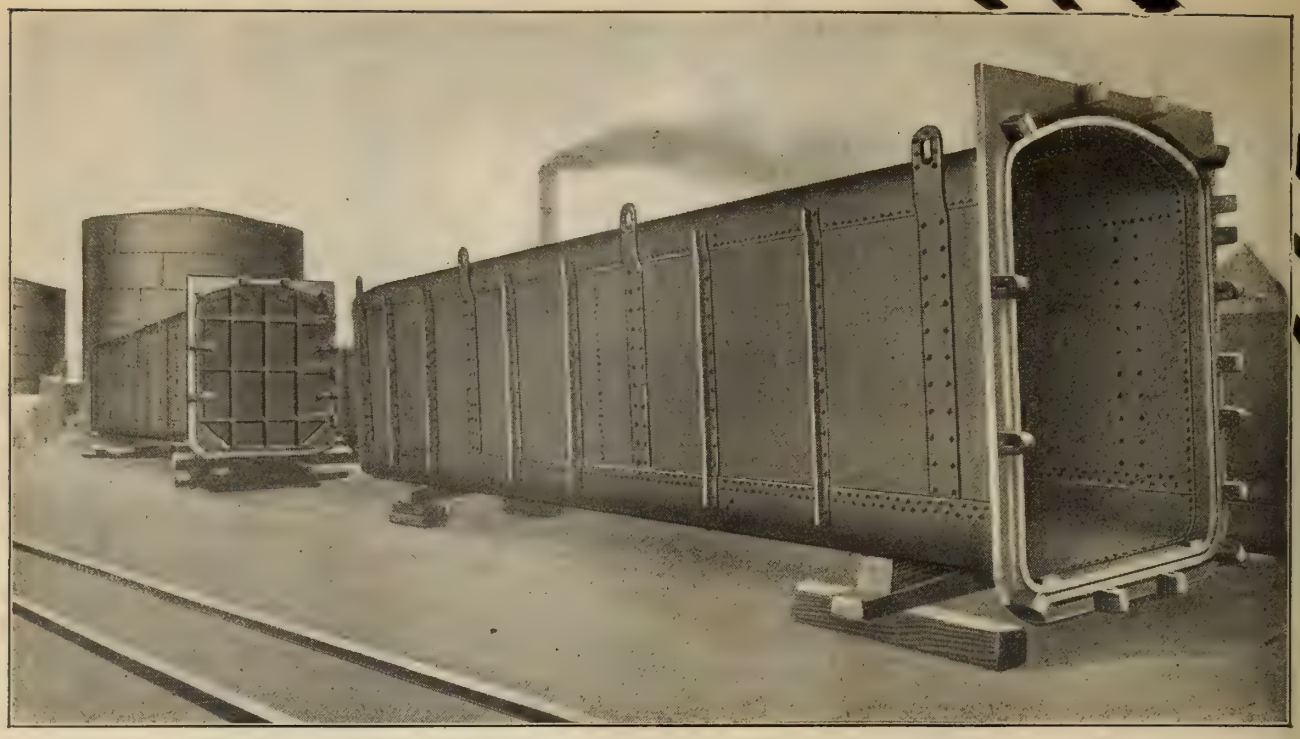
Send us your blue prints for estimates when you require any kind of special machinery, gauges, punches, jigs, dies, precision tools, etc.

MADE IN BR·EN·CO CANADA

Brown Engineering Corporation LIMITED, TORONTO

415-419 King St., W. Tel. Adel. 425

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STEEL TANKS

IF you require a steel storage or pressure tank, consult us. Every tank we make is made to rigid specifications and is guaranteed to give service and satisfaction.

Here are a few of the lines we design and build:

STORAGE TANKS
For Oil Refineries
Oil Distributing Stations
Sugar Refineries
Distilleries
Packing Houses
Soap Works
Chemical Works
Asphalt Plants
Cyanide Installations
Varnish Works

PRESSURE TANKS
Filter Tanks
Air Receivers
Hydro-pneumatic Tanks
Hot Water Tanks
Blow-off Tanks
Steam Jacketed Tanks

BINS AND HOPPERS
For Coal and Ash Handling Systems
Grain Elevators
Mines and Quarries

SMOKE STACKS

BOILER BREECHINGS

RIVETED STEEL PIPE

PENSTOCKS

CAISSONS

TANK WAGONS

Heavy & Light
STEEL
PLATE
CONSTRUCTION
Erected
Anywhere

THE
TORONTO IRON WORKS
LIMITED

Head Office:
Royal Bank Building

Works:
Cherry Street

"DOUBLE MUSHET"



High Speed Steel
H. S. Twist Drills
Bridge Reamers

"TITANIC"

Carbon Steels
Gauge Steels
Alloy Steels

TAYLOR IRON

GRANTED 1833

SAM'L OSBORN (CANADA) LTD.
MONTREAL

Write for Our Stock List

Stocks Also Carried:

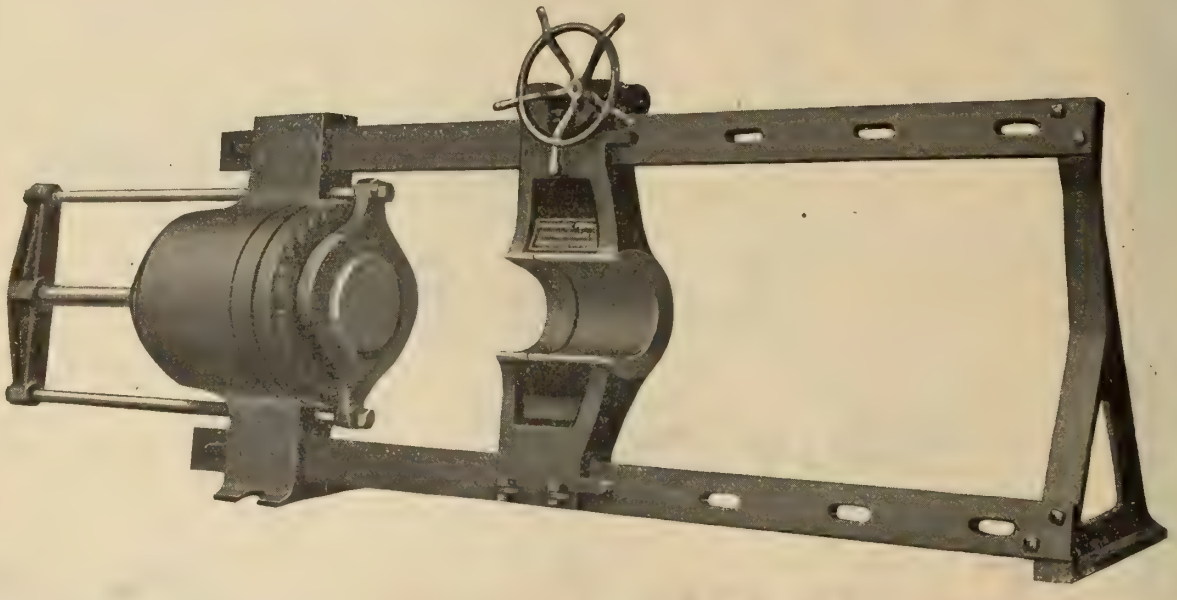
TORONTO WINNIPEG CALGARY VANCOUVER

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HYDRAULIC PRESSES

ALSO

Hydraulic Pumps and Accumulators



Hydraulic Wheel Press with Pull Back Cylinder.
Built for the Canadian National Railways, Quebec.

MADE IN CANADA

William R. Perrin, Limited

TORONTO, ONTARIO



Where Canadian Crocker-Wheeler apparatus is made

The modern design and excellent construction of Canadian Crocker-Wheeler apparatus is well known and has been still further improved in recent development work. The following apparatus is now all made by the Canadian Crocker-Wheeler Company at their St. Catharines plant.

Service Transformers	A. C. Generators
Power Transformers	D. C. Generators
Induction Motors	D. C. Motors.

We are distributors of this apparatus, which can be obtained from any of our branch houses, standard equipment being carried in stock.

Northern Electric Company
LIMITED

Montreal Quebec Toronto Winnipeg Edmonton
Halifax Ottawa London Regina Calgary Vancouver

If interested tear out this page and place with letters to be answered.

"Van Dorn"

Portable Electric Drills



Portable Electric Drills make quick and easy work of repair jobs. Your Millwright should have one by all means.

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Aikenhead Hardware Co.
Toronto.
Wilkinson & Kompass,
Hamilton.
C. A. Strelinger & Co.,
of Windsor, Ont.

The Van Dorn Electric Tool Co.
Cleveland, Ohio
U. S. A.

Canadian Agents
R. E. T. PRINGLE, Limited
95 King St. East, Toronto, Canada
401 New Birks Building
Montreal, Canada

MEMBER OF
NEW YORK U.S.A.

STAFF

"Van Dorn"

Bench Drill Stand



A single factory delay right now may cost you many times the price of one or more of these tools, beside the annoyance of idle machines and delayed production. Order yours today.

Stocks carried by:
Aikenhead Hardware Co. Toronto.
Wilkinson & Kompass, Hamilton.
C. A. Strelinger & Co., of Windsor, Ont.

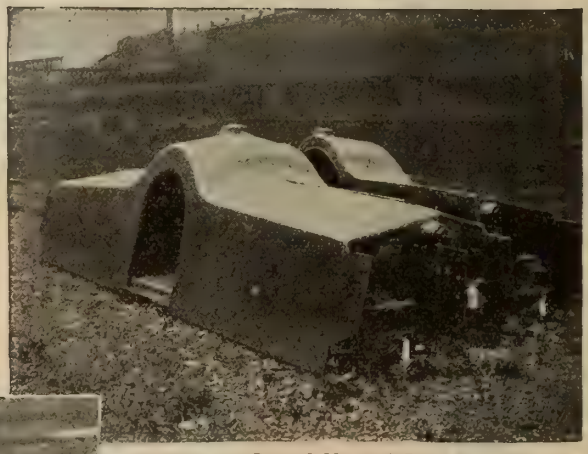
The Van Dorn Electric Tool Co.
Cleveland, Ohio
U. S. A.

Canadian Agents:
R. E. T. Pringle Limited
95 King Street East, Toronto Canada
401 New Birks Building,
Montreal, Canada

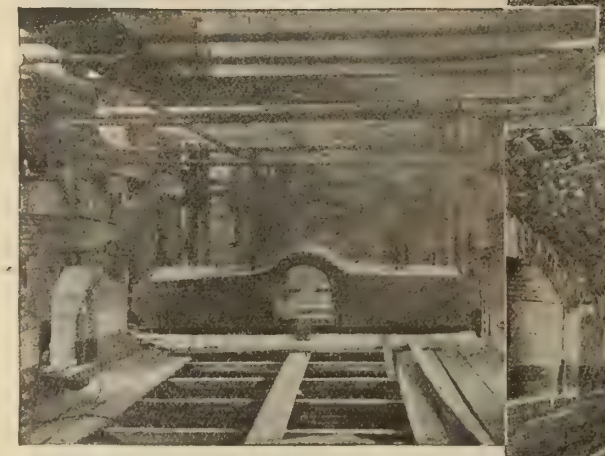
MEMBER OF
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ARMCO IRON WELDING RODS

AMERICAN ARMCO INGOT IRON



General View of Ports



Interior of Furnace Before Laying Brick



Interior of Furnace After Laying Brick

Water-Cooled Ports for Open Hearth Furnaces Welded with Armco Iron Welding Rods

The water-cooled ports illustrated were manufactured by Blaw-Knox Company, Pittsburgh, for the American Rolling Mill Company, Middletown, O. The ports mounted in furnaces as shown are subjected to a temperature of 3000° F. on one side and the temperature of water at approximately 60° F. on the other. All welds made with ARMCO IRON Welding Rods.

ARMCO IRON Welding Rods are furnished for both electric arc welding and oxy-acetylene welding. They are the purest commercial iron in the world—99.84 per cent. pure iron content (minimum) guaranteed. They flow freely, weld evenly, and lend themselves perfectly to finishing operations. Ask our nearest branch office for addresses of ARMCO distributors in your locality.

PAGE STEEL & WIRE CO

Established 1883 as Page Woven Wire Fence Co.

STEEL AND WIRE PAGE QUALITY PRODUCTS

Makers of ARMCO IRON Welding Rods and Electrical Wire; "Copperweld" Copper Clad Steel Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stock Room Partitions; Architectural Iron.

Plants: Monessen, Pa., and Adrian, Mich.

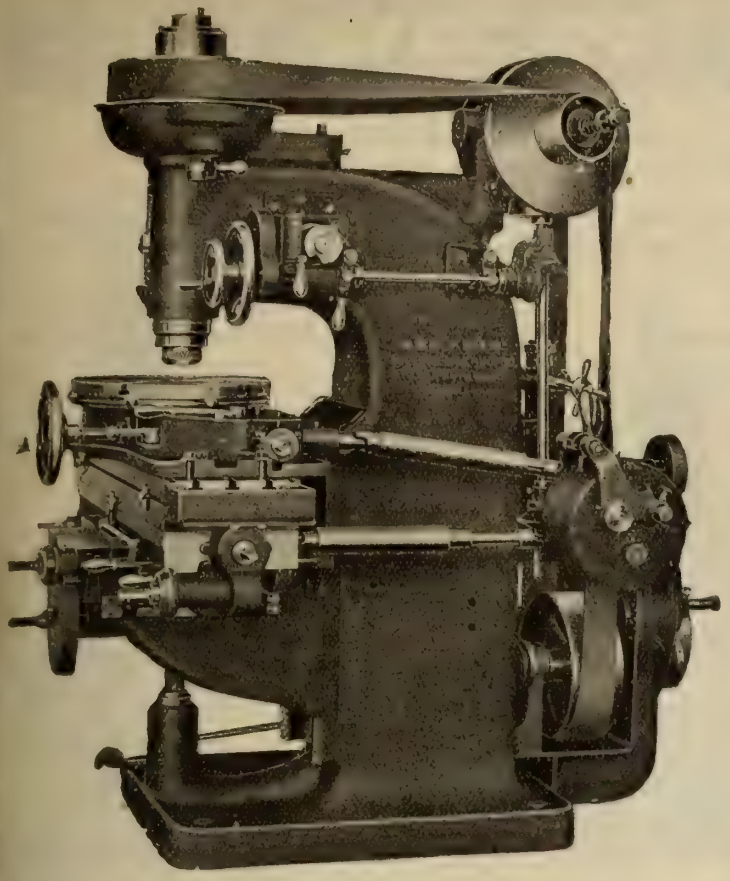
SALES OFFICES: 30 CHURCH STREET, NEW YORK

CHICAGO. 29 South La Salle Street DETROIT: Book Building

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65



BECKER
BELT DRIVEN
MILLERS

"THE MACHINE THAT GIVES THE SMOOTH FINISH"

All gear driven spindles lack flexibility and induce vibration through the unavoidable progressive development of back lash between gears resulting in vibration and hammer action which has a crumbling effect upon the cutter teeth and leaves chatter marks on the finished work.

With the Becker Elastic Belt Drive this gearing is eliminated.

Write for Circular 0-702.

Becker Milling Machine Co.
HYDE PARK, BOSTON, MASS.

A. R. Williams Machinery Co., Ltd., 64 Front St. W., Toronto
Rudel-Belnap Machinery Co., Ltd., 137 McGill St., Montreal

Heat Under Accurate Control

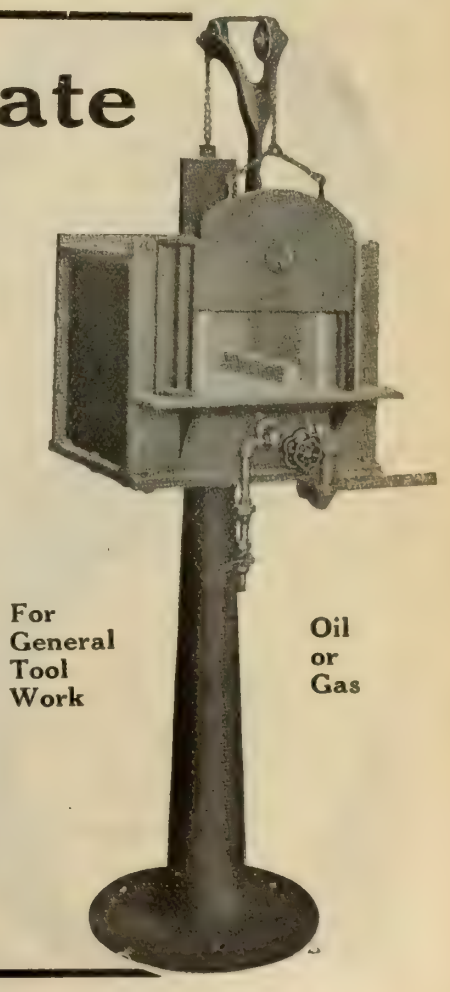
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



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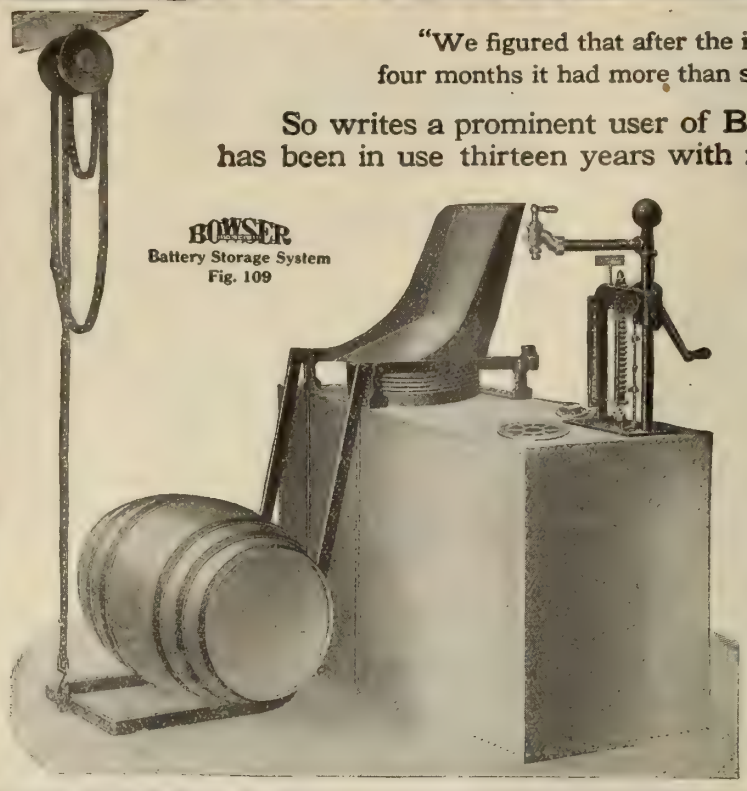
Oil or Gas

Bellevue Industrial Furnace Company
Julius C. Hinz, President
703 Bellevue Ave. - Detroit, Mich.
Representatives in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

Why Don't You Save Too!

"We figured that after the installation had been in three or four months it had more than saved its entire cost."

So writes a prominent user of **Bowser Oil Storage.** Their equipment has been in use thirteen years with no operating troubles or upkeep cost.



BOWSER
Battery Storage System
Fig. 109

If you are not using Bowser Storage Systems for your oils you are losing money every day.

BOWSER ESTABLISHED 1885

Systems Do Save

You can save the Bowser Way. Our literature shows how. Write for it at once.

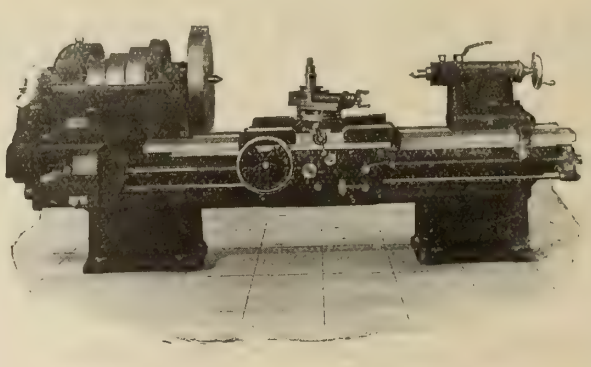
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Sidney for Service

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include step cone, double bra gear, semi-quick chan gear lathe, built on 10 bed. This lathe also fu nished with quick-chan gears. Bed lengths ava able: 10, 12, 14, 16, 18 a 20 ft.

The Sidney Line compris 15-inch, 17-inch, 19-in 25-inch, 27-inch, 30-in and 36-inch lathes, whi are adaptable to the fine tool room work or t heaviest duty shipyard factory rapid producti work.

Heavy Duty Engine Lathes

The Sidney Tool Company, Sidney, Ohi

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
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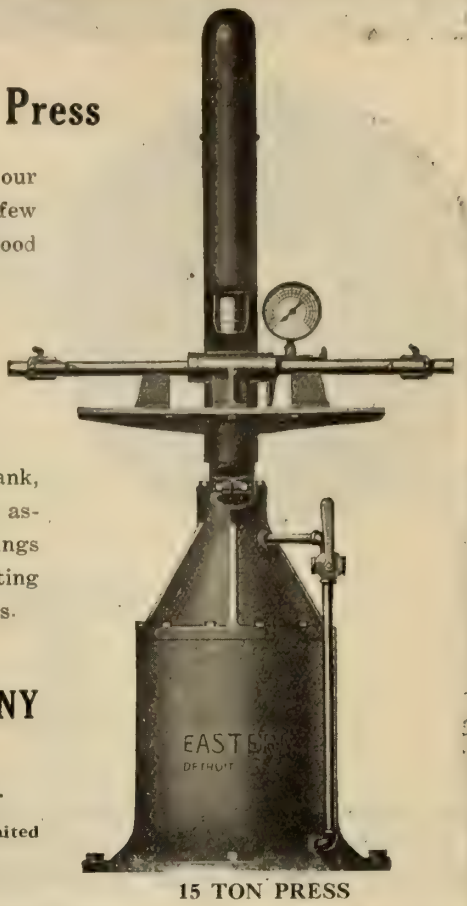
A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

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Canadian Representative: F. F. Barber Machinery Co., Limited
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Square and Hexagon Holes

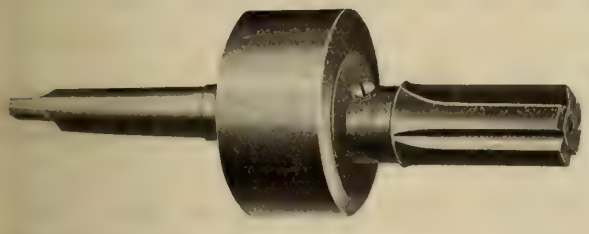
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Chipped in 10 Hours



Drilled in 10 Minutes

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Globe Angular Hole Drilling Tools have saved 95 per cent. on some jobs.

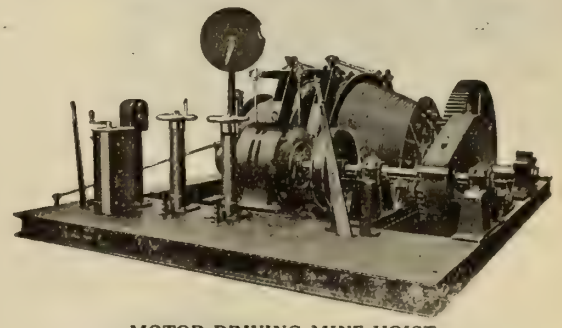
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HAVE WORLD WIDE REPUTATION FOR

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SEND YOUR ENQUIRIES TO

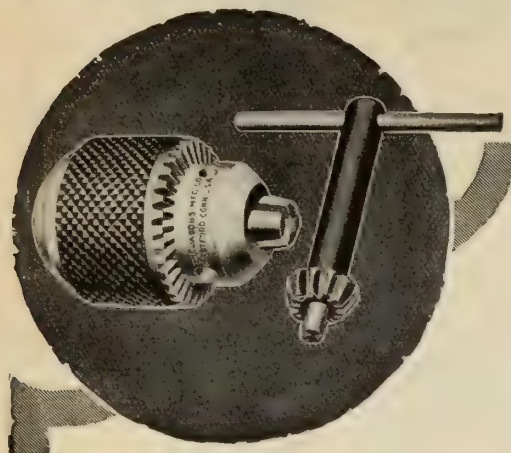
The Lancashire Dynamo & Motor Co., of Canada, Limited

Head Office and Works
45 NIAGARA ST
TORONTO

Branch Office
602 NEW BIRKS BLDG.
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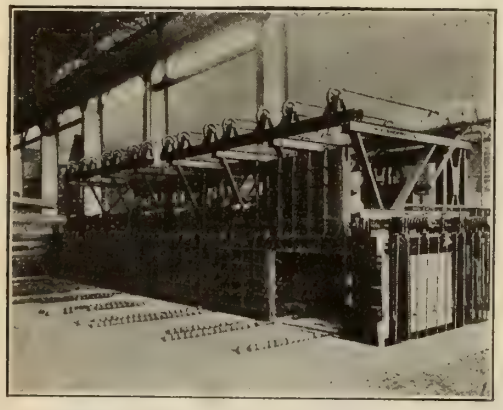
The Mechanic Knows



The workman expects Jacobs as the drill chuck on his machine. He knows it does not break drills, that the toothed sleeve and key make adjusting easy and safe.

Are your machines Jacobs equipped?

THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.



INCREASED WIDTH—INCREASED EARNINGS

This **Side-Opening Heat-Treatment Furnace** proved so advantageous that it's now being widened from 36 ft. to 105 ft.

Movable partitions permit division into separate chambers 5 ft. wide. Pieces larger than 5 ft. may be heat-treated by withdrawing one or more of the partitions.

Furnace is underfired and provided with **Rockwell preheaters.** Fuel consumption (oil or gas) extremely low due to efficient application of heat and utilization of heat in spent gases.

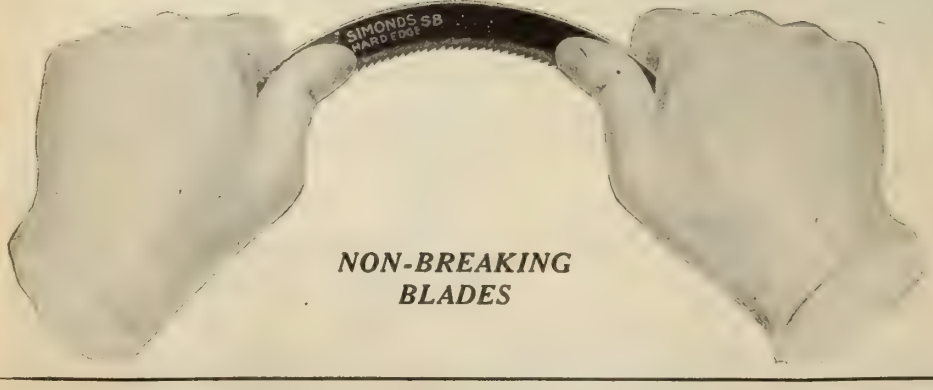
W. S. ROCKWELL CO. INDUSTRIAL ESTABLISHED 1888 FURNACES 50 CHURCH ST. NEW YORK

Bulletin 200-T *tells all about this Side-Opening Heat-Treatment Furnace*

Canadian Representative, R. J. McLEAN, 604 Southam Bldg,. Montreal, P.Q.

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CUT CUTTING COST



NON-BREAKING BLADES

For Machine or Hand Use
Any Size or Length

Simonds Canada Saw Co.
LIMITED
MONTREAL
St. John Vancouver

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

WHERE INDUSTRY FLOURISHES

The City of GALT Ontario

The status of the "Manchester of Canada" as a manufacturing centre, is the best proof of the advantages it offers. Noted for its large plants engaged in the manufacture of machinery and machine tools, engines and boilers, machine screws, pumps, boots and shoes, knitted goods, and other lines, it is furthermore the hub of one of the busiest sections in busy Western Ontario.

Located on the Grand river, and on the C.P.R., G.T.R., Galt and Elmira Railway, Grand River, and the Lake Erie and Northern Electric Railways, it is not only in close touch with a thriving district, whence male and female help is available, but these railway facilities give the city unequalled advantages in the matter of country-wide transportation.

Abundance of Hydro-Electric power, natural gas, fine residential section, good schools and every advantage of a modern, progressive city.

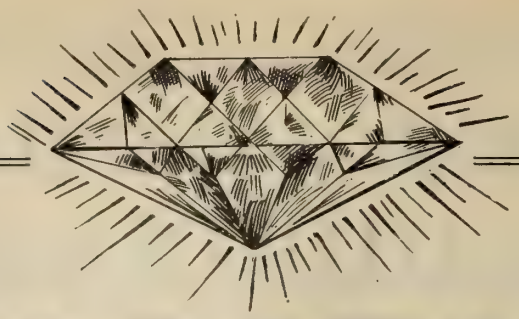
Your industry located here, will be close to the heart of industrial Canada.

For further particulars address:

J. P. Jaffray

Galt Chamber of Commerce

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Brown and Sharpe



Norton

We manufacture diamond tools for every mechanical purpose. Our copper and brass mountings are guaranteed to hold up even under the most severe and unusual service.

Diamonds, to give the best service, must be properly set.

Let us do your mounting.

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88 West Pitt St., Windsor, Ont.
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The City of Sarnia

The Gateway to the Upper Lakes

Mr. Manufacturer, study the location of Sarnia on the map and ask yourself this question:

COULD SARNIA BE BETTER LOCATED?

With our frontyard an immense waterway, in fact, the world's most industrious waterway, and with transportation by rail so accessible, there is nothing in location whereby Sarnia could be bettered.

In the past, Sarnia has been built substantially with none of the semblance of a boom. In the future, Sarnia will be built as substantially with the boom which is only possible by its citizens' investment of faith in its bright future. These are days of reconstruction; we stand at the portals of a new day and see just ahead of us important strides in progress.

A summary of the advantages Sarnia offers to manufacturers seeking sites for new plants:

Sarnia is located at the gateway of the West. It is the terminus of the Grand Trunk Railway, with the world-famous St. Clair Tunnel, and the headquarters of the Northern Navigation Co. and P.M. Rly. Best shipping facilities and abundance of electric power at reasonable rates.

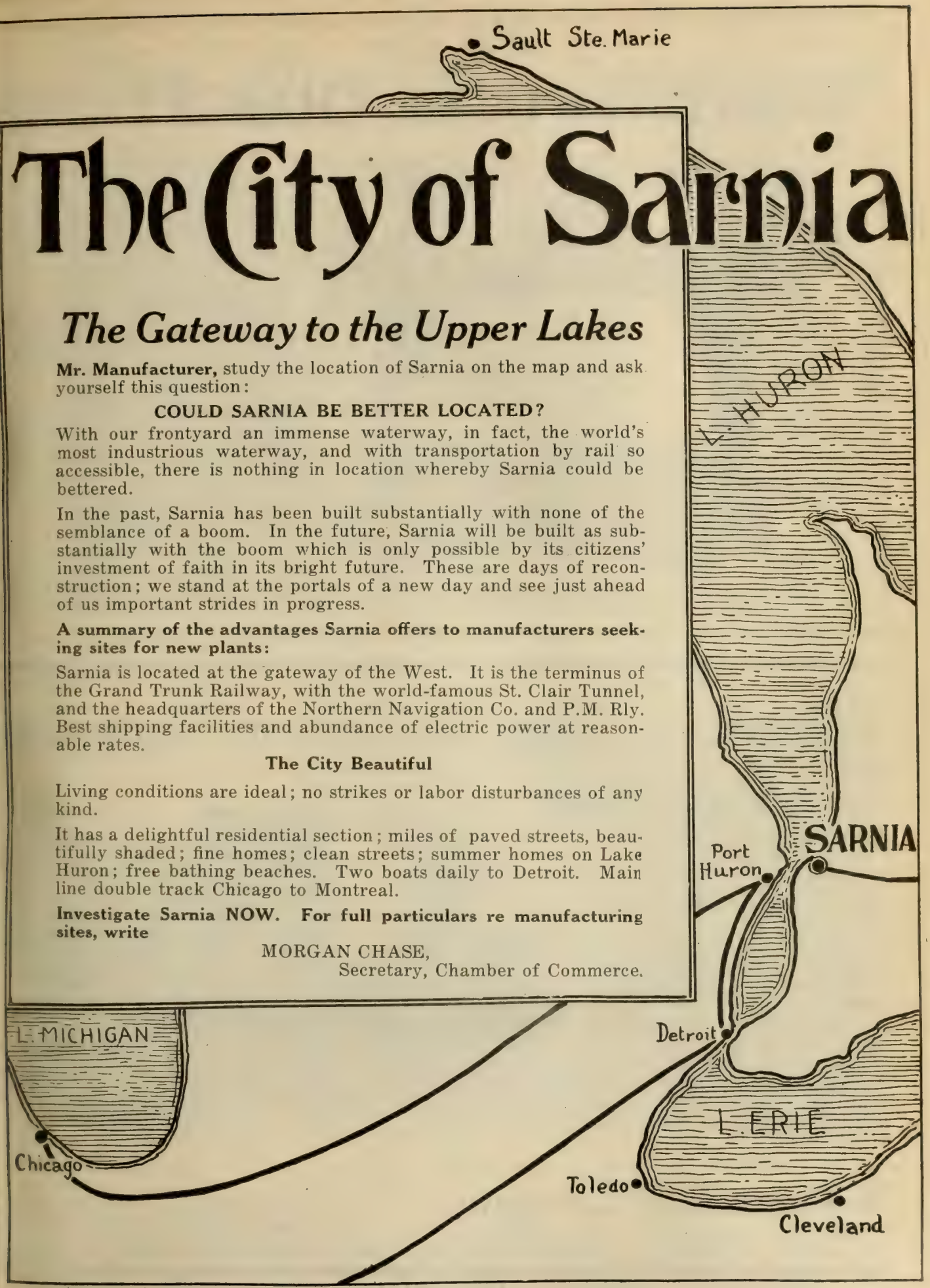
The City Beautiful

Living conditions are ideal; no strikes or labor disturbances of any kind.

It has a delightful residential section; miles of paved streets, beautifully shaded; fine homes; clean streets; summer homes on Lake Huron; free bathing beaches. Two boats daily to Detroit. Main line double track Chicago to Montreal.

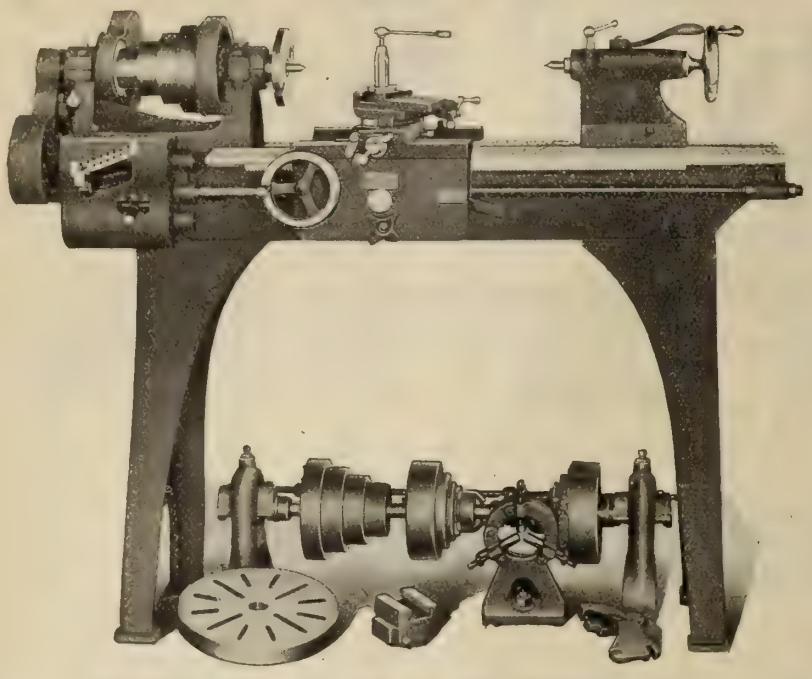
Investigate Sarnia NOW. For full particulars re manufacturing sites, write

MORGAN CHASE,
Secretary, Chamber of Commerce.



THE NEW

WORCESTER QUICK CHANGE LATHE



12″ and 14″ Swing
Cone or Geared Head
Single Pulley or Motor Drive
Quick or Semi-Quick Change Feed

In placing this lathe on the market we are offering to the machine tool trade a lathe which is the utmost in efficiency and reliability.

Its exceptional accuracy and durability, together with the small floor space which it requires makes this lathe very desirable and unsurpassed for tool room work.

Write for Complete Information.

WORCESTER LATHE CO., WORCESTER, MASS.

Wherever Pipe is Cut or Threaded Economically

The probability is two to one that it's a

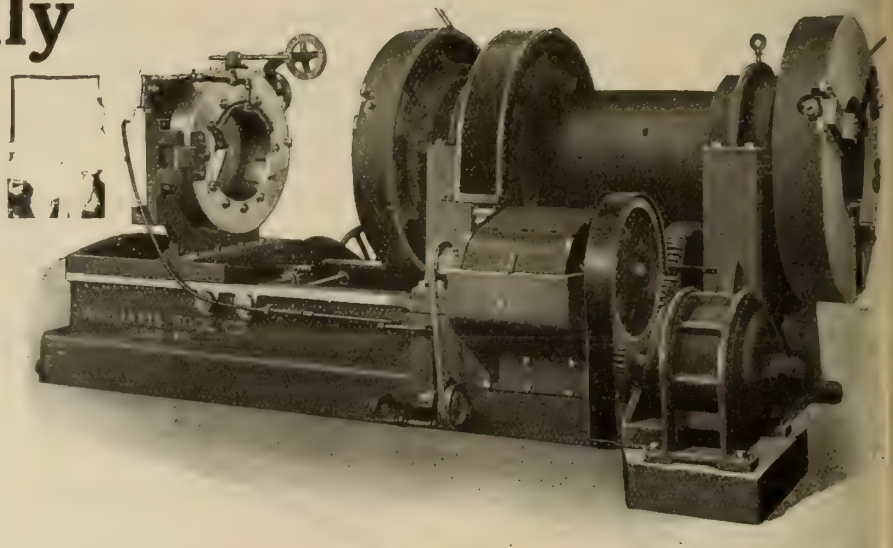
Williams Pipe Machine

that's on the job.

For in approximately two-thirds of all the larger plants in this country Williams' Pipe Machines are used.

It was the Williams Pipe Machine that brought highest honors home from the Panama Exposition.

The Machine illustrated has a capacity of 21½″ to 12″. Also nine other sizes to meet your requirements.



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Williams Tool Company

Erie - Penn. - U.S.A.

Canadian Agents: The A. R. Williams Machinery Co., Limited, Toronto, Canada

European Agents: Universal Machinery Co. London - Eng.

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

—for Quality Castings



6-Ton VOLTA Furnace in Running Position

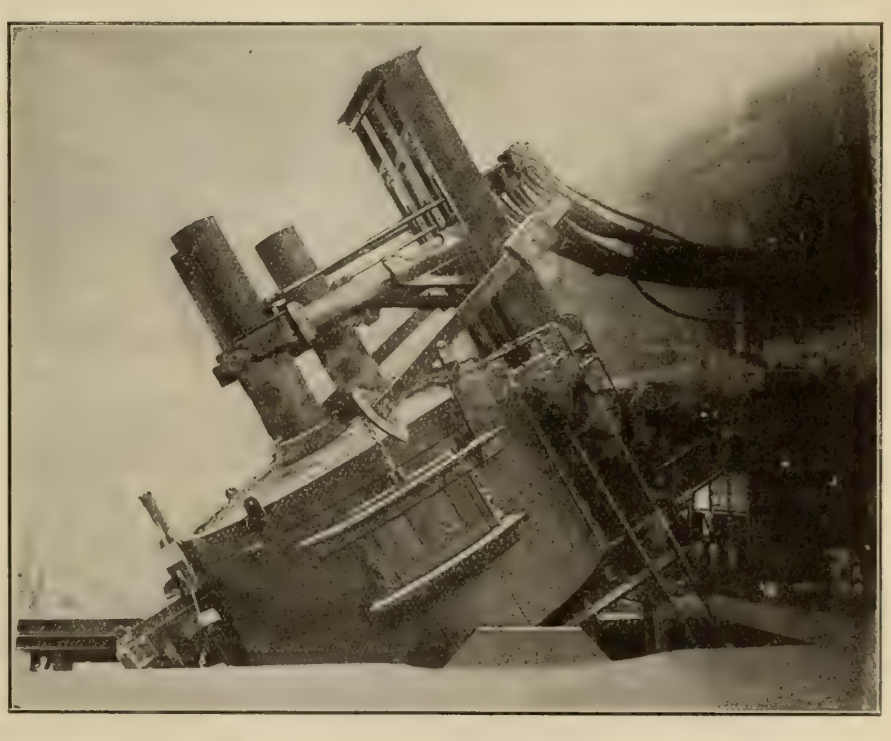
Besides the economy involved, the production of steel castings with the electric furnace means a particularly fine grained product, with a perfect control of its chemical composition.

VOLTA Electric Furnace

A consistent producer of high grade steel castings of superior physical properties.
For the most economical results an electric furnace must be designed with all the modern operating devices which help in eliminating delays between heats and excessive length of time in refining.

Volta Electric Furnaces are built in capacities from one to six tons and nothing is spared in their design and equipment to make them efficient. Our ten years of extensive experience in electric furnace work has made us competent to advise you on your steel casting proposition.

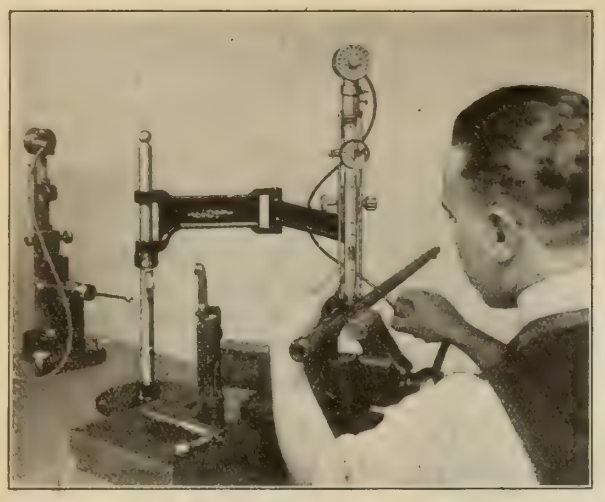
The accompanying illustrations show the Volta furnaces recently installed by us for the Dominion Foundries and Steel Co., Hamilton, where the two six-ton furnaces have replaced the open hearth furnace for the production of high-grade steel castings and alloy steels.



6-Ton VOLTA Furnace in Pouring Position

Volta Manufacturing Co., Limited, Welland, Ont.

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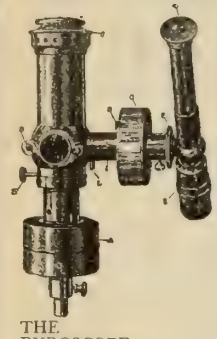


FOR HARDNESS TESTING

Absolutely uniform quality in manufacturing large quantities of duplicate parts is impossible; but it is easy to eliminate all parts that are not up to a reasonable standard of quality by means of

The Scleroscope

This simple, easily-operated device gages the hardness of metal by a practical development of the rebound principle, which is infallible. It requires no skill and is adapted for use on all classes and sizes of work.



THE PYROSCOPE

The Pyroscope

A practical and reliable indicator of the temperature of metal in process of heat treatment and requires little skill to use. Used by the Government and the best firms.

Ask for our booklet, which describes the Scleroscope and Pyroscope in detail.

Shore Instrument & Mfg. Company
555-7 West 22nd St., New York
Agents for Canada: A. R. Williams Machinery Company, Limited, Toronto, Canada.

Announcing—



WILLIAMS' "Vulcan" Forged-Cutter Tool Holders give unequalled service to those who prefer the solid, forged-type of cutting tool. Each Holder, by the mere insertion of small High Speed Forged-Cutters is adapted to the heaviest service on Lathe, Planer, etc.

The economy and convenience of this line, when installed as standard shop equipment, is at once apparent, as all blacksmith work, to say nothing of the very considerable investment necessitated by heavy, solid forged-tools of costly High Speed Steel, is eliminated.

Absolutely simple in construction, yet possessing all the advantages of the solid tool without its expense.

Cutters, drop-forged from the finest grade of High Speed Steel, in stock in a great variety of sizes and types, finished and hardened ready for use. Ask for descriptive booklet.

J. H. Williams & Co., 45 Richards Street, Brooklyn, N.Y.
The A. G. Low Co., Ltd., 45 Pacific Ave., Saskatoon, Sask.
Agents for Manitoba, Saskatchewan, Alberta and British Columbia

Williams' "Vulcan" Forged-Cutter Tool Holders



Sterling

HACK SAW BLADES

Maximum Production -- Minimum Cost

Sterling Hack Saw Blades have been a boon to Canadian and United States industries for the past twenty years. Known by their name, recognized by their quality, and appreciated by the men who use them. They have so definitely established their reputation for quality that no substitute will satisfy in the shops where they have been once used.

Sterling Hack Saw Blades, Frames and Machines. Ask for them everywhere.



DIAMOND SAW & STAMPING WORKS
BUFFALO, N.Y., U.S.A.

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CANADIANS MUST BE SQUARE

IN the course of an article in January issue of MACLEAN'S MAGAZINE (now on sale), Mr. Lloyd Harris, who was head of the Trade Mission to Great Britain, makes the important statement that "Canada must develop a high standard of commercial morality—she hasn't that standard now." This is a vitally important article, pointing out the tremendous opportunity for profitable trade in Europe that is open to Canada, but at the same time issuing a grave warning as to what we must do, and must not do, if we are to grasp the golden chance.

Mr. Harris shows the opening for permanent trade connections that has come about as the result of war conditions and the "sentimental preference" that Canada now has in Europe—a preference created by the record of our soldiers. His message is one that every Canadian should read—business man or workingman, exporter or laborer.

Other features found in January MACLEAN'S are:

"Politics Under the Shadow"

Dominion politics are summed up by J. K. Munro in his usual pithy and unsparing style. He tells what is happening in Ottawa where the shadow of an impending farmer invasion hangs over everything.

"The Birth of a Labor Party"

Up to the recent election in Ontario, Canada hadn't a real Labor party. As a result of the return of a solid group of Labor candidates, a new party may be said to have been born. J. L. Rutledge gives interesting sketches of the first Labor members.

"The Woman's Court"

Mrs. Arthur Murphy (Janey Canuck), the first woman magistrate to sit on a bench in Canada, tells of the operation of the first Woman's Court.

"A Woman on the Warpath"

Mrs. Nellie McClung, who has figured on the public platform more prominently than any other Canadian woman, tells interestingly of her experiences, particularly with regard to the campaign in Manitoba against the Roblin Government.

Six Bright Stories by Well-Known Authors

The Thread of Flame—By Basil King.
His Majesty's Well-Beloved—By Baroness Orczy.
Spanish Doubloons—By Camilla Kenyon.
The Fall Triumphant—By C. L. M. Brown.
The Empty Chair—By Alice and Claude Askew.
Winning a Post in Fur Land—By Robert E. Pinkerton.

Keep in Touch with the World

The world is being remade in these trying times and the man or woman who would keep up with the march of events, can do no better than read the "Review of Reviews" department in January MACLEAN'S, in which the best articles and most interesting selected from the periodicals of the world are reprinted in condensed form. Look at the list of articles in this department in January MACLEAN'S:

Britain's Supremacy is Threatened
Japan is Fighting For Her Life
Admiral Reveals Vital Secrets
Germany is Still Dangerous
Can Life be Lengthened?
How Ole Hanson Was Elected
The Diamond Market Cornered
Balking Life's Handicap
Britain Must Remain Strong Military Power
The Song of the Bolsheviks
Political Chaos in Britain
The New Roosevelt
Death Rate Exceeds Births
Secrets of "Make-Up."
Revolution Brewing in Egypt

Over 350,000 Canadians Read

MACLEAN'S

"CANADA'S NATIONAL MAGAZINE"

JANUARY ISSUE *Now On Sale At All News Dealers* **20c**

Install Steam Flow Meters *only* Where Their Saving Will Absorb Their Cost

In a paper delivered before a joint session of the A.S.M.E. and the A.S.R.E. on the cost of ice and refrigeration it was stated that in making ice *"the cost of fuel is usually the largest item and may often represent the difference between profit and loss."*

There is nothing startling about that statement. Most engineers know that there are many industries that could not thrive without taking every possible step to avoid fuel waste. It *is* startling, though, that more engineers do not see that if fuel saving is vital to an industry where fuel plays such an important part, it is relatively as necessary to their own plant. If, in the case of the ice plant, fuel economy represents the difference between profit and loss, it means the difference between profit and *more* profit in *any* plant.

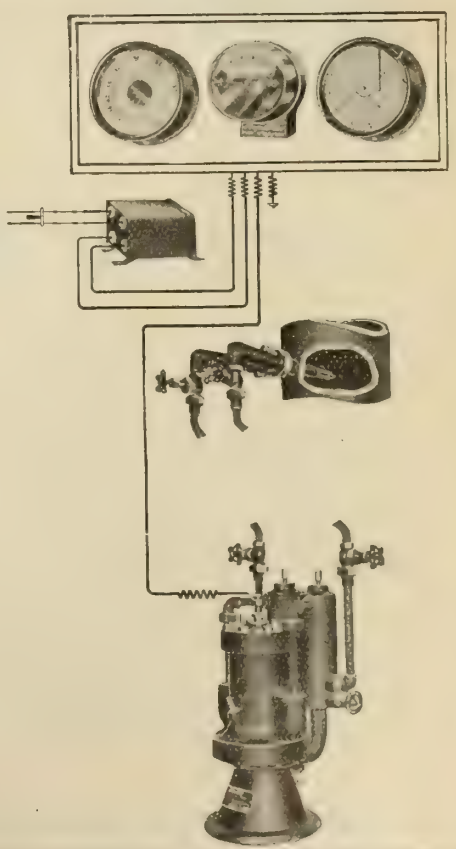
Used as a *steam* flow meter, the Republic is essentially a device for saving fuel by conserving steam. The Republic catalog points out a wide range of application for steam flow measurement—no doubt application that will coincide with your plant conditions. Write for a copy and use it as a basis for determining what saving will be effected in your plant by installing Republic Flow Meters. If necessary, put your problem up to our specialists. We will not advise Flow Meters unless their saving will absorb their cost!

Republic Flow Meters

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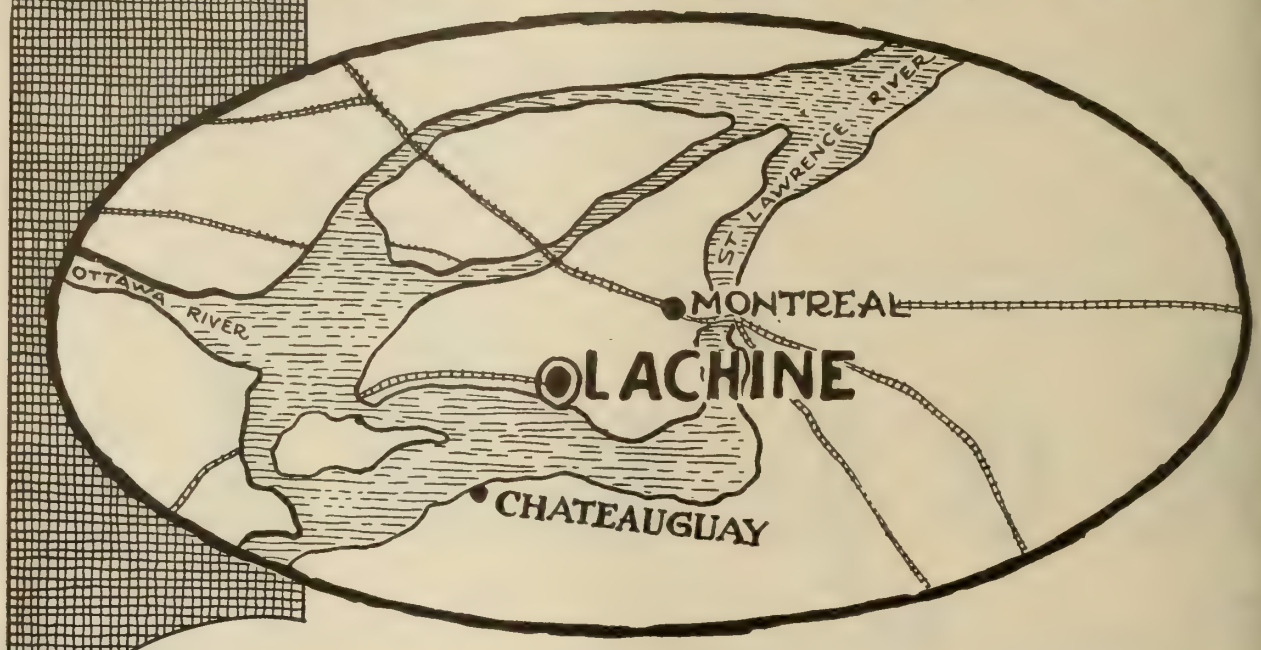
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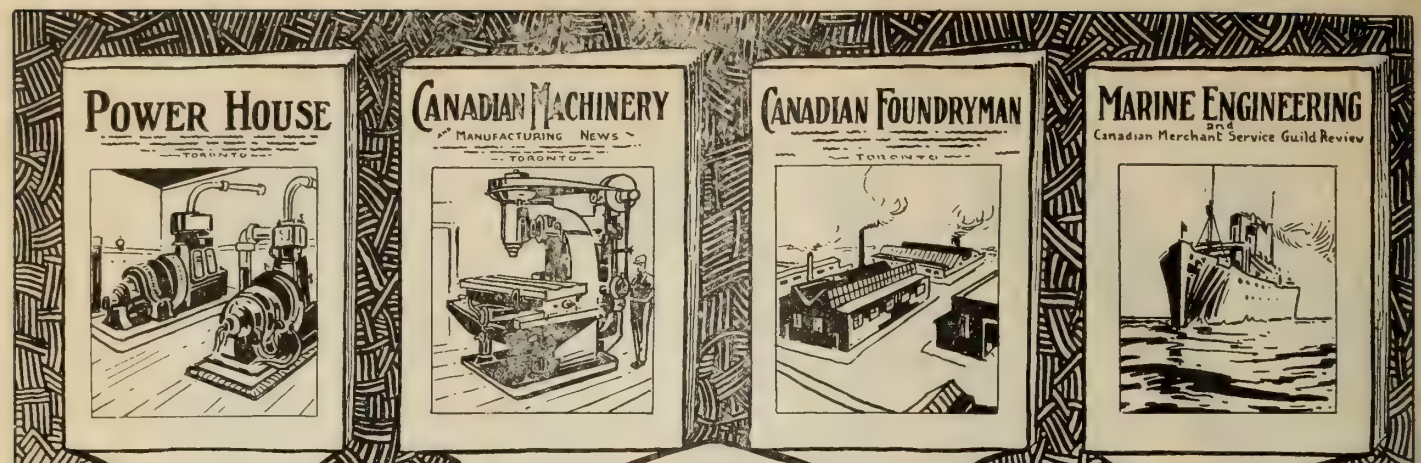
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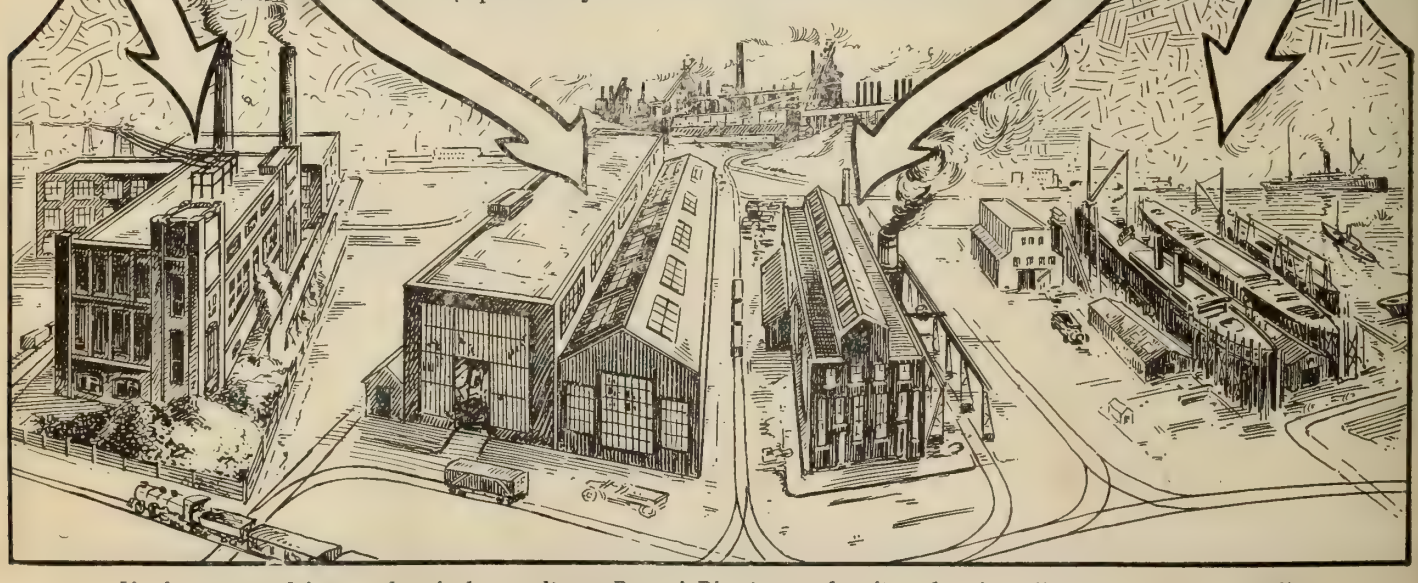
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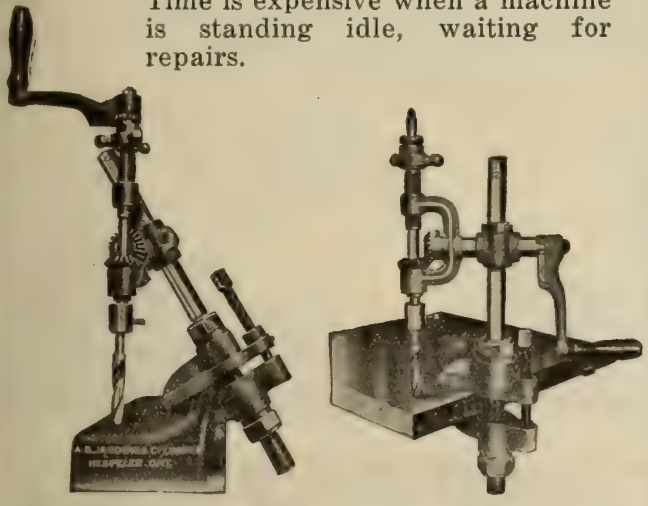
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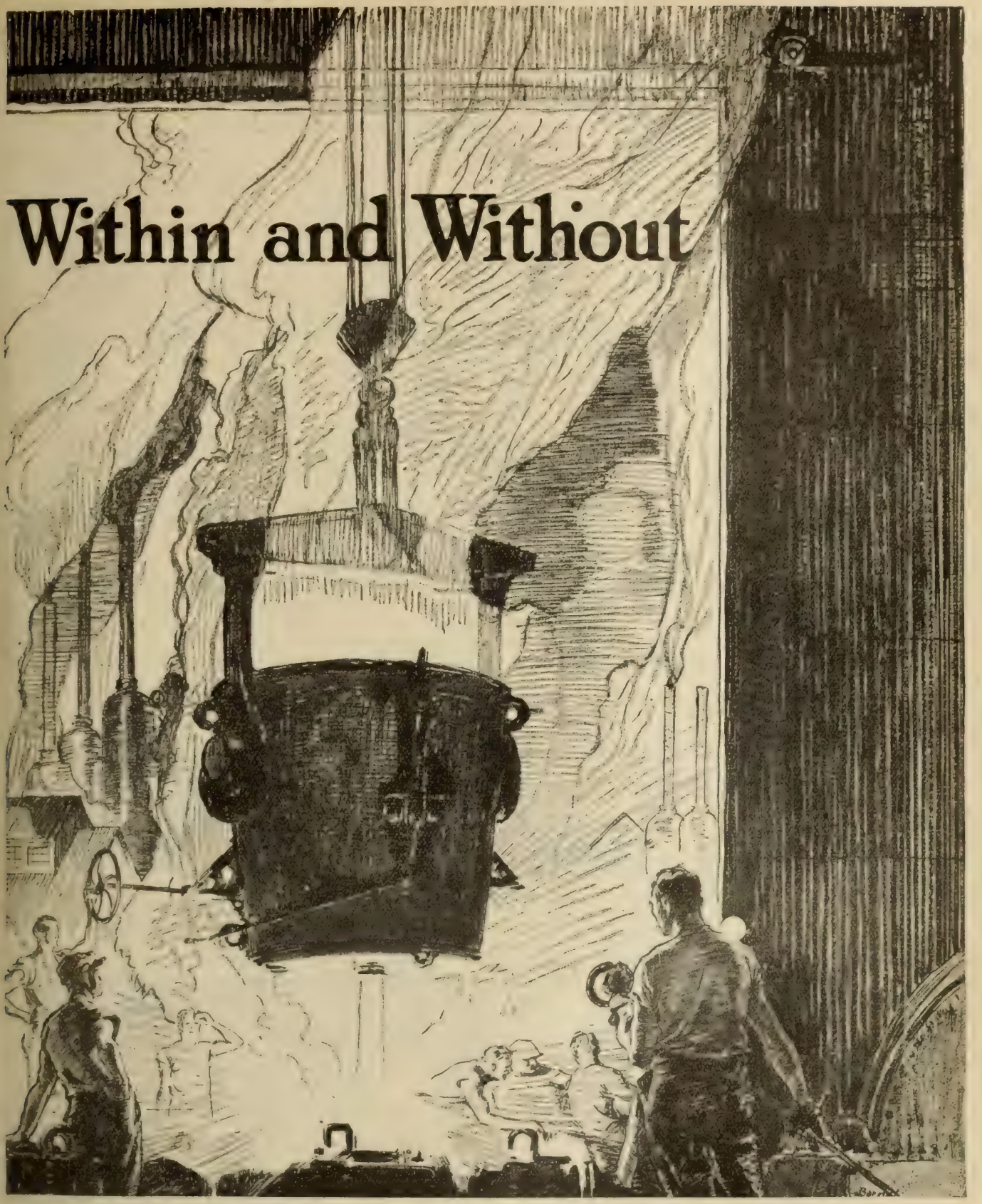
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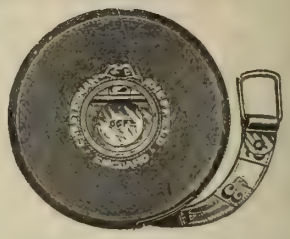
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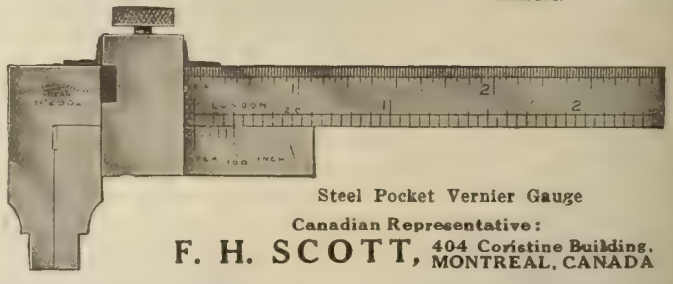


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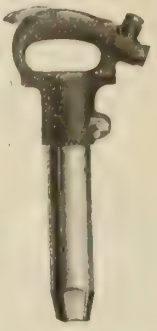
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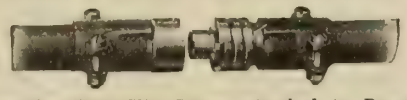
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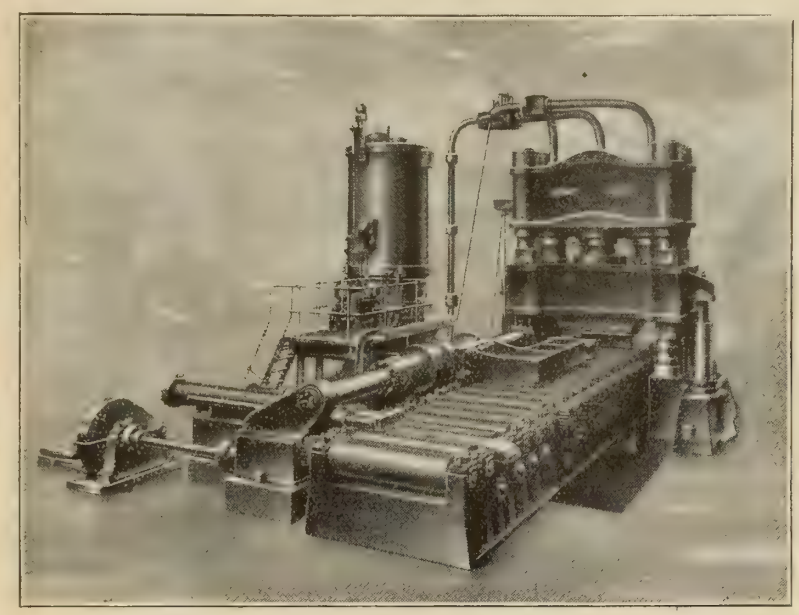
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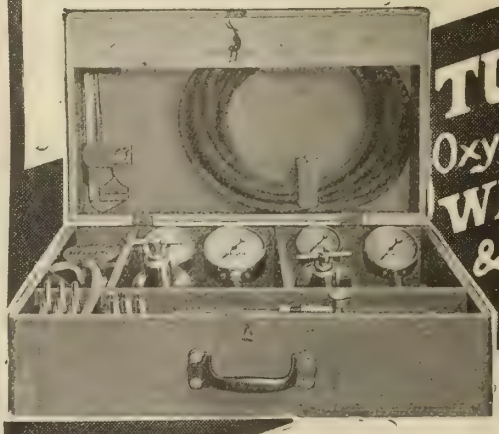
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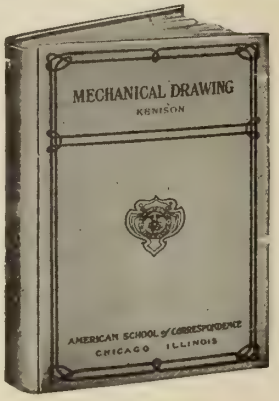


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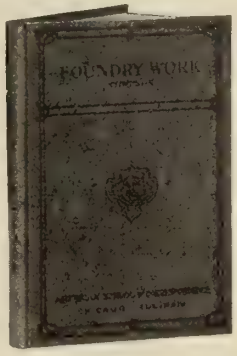
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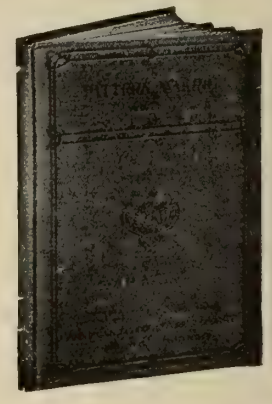
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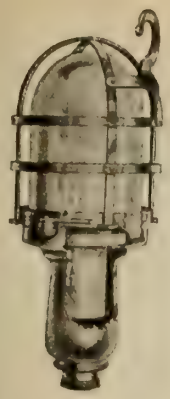
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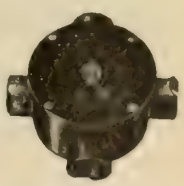


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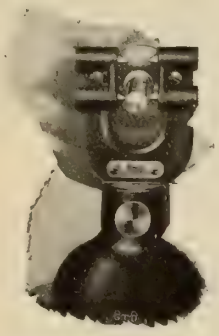


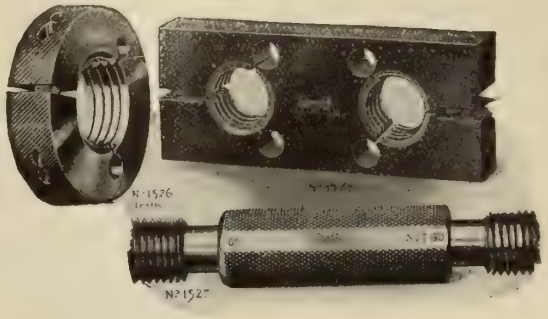
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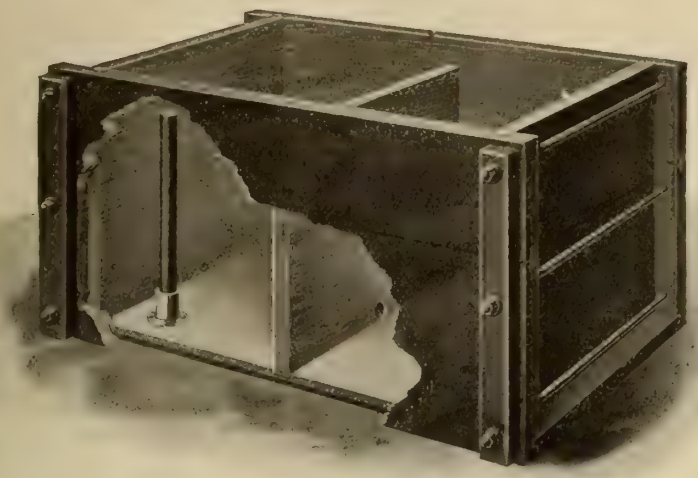
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CANADIAN HANSON & VAN WINKLE

WOOD TANKS

LEAD LINED



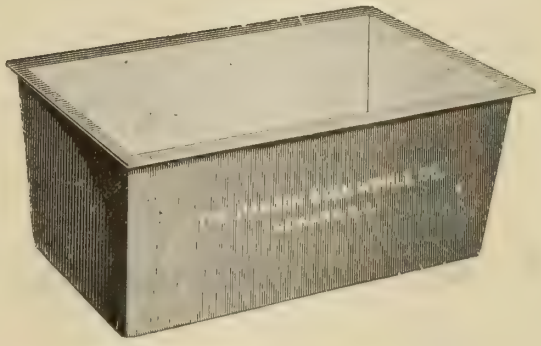
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Our Lead Lined Tanks are absolutely guaranteed not to leak. Only expert welders are employed and the quality of workmanship insures that all joints and seams are carefully and thoroughly made so as to stand the test of strongest acid solutions.

Welded Steel Tanks

Never Leak!

These welded steel tanks are constructed by the oxy-acetylene welding process. They are made of sheet steel welded in such a manner as to make a thoroughly homogeneous one-piece tank, which cannot leak. They are fitted with a stout angle-stiffening rim around the top. These tanks are unsurpassed for use with cyanide solutions, electric cleaners, kostico, potash, lye, soap solutions and hot water.



WE ARE PREPARED TO FURNISH ANY SIZE ON SHORT NOTICE. Let us quote on your requirements; we are sure our price and delivery will suit you.

THE

CANADIAN HANSON & VAN WINKLE CO.

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15-25 Morrow Ave., Toronto, Canada

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Ford-Smith Mach. Co., Hamilton, Ont.
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Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Ltd., Montreal.
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See Compressors.

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B. F. Sturtevant Co., Galt, Ont.

AIR CYLINDERS
Smalley-General Co., Bay City, Mich.

AIR RECEIVERS
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Pilot Steel & Tool Co., Montreal, Que.
Samuel Osborne (Canada) Ltd., Montreal.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
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Wilson & Co., J. C., Belleville, Ont.
Garlock-Walker Machinery Co., Toronto
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Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

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Gardner & Son, Robert, Montreal.
Knight Metal Products, Toronto.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
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Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Wells Bros., of Can., Galt, Ont.
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Canada Metal Co., Toronto.
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Hoefer Mfg. Co., Freeport, Ill.

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British Smelting & Refining Co., Ltd., Montreal.
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Cummiss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
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Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., Ltd., A. R., Montreal
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Boker & Co., Inc., Montreal, Que.
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Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
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Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Gray Ball Bearing Co. Ltd., Toronto.

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BARRELS, STEEL SHOP
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Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
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Northern Crane Works, Walkerville, Ont.
Wilson & Co., J. C., Belleville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Gisholt Machine Co., Madison, Wis.
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Aikenhead Hardware Co., Toronto, Ont.
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BELTING, BALATA
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Williams Mchy Co., Ltd., A. R., Montreal
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Kayser-Ellison & Co., Ltd., Montreal.
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Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Rice, Lewis & Son, Toronto, Ont.
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Morrow Screw & Nut Co., John, Ingersoll.

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Morrow Screw & Nut Co., John, Ingersoll.

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National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams & Wilson, Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto

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Victor Tool Co., Waynesboro, Pa.
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Rudel-Belnap Mch. Co., Montreal, Que.
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BRAKES, CORNICES
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Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal

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BROACHES
La Pointe Co., J. N., New London, Conn

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Canada Metal Co., Toronto.
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Canada Metal Co., Toronto.

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Lyman Tube & Supply Co., Montreal, Que.

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Foss Mchy. & S'ply Co., Geo. F. Montreal
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

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Northern Crane Works, Ltd, Walkerville.

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Canada Machinery Corp., Galt, Ont.
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Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Williams, White & Co., Moline, Ill.

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W. S. Rockwell Co., New York, N.Y.

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Parmenter & Bulloch Co., Gananoque,.

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Peck, Stow & Wilcox Co., Southington, Conn.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

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Brown's Copper & Brass Rolling Mills, New Toronto.

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Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

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Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
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Swedish Crucible Steel Co. Windsor.

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Jones & Glassco, Montreal.

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Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
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Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont

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John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
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International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.
London Concrete Mach. Co., London, Ont

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
London Concrete Mach. Co., London, Ont

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Morse Chain Co., Ithaca, New York

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca N.Y.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York, Glasgow N.S.

CHAINS, SPROCKET WHEEL
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach & Tool Co Galt, Ont.
Smalley General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bicknell-Thomas Co., Greenfield, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Bicknell-Thomas Co., Greenfield, Mass.
Can. Blower & Forge Co., Kitchener.
Whitney Mfg. Co., Hartford, Conn.

CHUCKS, FRICTION AND TAP
Bicknell-Thomas Co., Greenfield, Mass.
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach Co., Brazil, Ind.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal, Que

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill
International Business Mche. Co. Toronto, Ont.

CLOCKS, TIME
International Business Mche. Co. Toronto, Ont.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.

Lyman Tube & Supply Co., Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que.

COAL HANDLING MACHINERY

Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING

Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

COLLECTORS, PNEUMATIC

Can. Blower & Forge Co., Kitchener.

COLLETS

Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT

Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING

Oakley Chemical Co., New York, N.Y.
Ontario Lubricating Co., Ltd., Hamilton, Ontario.

COMPRESSORS, AIR

Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
Hinckley Machine Co., Hinckley, Ill.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CONCRETE MACHINERY

London Concrete Machy. Co., London, Ont

CONDENSERS

MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONNECTING RODS

Canada Found'n & Forgings, Ltd., Welland, Ont.

CONTRACT WORK

Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS

Volta Mfg. Co., Welland, Ont.

CONNECTIONS, FLANGED

Dart Union Co., Toronto, Ont.

CONTROLLERS AND STARTERS

Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS

Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY

MacGovern & Co., Montreal, Que.

CONVEYORS, BELT AND CHAIN

Brown Portable Conveying Mchy. Co., Chicago, Ill.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

CONVEYORS, OVERHEAD

Beatty Bros., Fergus, Ont.
Brown Portable Conveying Mchy. Co., Chicago, Ill.

COOLERS, WITH DRINKING FOUNTAINS

Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COOLING EQUIPMENT, SPRAYS

Spray Engineering Co., Boston, Mass.

COPING MACHINES

Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS

British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

CORE OIL

Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS

Aikenhead Hardware Co., Toronto, Ont.
Blanchc Co., L. C., New York City.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

COUNTERSHAFTS

Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.

Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

COUPLINGS, FRICTION

Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

COUPLINGS, RAPID HOSE

Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING

Garlock-Walker Machinery Co., Toronto.

COKE AND COAL

Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF

Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE

Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC

Volta Manufacturing Co., Welland, Ont.

CUPS, OIL

Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE

Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS

MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE

Barber, Foster Engineer'g Co., Cleveland, Ohio.
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER

Barber, Foster Engineer'g Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS

Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE

Aikenhead Hardware Co., Toronto, Ont.
Barber, Foster Engineer'g Co., Cleveland, Ohio.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CRIMPS, LEATHER

Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS

Elec. Steel & Metals, Welland, Ont.

CUPOLAS

Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE

Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS

Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION

Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CUTTERS, BOLT

See Bolt Cutters.

CUTTERS, GEARS

Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE

Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS

Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING

Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.

Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Machc. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.

CUTTER RELIEVING MACHINES

Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES

Armstrong Bros., Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Curtis & Curtis Co., Bridgeport, Conn.
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Peerless Machine Co., Racine, Wis.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CUTTING COMPOUND AND CUTTING OIL

Cataract Refining Co. Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM

Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS

Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS

Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR

Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS

Hinckley Machine Co., Hinckley, Ill.
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING

R. F. Sturtevant Co. Galt, Ont.

DERRICKS

Aikenhead Hardware Co., Toronto, Ont.
M. Beatty & Sons, Ltd., Welland, Can.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND (BORTZ)

Burniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS

Ford-Smith Machine Co., Hamilton, Ont.
Burniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

DIAMONDS, CARBON AND BORTZ

Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH

Joyce Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, CUTTING

Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC

Greenfield Tap & Die Corp., Greenfield Mass
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING

Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE

Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS

Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Wells Brothers of Canada, Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que
Williams Mchy Co., Ltd., A. R., Montreal

DIES, METAL STAMPING

Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING

A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.
Williams & Wilson, Ltd., Montreal, Que.

DIES, THREADING

Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS

Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co. Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES

Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS

Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING

Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DIE FILING MACHINES

Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK

Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

DIES FOR SCREW PLATES

Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING

E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Illinois Tool Works, Chicago, Ill.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD

Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Can., Galt, Ont.

DISCS, LEATHER, STEEL

Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS

MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL

Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRAWING INSTRUMENTS

Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES

Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL

Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

DRILL PRESSES

Aurora Tool Works, Aurora, Ind.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILL RODS

Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, BALL BEARING

Cincinnati Pulley Mch. Co, Cincinnati, O.

DRILLING MACHINES, GANG

Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn

BUYERS' DIRECTORY

Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILLING MACHINES, VERTICAL
Superior Machine Tool Co., Kokomo, Ind.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Carlton Mchc. Tool Co., Cincinnati, O.
Garlock Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Edland Mchy. Co., Inc., Cortland, N.Y.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Defiance Mchc. Works, Defiance, Ohio.
Edland Mchy. Co., Inc., Cortland, N.Y.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Lathe & Drill Co, Rockford, Ill.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto
Williams & Wilson, Ltd., Montreal, Que.

DRILLING MACHINES, SPECIAL
Edland Mchy. Co., Inc., Cortland, N.Y.
Hoefer Mfg. Co., Freeport, Ill.
Rockford Lathe & Drill Co, Rockford, Ill.

DRILLING MACHINES, WALL RADIAL
Carlton Mchc. Tool Co., Cincinnati, Ohio

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Demco Mchc. Tool Co., Cleveland, Ohio
Geo F. Foss Mch. & S'ply Co., Montreal
Fox's (London), Ltd., London, England
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
J. T. Ryerson & Son, Chicago, Ill.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland
Demco Mchc. Tool Co., Cleveland, Ohio.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co., of Can., Walkerville
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Boker & Co., Inc., H., Montreal, Que.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co. Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pringle Co., R. E. T., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Clark Equipment Co., Buchanan, Mich.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Rudel-Belnap Mach. Co., Montreal.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, RADIAL
American Tool Wks. Co, Cincinnati, Ohio
Rudel-Belnap Mach. Co., Ltd., Montreal.
Mueller Mach. Tool Co., Cincinnati, Ohio

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Greenwood & Batley, Leeds, England.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

ELECTRIC FURNACES
Electric Furnace Construction Co., Philadelphia, Pa.
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORI CHROMAX, CLIMAX, NICKEL SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Ontario Pneumatic Machy. Co. St. Louis
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

ELEVATING AND CONVEYING MACHINERY
Brown Portable Conveying Mchy. Co., Chicago, Ill.
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY PAPER
H. H. Barton & Son Co, Philadelphia Pa
Wanson Abrasives Co., Chicago, Ill.

EMERY CLOTH
H. H. Barton & Son Co, Philadelphia, Pa
Wanson Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Brantford Emery Wheel Co., Brantford, Canada
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE
Furness, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy Co., Toronto.
Petrie, Ltd., H. W., Toronto
Williams Mchy Co, Ltd., A. R., Montreal

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Williams & Wilson, Ltd., Montreal.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Illinois Tool Works, Chicago, Ill.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLOW METERS
Spray Engineering Co., Boston, Mass.

FLUMES
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Greenwood & Batley, Leeds, England.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Standard Fuel Engr. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES, ELECTRIC
Elec. Furnace Construction Co., Philadelphia, Pa.
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

GALVANIZING FLUX
British Smelting & Refining Co., Ltd., Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GAS WASHING EQUIPMENT
Spray Engineering Co., Boston, Mass.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd. S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

GAUGES, THREAD
Bicknell-Thomas Co., Greenfield, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal,
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
D. E. Whiton Machine Co., New London, Conn.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEAR-TURNING MACHINES, BEVEL
Bridgeford Mach. Tool Wks, Rochester

GEAR BOXES, REDUCTION
Coventry Chain Co., Coventry, Eng.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.

GEARS, CUT, MORTISE, ANGLE WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q
Illinois Tool Works, Chicago, Ill.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Gould & Eberhardt, Newark, N.J.

GENERATORS, HOT WATER
H. F. Hot Water Heater Co., Montreal.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GEARS, SILENT CHAIN GENERATORS, STEAM TURBO
Can. General Electric Co., Toronto, Ont.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

GENERATORS AND CONVERTORS
Can. General Electric Co., Toronto, Ont.
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GERMAN SILVER
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa

GOVERNOR, WATER WHEEL
Wilson & Co., J. C., Belleville, Ont.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland
Willson & Co., Inc., T. A., Reading, Pa
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Can. Mathews Gravity Co., Port Hope, Ontario.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
McDonough Mfg. Co., Eau Claire, Wis.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Rudel-Belnap Mach. Co., Ltd., Montreal
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
McDonough Mfg. Co., Eau Claire, Wis.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Oakley Mche. Tool Co., Cincinnati, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Rudel-Belnap Mach. Co., Ltd., Montreal

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Badger Tool Co., Beloit, Wisconsin.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
La Salle Tool Co., La Salle, Ill.
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
La Salle Tool Co., La Salle, Ill.
McDonough Mfg. Co., Eau Claire, Wis.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Oakley Machine Tool Co, Cincinnati, Ohio
Petrie, Ltd., H. W., Toronto.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Electrical Tool Co., Cincinnati.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND FACE AND DEEP HOLE
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, MAGNETIC CHUCK
Blanchard Mach. Co., Cambridge, Mass.

GRINDERS, PLAIN CYLINDRICA
Fitchburg Grinding Mach. Co., Fitchburg, Mass.
La Salle Tool Co., La Salle, Ill.
Oakley Mach. Tool Co., Cincinnati, Oh

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto
Garlock-Walker Machinery Co., Toronto
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicag
La Salle Tool Co., La Salle, Ill.
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Clevelan

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.
Bristol Machine Tool Co., Bristol, Conn
La Salle Tool Co., La Salle, Ill.
Manhattan Machine & Tool Co., Gran Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.
Ford-Smith Machine Co., Hamilton, Ont
Greenfield Machine Co., Greenfield, Mass
Greenfield Tap & Die Corp., Greenfield
La Salle Tool Co., La Salle, Ill.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.
Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
McDonough Mfg. Co., Eau Claire, Wis
Norton Co., Worcester, Mass.
Rudel-Belnap Mach. Co., Ltd., Montreal
Williams Mchy Co, Ltd., A. R., Montrea

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Blanchard Mach. Co., Cambridge, Mass
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., La Salle, Ill.
Norton Co., Worcester, Mass.
Oakley Mach. Tool Co., Cincinnati, Ohio
Williams Mchy Co, Ltd., A. R., Montreal

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
La Salle Tool Co., La Salle, Ill.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.
Waltham Grinding Wheel Co., Waltham, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
Strong, Kennard & Nutt Co., Cleveland.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.

Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

HACK SAW FRAMES

Aikenhead Hardware Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Ford Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal.

HACK SAWS, POWER

Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Peerless Machine Co., Racine, Wis.
Perfect Machine Co., Galt, Ont.
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

HAMMERS, FORGING

Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC

Haskins & Co., R. C., Chicago, Ill.

HAMMERS (DROP), MOTOR AND BELT DRIVEN

Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, C. C., Syracuse, N.Y.
Brown Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

HAMMERS, HELVE POWER

Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Wear Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

HAMMERS, CHIPPING, CAULKING, PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE

Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER

Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, RIVET HEADER

Greenwood & Batley, Leeds, England.

HAMMERS, STEAM

Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS

Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY

Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS

Graton & Knight Mfg. Co., Montreal.

HANGERS

Brown & Sharpe Mfg. Co., Providence, R.I
Dodge Sales & Eng. Co., Mishawaka, Ind.

HANGERS, SHAFT

Algoma Steel Corp., Sault Ste. Marie.
Can. General Electric Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
New S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glasseo, Montreal.
Standard Pressed Steel Co., Philadelphia
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY

Hoefer Mfg. Co., Freeport, Ill.

HEATERS, HOT WATER

R. F. Hot Water Heater Co., Montreal.

HEATING AND VENTILATING ENGINEERS

Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.

HEAT TREATMENT OF STEEL

Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING

Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA

Strong, Kennard & Nutt Co., Cleveland.

HIGH SPEED STEEL

See Steel.

HINGE MACHINERY

Baird Machine Co., Bridgeport, Conn.
Illinois Tool Works, Chicago, Ill.

HINGES

Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBBERS, GEAR

Gould & Eberhardt, Newark, N.J.

HOBS

Greenfield Tap & Die Co., Greenfield, Mass
Illinois Tool Works, Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

HOISTS, AIR

Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC

Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

HOISTS, ELECTRICAL

A. Beatty & Sons, Ltd., Welland, Can.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Yale & Towne Mfg. Co., New York, N.Y.

HOISTS, ELEC., STATIONARY, MONO RAIL

A. Beatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.
Yale & Towne Mfg. Co., New York, N.Y.

HOLDERS, STEEL DIE FOR MARKING

Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC

Electric Steels & Metals, Ltd., Welland.

HOOKS, BELT LACING

Clipper Belt Lacer Co., Grand Rapids.

HOPPERS

MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION

Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC

Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS

Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Quaker City Rubber Co. Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST

Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER

Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply. Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS

Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS

Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY

Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Victoria Foundry Co., Ottawa.

HYDROMETERS, HYGROMETERS, HYGRODEIKS

Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED

Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES

Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

INDICATING INSTRUMENTS

Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES

Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES

City of St. Johns, Quebec.

INGOT METAL

Brown's Copper & Brass Rolling Mills, New Toronto, Ont.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR

Thomas Moore & Son, Montreal.

INGOTS, STEEL

Nova Scotia Stl. & Coal Co., New Glasgow

INGOTS, FORGING AND ROLLING

Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS

Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING

Consolidated Optical Co., Toronto.

IRON ORE

Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG

Swedish Steel & Impt. Co., Ltd., Montreal

JACKS

Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

JACKS, PIT AND TRACK

Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE

Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS

Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.

Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Illinois Tool Works, Chicago, Ill.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES

Canada Foundries & Forgings, Welland.

KEY SEATERS

Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

KEYS, MACHINE

Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS

Can. Blower & Forge Co., Kitchener, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

KNIVES, MACHINE

E. C. Atkins & Co., Inc., Indianapolis, Ind.

KNIFE GRINDERS

Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS

Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY

Northern Crane Works, Walkerville.

LACING MACHINES

Clipper Belt Lacer Co., Grand Rapids, M.

LAMPS, ARC, INCANDESCENT

Can. General Electric Co., Toronto, Ont.

LAMPS, TUNGSTEN AND NITRO

Can. General Electric Co., Toronto, Ont.

LAG SCREW GIMLET POINTERS

National Machy. Co., Tiffin, Ohio.

LATH

Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING

Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS

Armstrong Bros. Tool Co., Chicago.
Curtis & Curtis Co., Bridgeport, Conn.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC

Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE

Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING

Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

LATHES, PRECISION (See Engine)

American Tool Wks. Co., Cincinnati, O.
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

LATHES, BRASS

Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

LATHES, ENGINE

Adams Mfg. Co., Inc., O. R., Rochester, NY.
Acme Machine Tool Co., Cincinnati, Ohio.
American Tool Wks. Co., Cincinnati, O.
John Bertram & Sons Co., Dundas.
Bridgeford Mach. Tool Wks., Rochester.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati Ohio.
Cincinnati Lathe & Tool Co., Cincinnati, Ohio.
Wickes Bros., Saginaw, Mich.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm. Owen Sound Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McAnsall Co., Galt.
Mueller Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co New York
Perfect Machine Co., Galt, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Rae Mach. Tool Co., Ramilton.
Rudel-Belnap Mach. Co., Ltd., Montreal.
J. T. Ryerson & Son, Chicago, Ill.
Rockford Lathe & Drill Co., Rockford, Ill
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER

Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL

Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING

Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND

Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'

J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto Ont.
Williams Mchy Co., Ltd., A. R., Montreal

LATHES, POLISHING

Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

LATHES, SCREW CUTTING

Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

LATHES, SPINNING

Bliss Co., E. W., Brooklyn, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

LATHES, TOOL ROOM

Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

Worcester Lathe Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co. Ltd., A. R., Montreal.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHES TURRET
Bardons & Oliver, Cleveland, Ino.
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio
Rudel Belnap Mach. Co., Montreal, Que.

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.
Ontario Lubricating Co., Ltd., Hamilton, Ont.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
Ontario Lubricating Co., Ltd., Hamilton, Ont.

LUBRICATORS
Trahern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Hamilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox Southington, Conn.

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy Co. Toronto, Ont.
Rudel-Belnap Mach. Co., Montreal, P.Q.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Joseph T. Ryerson & Son, Chicago, Ill.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS
Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, FLOW
Republic Flow Meters Co., Toronto.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.

MICROMETERS
Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
E. C. Atkins & Co., Inc., Indianapolis, Ind.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.

MILLING ATTACHMENTS
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co. Woonsocket, R.I.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Blancke Co., L. C., New York City.
Cleveland Milling Machine Co., Cleveland.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall Son & Bunney Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Steptoe Co., John, Cincinnati, Ohio.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Defiance Mach. Wks. Defiance, Ohio.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
Rudel-Belnap Mach. Co., Ltd., Montreal.
Steptoe Co., John, Cincinnati, Ohio.
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Joseph T. Ryerson & Son, Chicago, Ill.
Rockford Milling Mach. Co., Rockford, Ill
Rudel-Belnap Mach. Co., Ltd., Montreal
Standard Equipment & Tool Wks., Montreal, P.Q.
Steptoe Co., John, Cincinnati, Ohio.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, PLATE
Marshalltown Mfg. Co., Marshalltown, Ia.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy Co. A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Can. General Electric Co., Toronto.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

MUNTZ METAL
Brown's Copper & Brass Roller Mills, New Toronto, Ont.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa
Pritchard-Andrews Co., Ottawa, Ont.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL SILVER
Brown's Copper & Brass Rolling Mills New Toronto, Ont.

NICKEL STEEL
See Steel.

NIPPLE HOLDERS
Curtis & Curtis Co., Bridgeport, Conn.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NOZZLES, ALL PURPOSES
Spray Engineering Co., Boston, Mas.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL MILL MACHINERY
Greenwood & Batley, Leeds, England.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OILS, LUBRICATING AND EMULSIVE
Ontario Lubricating Co., Ltd., Hamilton.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

BUYERS' DIRECTORY

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.
Durablo Mfg. Co., New York, N.Y.

PACKINGS, LEATHER, HYDRAULICS ETC
Durablo Mfg. Co., New York, N.Y.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
International Mach. Spls., Ltd., Montreal
[illegible] Toronto
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PARK SPRINKLERS
Spray Engineering Co., Boston, Mass.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
American Woodworking Machine Co. Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
McKenzie Co., D., Guelph, Ont.
Oliver Machy. Co. Grand Rapids, Mich.
Petrie, Ltd. H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Sudden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Mchy Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson Ltd., Montreal.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal
Cincinnati Planer Co., Cincinnati, Ohio.
Garlock Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Lincoln Iron Works (?)
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co. New York
Ohio Mach. Tool Co., Kenton, Ohio.
Petrie, Ltd., H. W., Toronto.
Rudel-Belnap Mach. Co., Montreal.
Standard Equipment & Tool Wks., Montreal.
Walcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PLANING AND SHAPING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal
Cowan Truck Co. of Galt, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York
Ohio Mach. Tool Co., Keriton, Ohio.
Petrie, Ltd., H. W., Toronto.
Steptoe Co., John, Cincinnati, Ohio.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.

PLATES, O.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, HYDRAULIC
Bertram & Sons Co., John, Dundas.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
Williams Machy. Co., A. R., Toronto
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Dodge Sales & Eng. Co., Mishawaka, Ind.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PULLEYS, STEEL, SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glasson, Montreal.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, BOILER FEED
Geo. W. Cole, Ltd., Toronto.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Furniss, Clarke & Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwool Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H., Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Peck, Stow & Wilcox Co., Southington, Ct.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Whitman & Barnes Co., St. Catharines.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PUNCHES, HAND
Peck, Stow & Wilcox Co., Southington, Ct.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Rudel-Belnap Mach. Co., Montreal, Que.
D. H. Stoll Co., Buffalo, N.Y.
Williams, White & Co., Moline, Ill.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
J. T. Rwerson & Son, Chicago, Ill
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS

Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE

Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED

Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto.
J. Boker & Co., Inc., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Illinois Tool Works, Chicago, Ill.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rich Tool Co., Raily. Exchange, Chicago.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING

Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Illinois Tool Works, Chicago, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rich Tool Co., Raily. Exchange, Chicago.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, CHUCKING

Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Rich Tool Co., Raily. Exchange, Chicago.
Wells Bros. of Canada, Galt, Ont.

REAMERS, HAND

Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Rich Tool Co., Raily. Exchange, Chicago.
Wells Bros. of Can., Galt, Ont.

REAMERS, PIN

Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.

REAMER FLUTING MACHINES

Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC

Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS

Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.

American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC

Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE

Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK, ALL KINDS

Elec. Steel & Metals, Welland, Ont.

RESPIRATORS

Strong, Kennard & Nutt Co., Cleveland.

RIVETS,

Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION

Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW

Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co. Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

ROAD BUILDING EQUIPMENT

Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY

G. F. Foss Mchy & Sply. Co., Montreal.

RODS, BRASS AND BRONZE

Thomas Moore & Son, Montreal.

RODS, ROPE AND SPRING

Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME

Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING

Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS

Can. Link-Belt Co., Toronto.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING

John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co. New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co. Toledo, O
Williams Machinery Co., A. R., Montreal.
Williams & Wilson Ltd., Montreal.

ROLLS AND TABLES

Elec. Steel & Metals, Welland, Ont.

ROOFING

H. H. Robertson. Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD

Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS

The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS

Electric Steels & Metals, Ltd., Welland.

ROLLING MACHINES, SHEET METAL

Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY

Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES

Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING

Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING

Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS

Hoggson & Pettis Mfg. Co., New Haven Conn.

RUBBER MFRS.' SUPPIES

Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES

Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES

Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto

RUBBER MILL MACHINERY

Bertrams Ltd., Edinburgh, Scotland
Dom. Steel Products Co., Ltd., Brantford

RUBBER PRODUCTS, MECHANICAL

Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS

Dominion Abrasive Co., Mimico, Ont.

RULES

Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING

Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING

Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG

Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES

Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS

Can. Link-Belt Co., Toronto.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SAFETY DEVICES

Strong, Kennard & Nutt Co., Cleveland.

SAND CLOTH

H. H. Barton & Son, Co., Philadelphia.

SAND MILLS

Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT SAND BLAST SUPPLIES AND ACCESSORIES

Pangborn Corporation, Hagerstown, Md.

SAFETY APPLIANCES

Strong, Kennard & Nutt Co., Cleveland.

SAFETY APPLIANCE GOGGLES

T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES

Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY

Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS

Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES

Canada Machinery Corp., Galt.

SAW MILL MACHINERY

Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis.
Preston Woodworking Mch. Co., Ltd., Preston, Ont.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

SASH SPRINGS

The Dunbar Brothers Co., Bristol, Conn.

SAWS, CIRCULAR METAL

E. C. Atkins & Co., Inc., Indianapolis.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HIGH SPEED FRICTION

Jos. T. Ryerson & Son, Chicago, Ill.

SAWS, HACK (See Hack Saws)

SAWS, PATTERN SHOP

McKenzie Co., D., Guelph, Ont.

SAWS, SILVER STEEL

E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS

Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING

E. C. Atkins & Co., Inc., Indianapolis.
J. A. M. Taylor. Stair Bldg., Toronto.

SCALES

Can. Kron Scale Co., Montreal, P.Q.

SCALES, MECHANICS'

Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES

Shore Instrument & Mfg. Co., New York

SCREENING MACHINERY

Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS

Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC

Bardens & Oliver, Cleveland, Ohio.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal
Cincinnati Automatic Mach. Co., Cincinnati, Ohio.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co. Dundas, Ont.
Rudel-Belnap Mach. Co., Montreal, Que.
Warner & Swasey Co. Cleveland, O
Wells Bros. of Can. Galt, Ont.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Wood Turret Mach. Co. Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL

Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son. Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS

Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED

Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES

Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son. Toronto.
J. A. M. Taylor. Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET

Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS

Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR

Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES

See Dies.

SEPARATORS, SAND

Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY

Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER

Jacobs Mfg. Co., Hartford, Conn.

SHAPERS

John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton.
Jackson Shaper Co., Jackson, Mich.
McKenzie Co., D., Guelph, Ont.
Milwaukee Shaper Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Smith & Mills Co., Cincinnati, Ohio.
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHAPERS, GEAR

Fellows Gear & Shaper Co., Springfield, V
Jackson Shaper Co., Jackson, Mich.
Knigh Metal Products, Toronto.

SHAFTING

Algoma Steel Corp., Sault Ste. Marie, O
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHARPENING STONES

Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE

John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio
Niles-Bement-Pond Co., New York.
J. T. Ryerson & Son, Chicago, Ill.
Rudel-Belnap Mach. Co., Montreal.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER

John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co. New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co. Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHEARS, ROTARY

The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC

Toledo Machine & Tool Co., Toledo, Ohio

SHEET METAL ROLLING MACHINES

Peck, Stow & Wilcox Co., Southington.

SHEETS, NICKEL, RESIST, ALLOY

Can. Driver-Harris Co., Ltd., Walkerville

SHEARS, PLATE CUTTING, SLITTING

Dom. Steel Products Co., Ltd., Brantford
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING

Dom. Steel Products Co., Ltd., Brantford
Peck, Stow & Wilcox Co., Southington

SHEARS, IRREGULAR AND CIRCLE CUTTING

The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY

Peck, Stow & Wilcox Co., Southington, O

SHEARS, SERPENTINE

The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING

Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED

Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton

SHEET METAL WORKING TOOLS

Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHEETS, CRUCIBLE, CAST

British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Ralph B. Norton, Agent, Montreal.

SHEETS, BLACK AUTO AND GALVANIZED

Peckovers, Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
H. Stoll Co., Inc., Buffalo, N.Y.

SHELVING, STEEL
nis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
nis Wire & Iron Works, London.

SIDE TOOLS
nstrong Bros. Tool Co., Chicago.
H Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Link-Belt Co., Toronto, Ont.
& Glassco, Montreal.

SLEDGES
enhead Hardware Co., Toronto, Ont.
Lewis & Son, Toronto, Ont.
man & Barnes Mfg. Co., St.
atharines, Ont.
kinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
ine Foundry, Galt, Ont.

SLICING CLAMPS
k, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
rris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
tts Machine Co., Rochester, N.Y.
nada Machinery Corp., Galt, Ont.
rvin Machine Co., New York.
tional-Acme Co., Cleveland, Ohio.
les-Bement-Pond Co., New York.

SMOKESTACKS
lliam Hamilton Co., Peterboro, Ont.
acKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
arney & Trecker Co., Milwaukee, Wis.
Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
own & Sharpe Mfg. Co., Providence.
tterfield & Co., Inc., Rock Island, Que
eland Twist Drill Co., Cleveland.
eystone Mfg. Co., Buffalo, N.Y.
odern Tool Co., Erie, Pa.
Morrow Screw & Nut Co., Ingersoll, Ont
one Twist Drill & Mch. Co., New Bedford, Mass.
ice Lewis & Son, Toronto. Ont.

OIL PIPE FITTINGS, CAST IRON
atie Foundry Galt,. Ont.

SOLDERING IRONS
enhead Hardware Co., Toronto, Ont.
rown, Boggs & Co., Hamilton, Ont.
ast-O-Lite Co., Inc., Toronto, Ont.
ice Lewis & Son, Toronto, Ont.

SOLDER
ish Smelting & Refining Co., Ltd., Montreal, Que.
enhead Hardware Co., Toronto, Ont.
anada Metal Co., Ltd., Toronto, Ont.
e Lewis & Son, Toronto, Ont.
illman Brass & Metal Co., Hamilton.

SPELTER
ish Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
an Link-Belt Co., Toronto, Ont.
nes & Glassco, Montreal.

SPRINGS, MACHINERY
ames, Wallace Co., Bristol, Conn.
an Steel Foundries, Ltd., Montreal.
eveland Wire Spring Co., Cleveland.
umbar Bros. Co., Bristol, Conn.
arlock Walker Machinery Co., Toronto.

SPECIAL MACHINERY
anel Machine Co., Bridgeport, Conn.
ertram, John. & Sons Co., Dundas.
ise, E. W. Co., Brooklyn, N.Y.
rown, Boggs & Co., Hamilton, Canada
rown Engineering Corp., Toronto, Ont
ne Steel Products Co., Ltd., Brantford.
ord-Smith Machine Co., Hamilton, Ont.
arlock-Walker Machinery Co., Toronto.
lliott & Whitehall Mach. & Tool Co., Galt, Ont.
arvin Machine Co., New York.
Engineering Co., Ltd., Hamilton.
ley & Edlund, Inc., Courtland, N.Y
hn H Hall & Sons, Brantford.
B Jardine & Co., Hespeler, Ont.
ine Foundry, Galt, Ont.
ional-Acme Co., Cleveland, Ohio
Machine Co., Pittsburgh, Pa.
e Mach. Tool Co., Hamilton.
el Co., D. H., Buffalo, N.Y.
awa Foundry Co., Ottawa, Ont.
liam R Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Engineering Co., Ltd., Hamilton.
mmon & Pettis Mfg. Co., New Haven, Conn
& Mfg. Co., Boston, Mass.

SPRAYING EQUIPMENT
Engineering Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
ord Machine Co., Bridgeport, Conn.
rvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
d Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
orse Chain Co., Ithaca, New York

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco. Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington. Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield. Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Matthews, Jas. H & Co., Hartford, Conn.
Pritchard-Andrews Co., Ottawa. Can.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.
Geo. W. Cole, Ltd., Toronto.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co. Ltd., Wm. Sheffield, Eng
Atlas Crucible Steel Co., Dunkirk, N.Y.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Boker & Co. Inc., H., Montreal, Que.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto.
Norton, Ralph B Agent Montreal.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Andrews Steel Co., Newport, Ky., U.S.A.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Andrews Steel Co., Newport, Ky., U.S.A.
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL FORGING BILLETS
Andrews Steel Co., Newport, Ky., U.S.A.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Andrews Steel Co, Newport, Ky., U.S.A.
Firth & Sons, Thos., Montreal, Que
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal.
Atlas Crucible Steel Co., Dunkirk, N.Y.
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford.

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal. Que.
Kayser-Ellison & Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie.
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Norton, Ralph B., Agent, Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal. Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

STELLITE HIGH-SPEED TOOL METAL
Deloro Smelting & Refining Co., Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven. Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert. Niagara Falls. Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield. Mass.
Wells Bros., of Can., Galt. Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
Hamilton Bridge Co., Hamilton, Ont.
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Can. General Electric Co., Toronto, Ont.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Panghorn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd. S. F. Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd. S. F. Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
Geo. W. Cole, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son. Toronto. Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Bicknell-Thomas Co., Greenfield, Mass.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Canada Machinery Corp., Galt, Ont.
Defiance Mach. Wks., Defiance, Ohio.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Rudel-Belnap Mach. Co., Ltd., Montreal.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BENDING
Peck, Stow & Wilcox Co., Southington.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE.
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Coventry Chain Co., Coventry, England
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, ELECTRIC
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Beatty Bros., Fergus, Ont.
Holyoke Truck Co., Holyoke, Mass.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal.
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES, LATHES
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Greenfield Tap & Die Corp., Greenfield.
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Petrie, Ltd., H. W., Toronto.
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Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., The, Cleveland, O.
Williams Mchy Co, Ltd., A. R., Montreal

TURBINES, STEAM
Greenwood & Batley, Leeds, England.

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
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Ford-Smith Machine Co., Hamilton, Ont.
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Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Geo. W. Cole, Ltd., Toronto.

VALVES, CHECK
Geo. W. Cole, Ltd., Toronto.

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Metalwood Mfg. Co., Detroit, Mich.

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Quaker City Rubber Co., Philadelphia.

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Williams & Wilson, Ltd., Montreal.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

VISES, PIPE
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Marshall, Son & Bunney, Toronto.
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Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
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Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

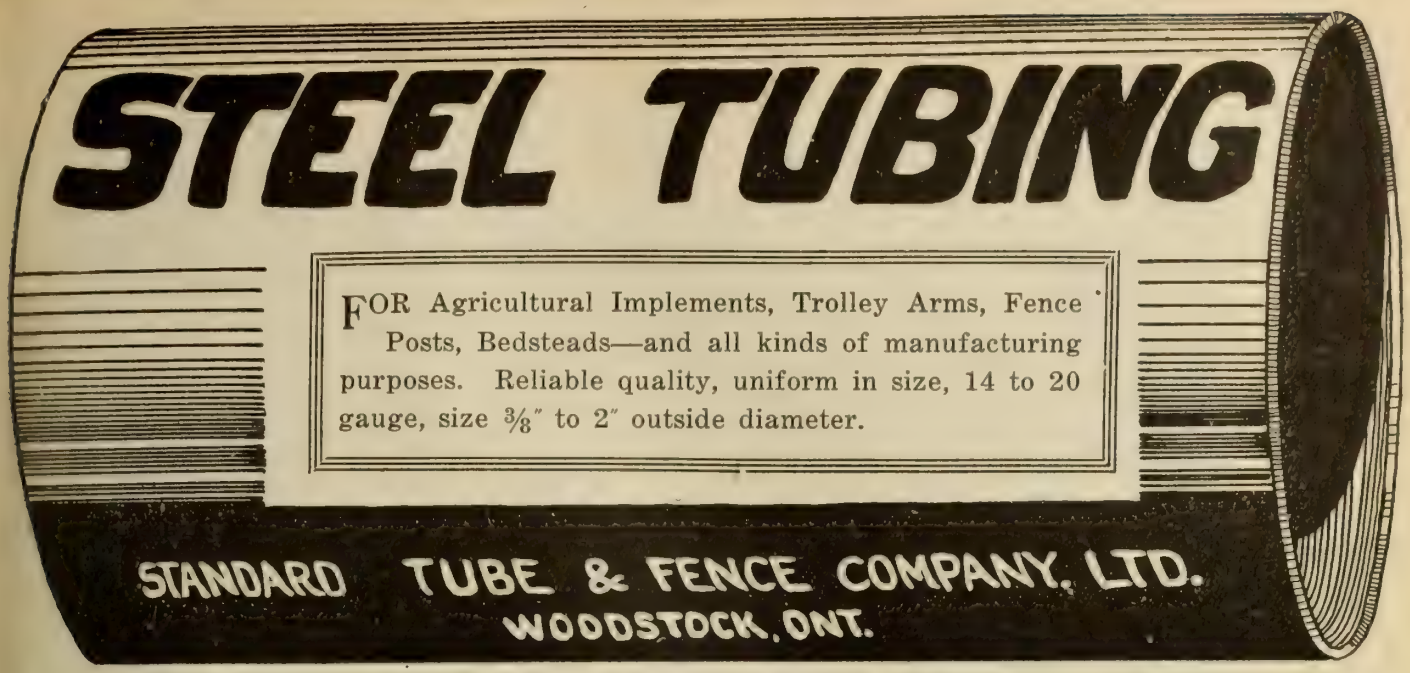
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Keystone Mfg. Co., Buffalo, N.Y.
Wells Bros. of Canada, Galt, Ont.

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Page Steel & Wire Co., Adrian, Mich.

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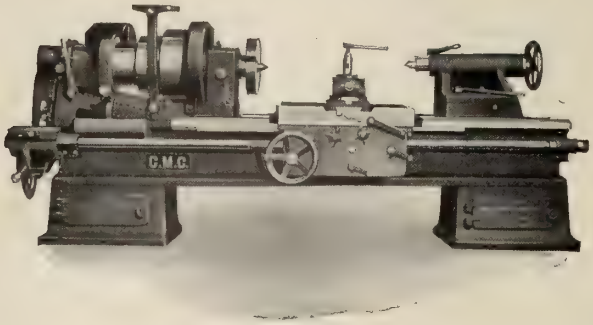
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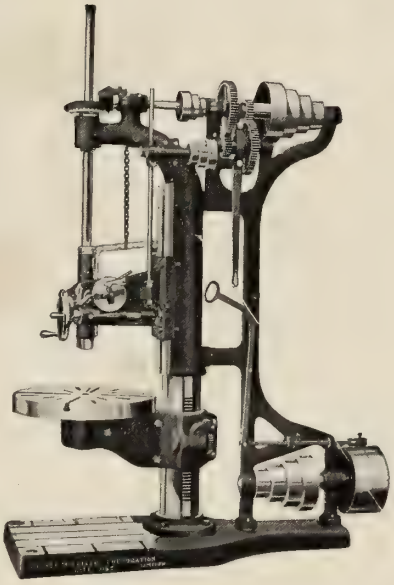
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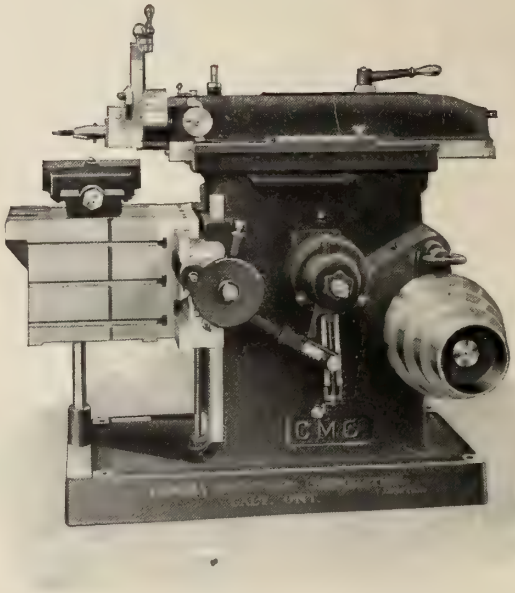


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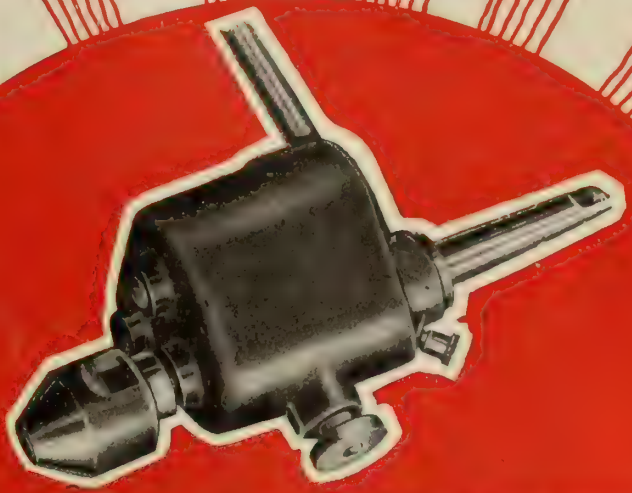
CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

Vol. XXIII., No. 3 Publication Office: Toronto, January 15, 1920 $3.00 per year. Subscription Price

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The Dawn of Economy and Speed in Tapping

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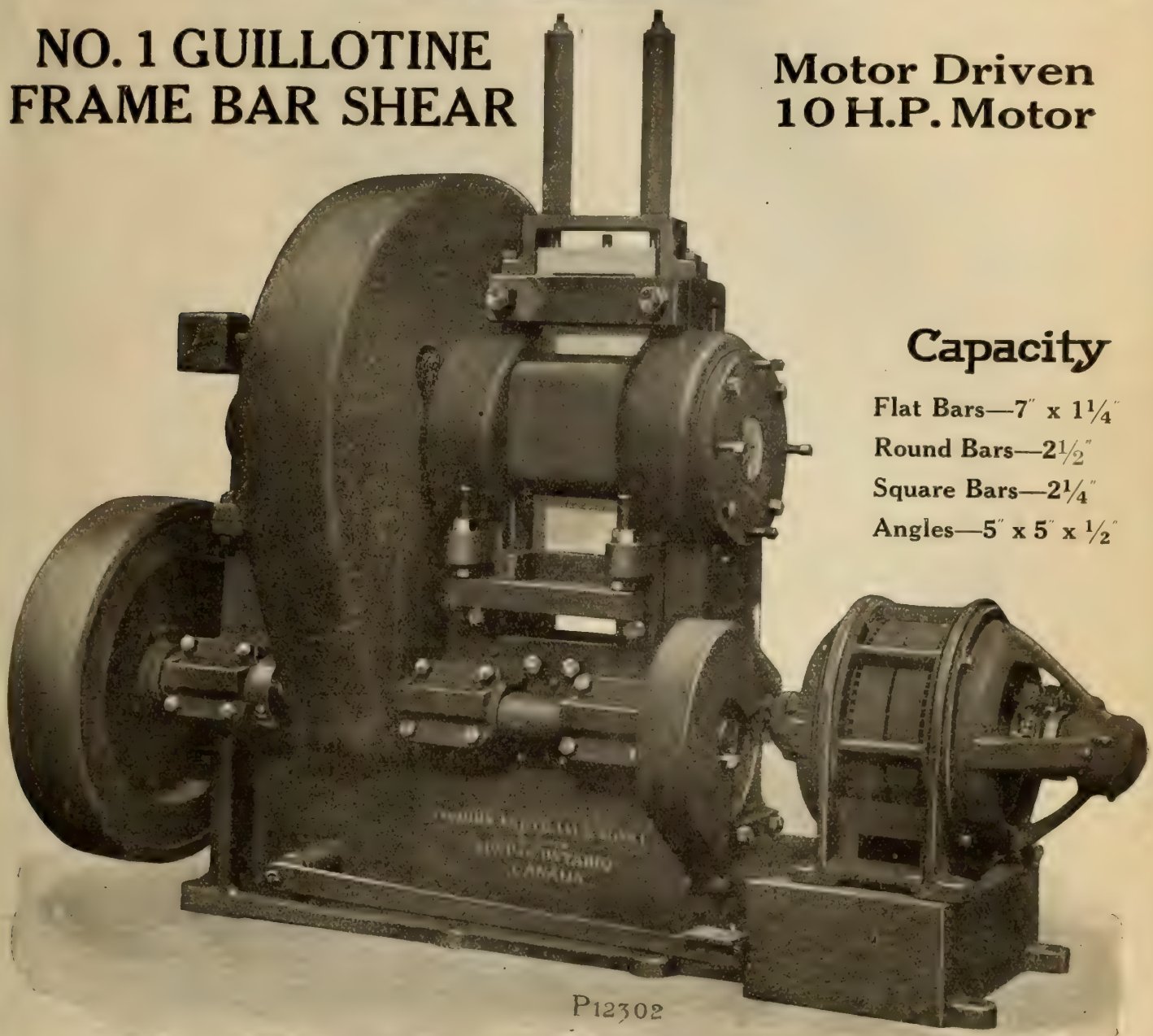
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Motor Driven
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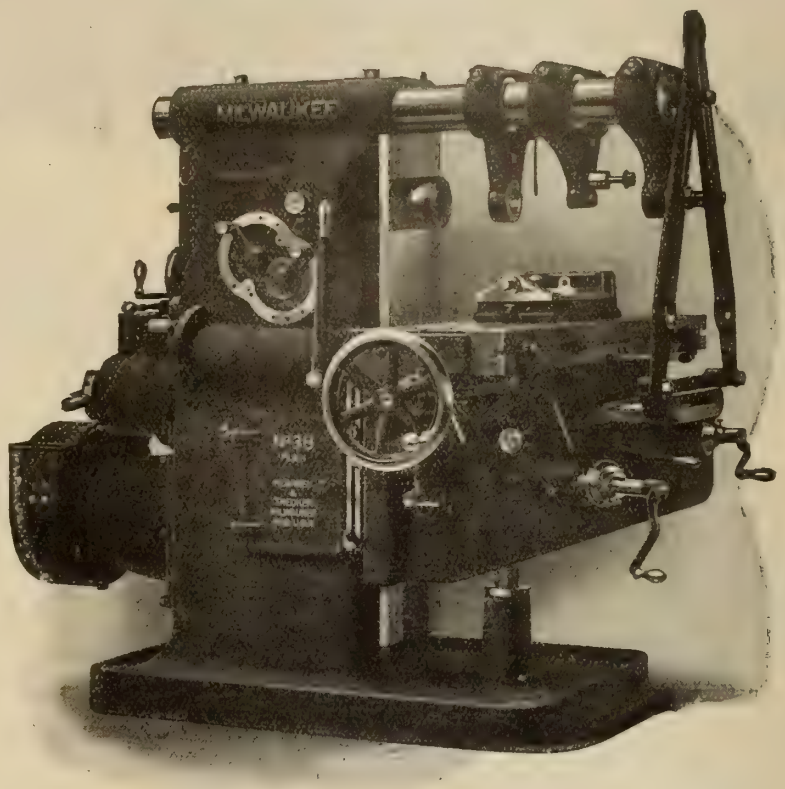
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Rigidity, Accuracy and Increased Production

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Located on the Richelieu River, 27 miles from Montreal, in the centre of the most densely populated district in Canada.

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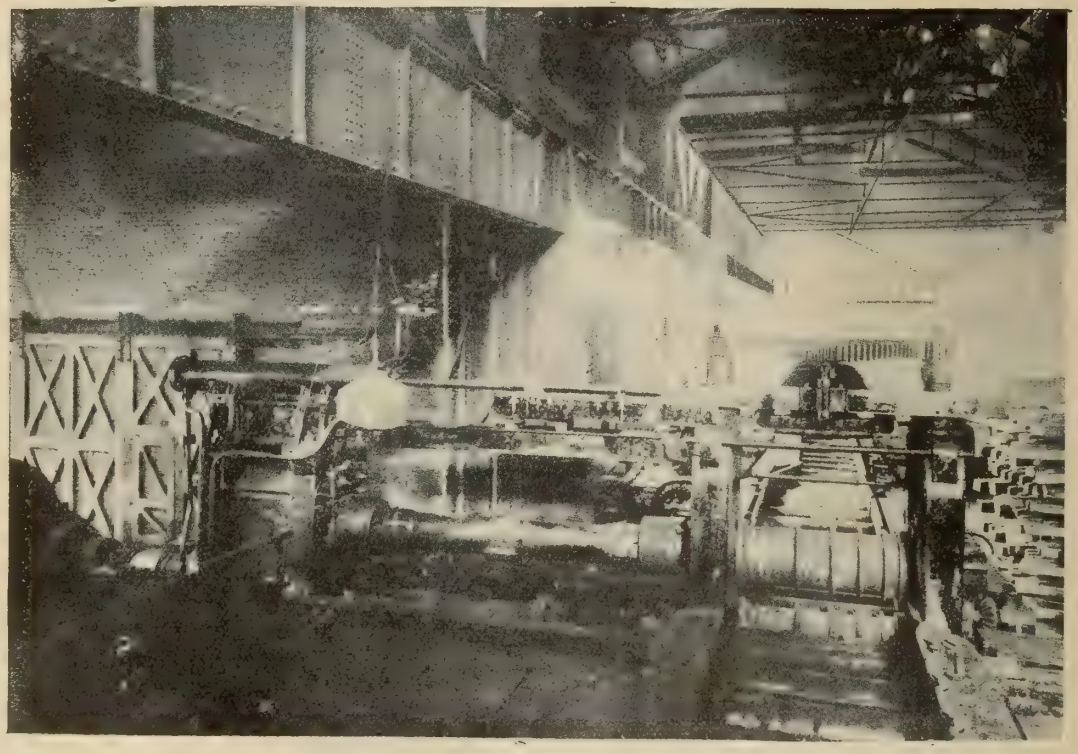
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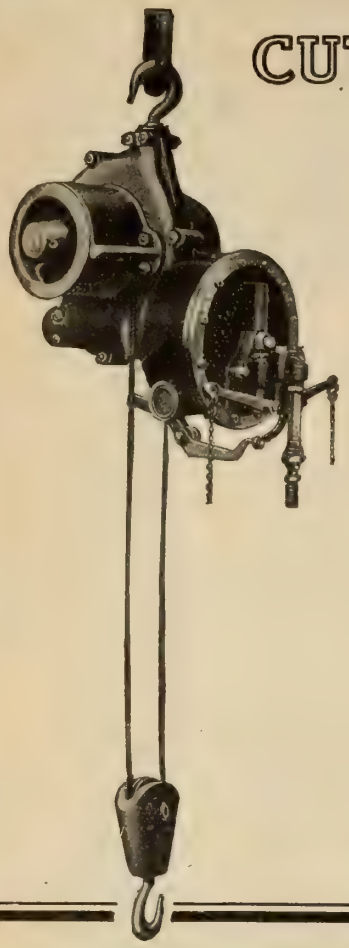
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Size No.	Capacity Lbs.	Ft. Lift per Min. 80 lbs. Pressure	Maximum Lift Feet	Net Weight Lbs.
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2	2000	16	20	270
4	4000	8	20	395
7	7000	8	20	785
10	10000	7	20	785

Cost of Hoisting With "Little David" Motor Hoists

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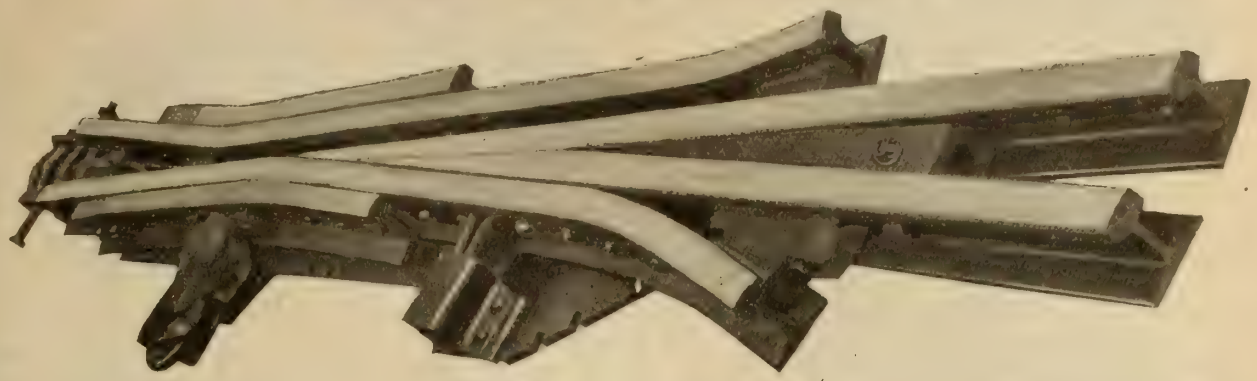
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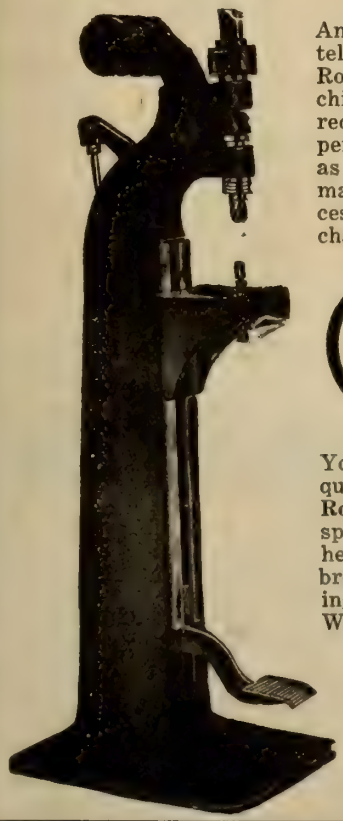


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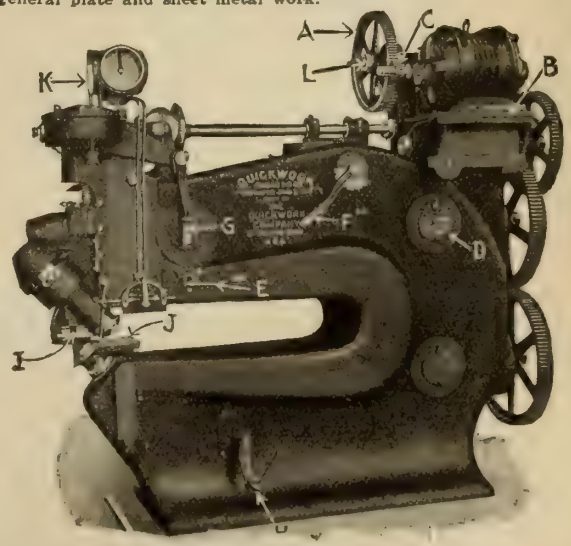
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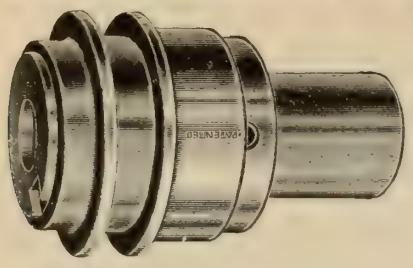
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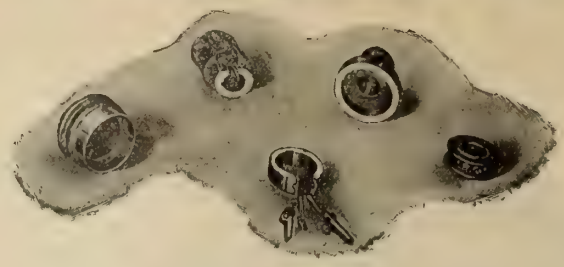
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SINGLE CLUTCH—EXTERIOR



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In a clutch or any other mechanical device, unnecessary complication means trouble. Make a single part serve where two have been used before, and you have reduced by one-half the places that can break, wear or get out of adjustment. Put the cost of *extra* material into *better* material, and you have doubled the length of service.

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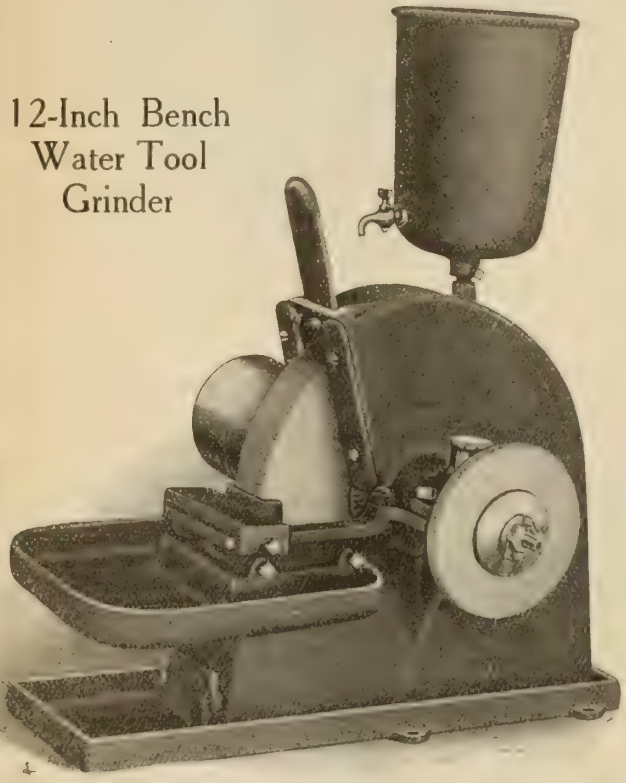
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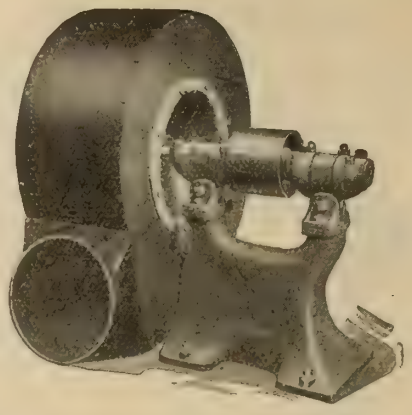


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Manufactured by

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Floors and machines covered with sawdust, chips or shavings, increase the fire risk in wood-working plants.

A spark from defective wiring or a hot bearing on a machine might cause a disastrous fire.

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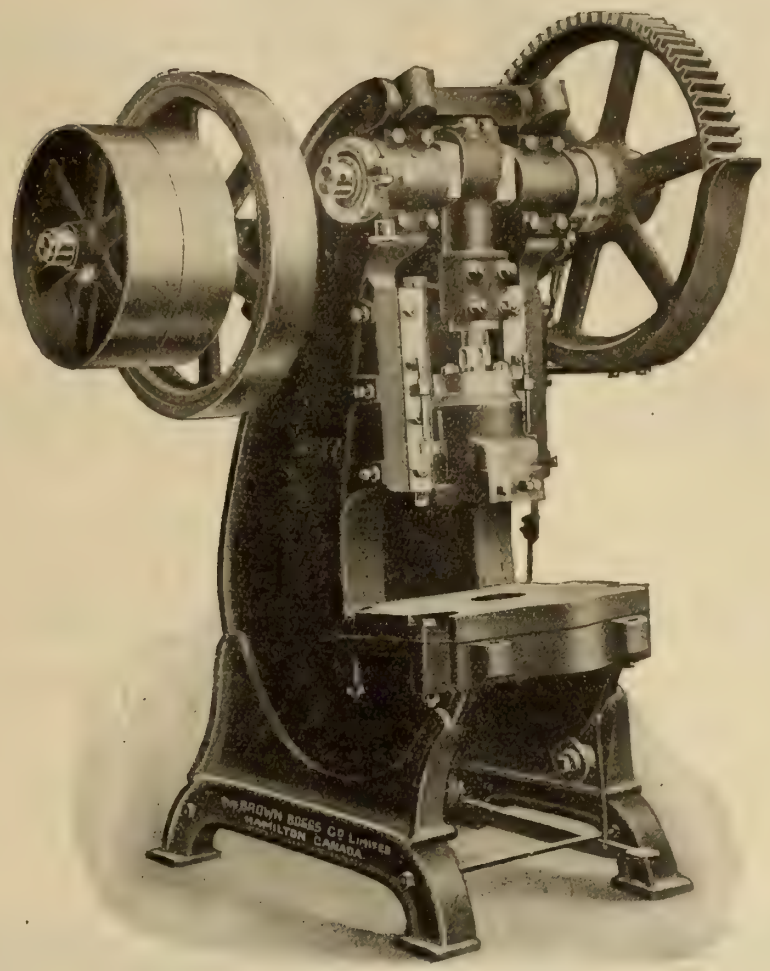
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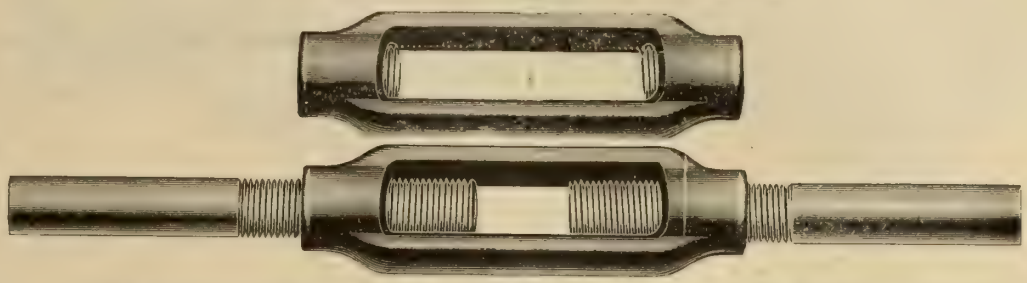
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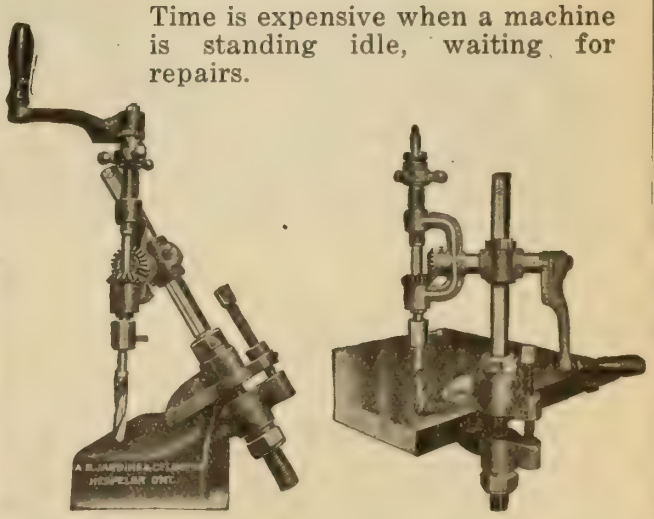
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Time is expensive when a machine is standing idle, waiting for repairs.



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Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

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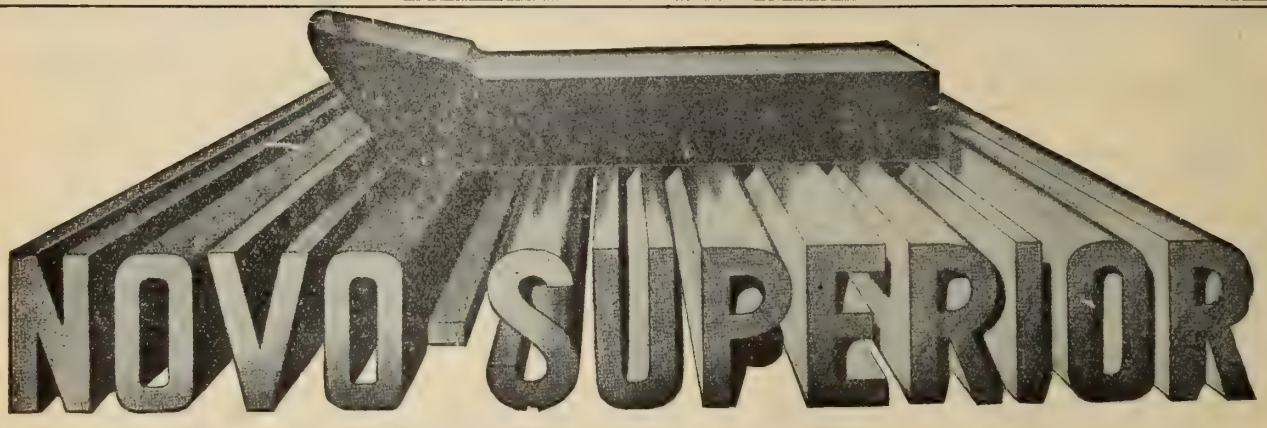
"WACO"

THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
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ALL SIZES
IN STOCK

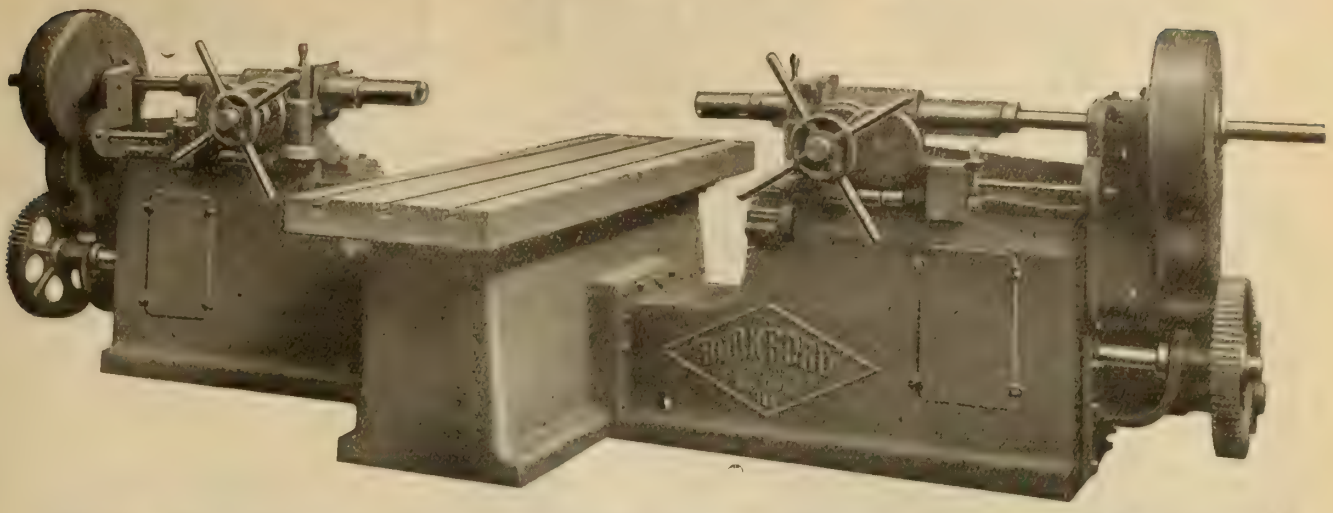


HIGH SPEED STEEL
INTRA STEEL *GIBRALTAR STEEL*
Tool Steel for Every Purpose
SWEDISH LANCASHIRE IRON.
Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
Music Wire for Springs, Steel Balls
Cold Rolled Tool Steel in Strips and Sheets.

We call to your particular attention that we make a specialty of and solicit your inquiries for
Circular Saws—for wood and for hot or cold metal cutting
Machine Knives—for cutting wood, paper, tobacco, agricultural.

PILOT STEEL & TOOL COMPANY, Limited, 322 St. James St., MONTREAL
Sole Agents for JONAS & COLVER, LIMITED Novo and Continental Steel Works, Sheffield, Eng
H. BOKER & CO., Inc. New York, N.Y.

FOR HEAVY DUTY



This Rockford Horizontal Heavy Duty Boring Machine

This model of Rockford will answer satisfactorily every demand for a heavy duty horizontal Boring Machine. It is of the Double End type, of massive design and great strength. It will stand up under the toughest of heavy duty operations.

This machine is a type of Direct Motor Drive with interchangeable pick-off gears.

The table is at right angles to the spindles, another unusual feature.

Forward and Reverse Feeds, Feed Back Gears and Complete Tooling Equipment are other points which warrant full consideration.

Complete details about this or any other Rockford Machine will gladly be sent to all who ask.

ROCKFORD DRILLING MACHINE COMPANY

Canadian Agents: Rudel-Belnap Machinery Co., Toronto, Montreal

Rockford THE ROCKFORD DRILLING MACHINE CO. ROCKFORD ILL. U.S.A. Illinois

"STAR" LATHES

are unexcelled for machine shops on SMALL WORK



May we send you our catalogue?

Sizes- 9" 11" 12" 13" Swing

Any work that may be machined on lathes of 13 in. swing and under can be turned out with greater accuracy, speed and profit on "Star" Lathes.

The "Star" will save you floor space —first cost—power. And its simplicity of construction and operation and ability to stand long, hard usage makes it invaluable for hard work.

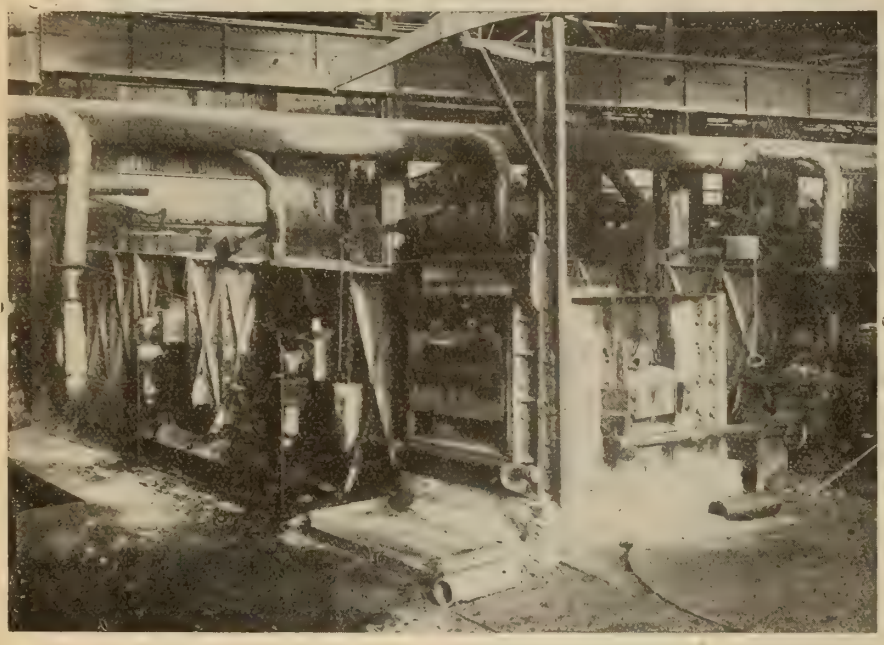
Write for our new Circular.

The Seneca Falls Mfg. Company, Inc.

366 W. Fall St., SENECA FALLS, N.Y.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

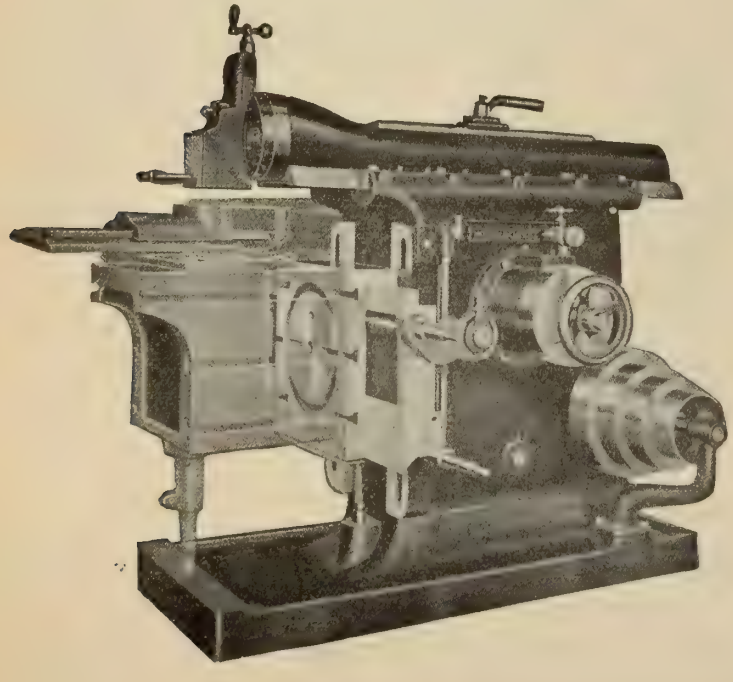
Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

Milwaukee Shapers

Are Needed in Up-to-Date Canadian Shops



A line that is unexcelled in Rigidity, Accuracy, Power, Simplicity and **Production.**

Built in three sizes: 16 inch, 20 inch and 24 inch.

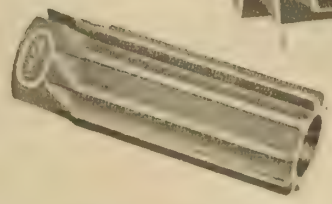
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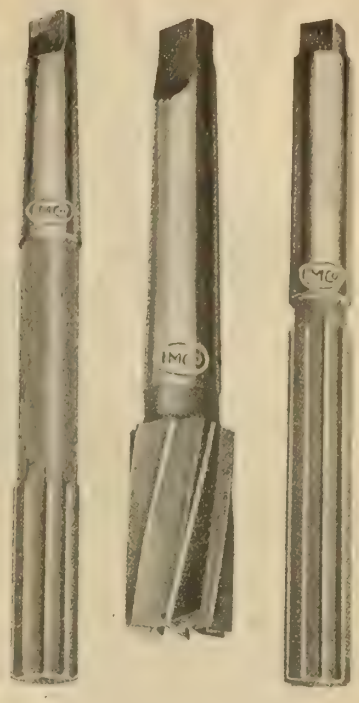
MILWAUKEE SHAPER CO.
1029 Coldspring Ave.
Milwaukee, Wisconsin

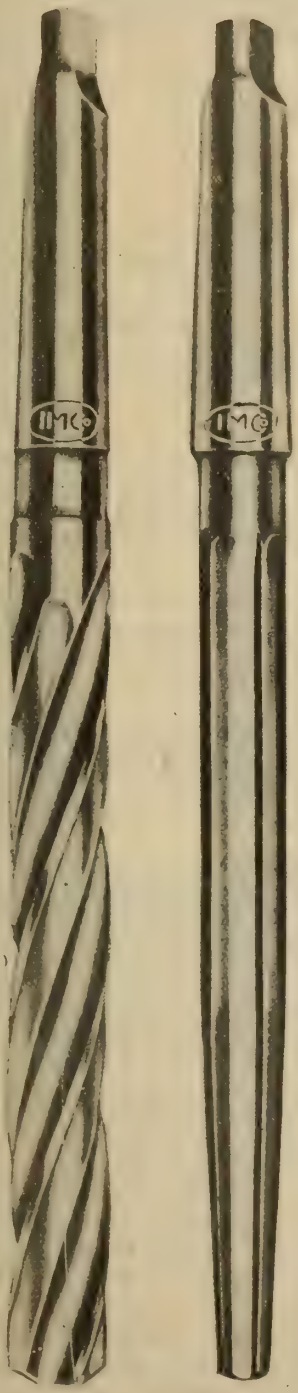
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TOOLS

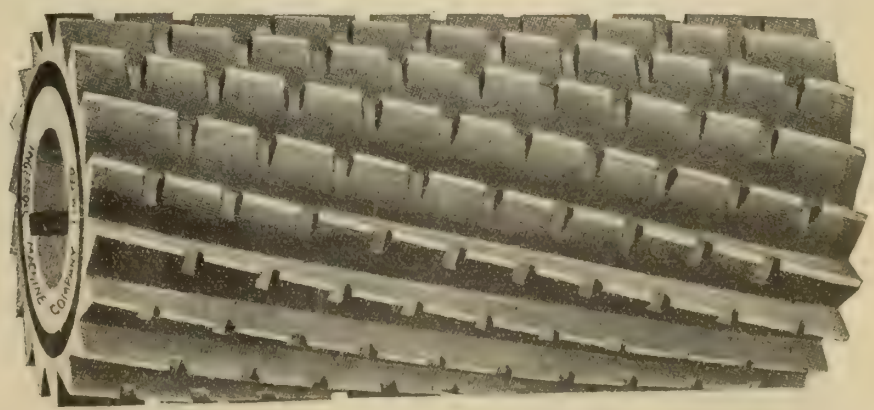
—and what depends on them

The tools that you use in your plant are the factors upon which depends the quality of your product.

Tools that stand up, tools that cost no more, yet last longer, hold the size, do their work properly—these are the kind that every manufacturer who is running his plant on a competitive basis will appreciate.

IMCO tools are good tools. Our three-lip drills and bridge reamers are used in many prominent plants and shipyards throughout the country, where they are rapidly building themselves a reputation for long-run economy.

Send for our catalog on Standard Milling Cutters, Reamers and Three Flute Drills. We carry a complete stock of standard sizes.



Ingersoll Machine Co., Limited

Ingersoll, Ontario

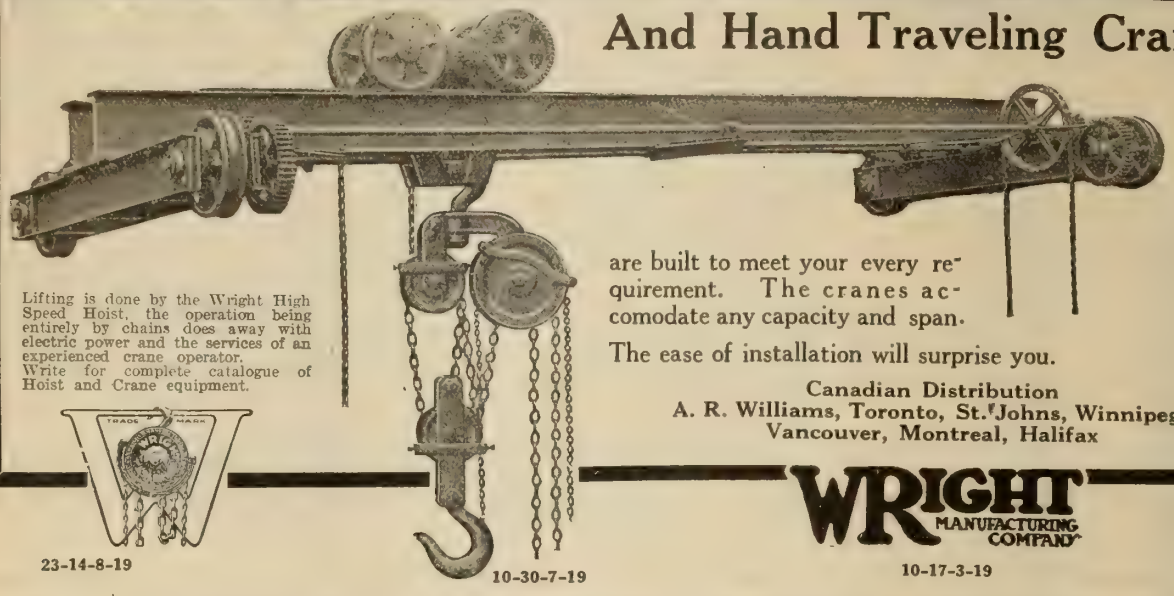
American Plant: American Machine Products Co., Inc.
DETROIT, Michigan

IMCO TOOLS

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WRIGHT HOIST

And Hand Traveling Cranes



Lifting is done by the Wright High Speed Hoist, the operation being entirely by chains does away with electric power and the services of an experienced crane operator.
Write for complete catalogue of Hoist and Crane equipment.

are built to meet your every requirement. The cranes accomodate any capacity and span.

The ease of installation will surprise you.

Canadian Distribution
A. R. Williams, Toronto, St. Johns, Winnipeg, Vancouver, Montreal, Halifax

WRIGHT MANUFACTURING COMPANY

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"STERLING" Hack Saw Blades



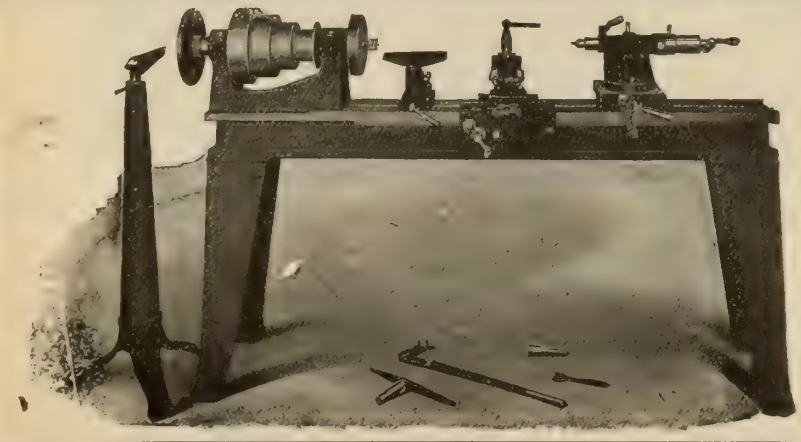
Guarantee satisfaction. A trial will convince you of their superiority.

Insist on securing the "STERLING" Brand.



Manufactured by

DIAMOND SAW & STAMPING WORKS, BUFFALO, N.Y., U.S.A.

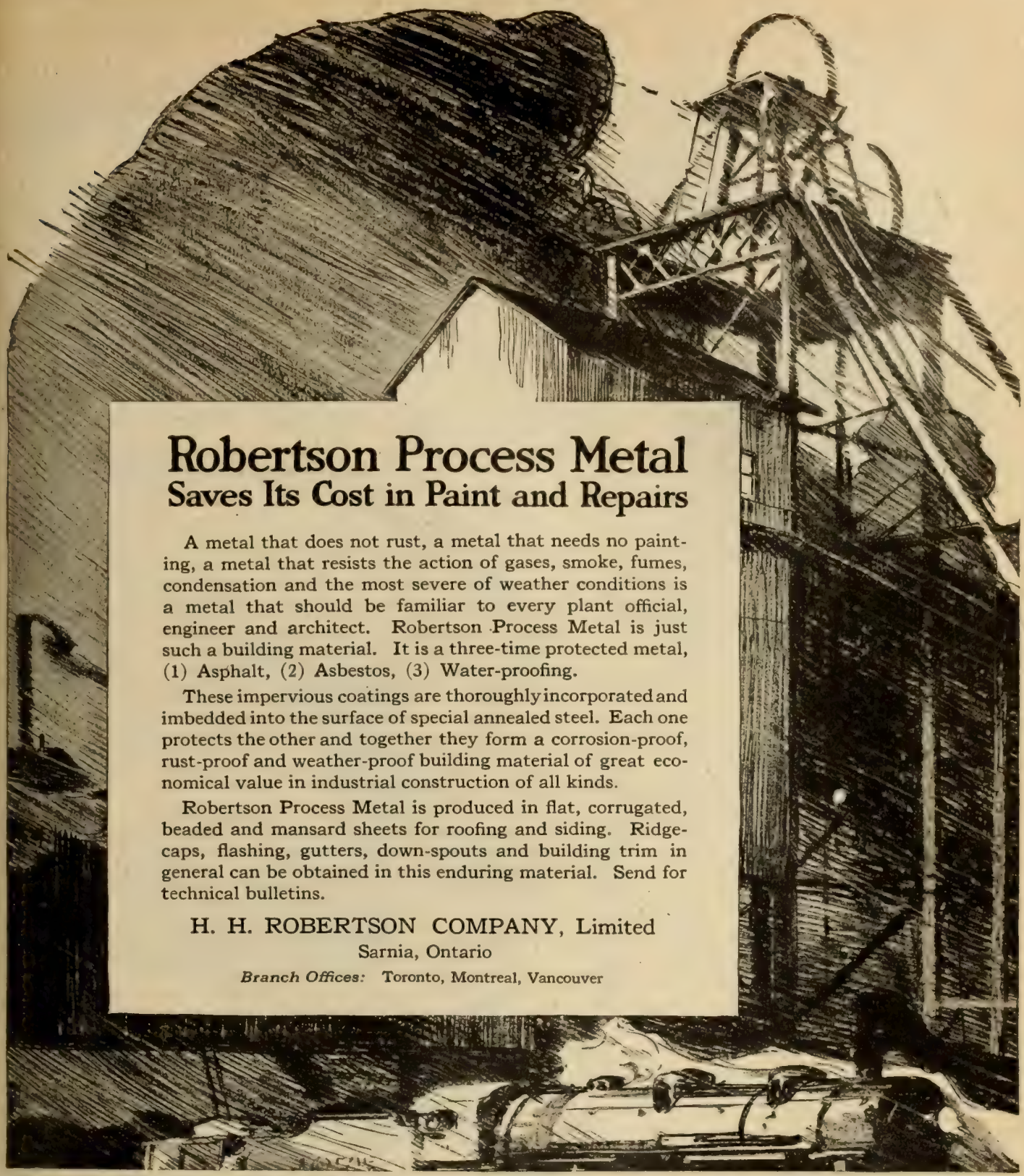


A Favorite—

Blount Pattern-makers' Lathe

FAST AND ACCURATE—Equipped with set over swivel tailstock and carriage, and outside face plate and tripod. Built in 16" swing with beds 6 or 8 feet in length. Spindle is made of high carbon steel, is hollow and fitted with Morse Taper and runs on self-oiling bronze bearings.
Our catalog gives a full description of this strong and highly efficient machine, also our other quality speed lathes and grinders. Give us your address.

J. G. BLOUNT COMPANY
EVERETT, MASS., U.S.A.



Robertson Process Metal
Saves Its Cost in Paint and Repairs

A metal that does not rust, a metal that needs no painting, a metal that resists the action of gases, smoke, fumes, condensation and the most severe of weather conditions is a metal that should be familiar to every plant official, engineer and architect. Robertson Process Metal is just such a building material. It is a three-time protected metal, (1) Asphalt, (2) Asbestos, (3) Water-proofing.

These impervious coatings are thoroughly incorporated and imbedded into the surface of special annealed steel. Each one protects the other and together they form a corrosion-proof, rust-proof and weather-proof building material of great economical value in industrial construction of all kinds.

Robertson Process Metal is produced in flat, corrugated, beaded and mansard sheets for roofing and siding. Ridge-caps, flashing, gutters, down-spouts and building trim in general can be obtained in this enduring material. Send for technical bulletins.

H. H. ROBERTSON COMPANY, Limited
Sarnia, Ontario

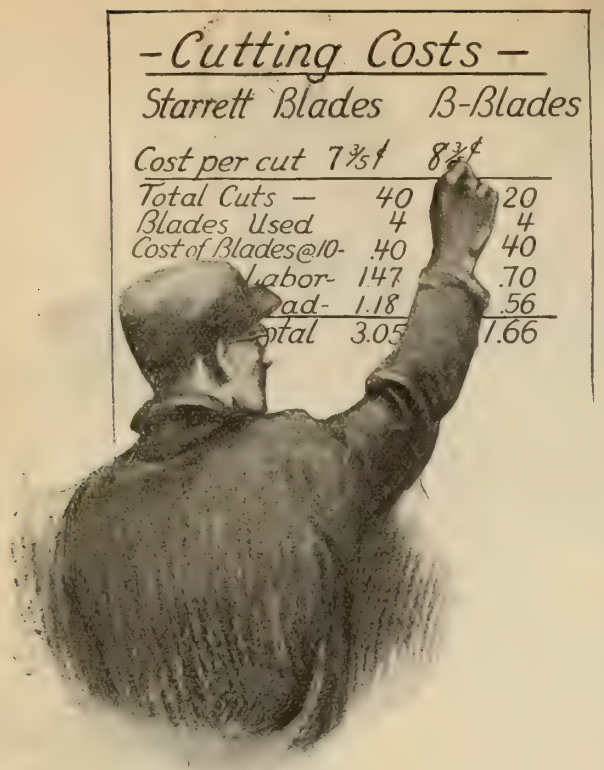
Branch Offices: Toronto, Montreal, Vancouver

ROBERTSON PROCESS

TRADE MARK REG. U. S. PAT. OFF.

BUILDING PRODUCTS & HIGHWAY MATERIALS

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More than Speed

Hack Saw Economy has something more to it than merely cutting speed.

The amount of work the saw will do before it is worn out and the variety of materials the saw will cut, without interfering with either the time per cut or the life of the blade, are also factors that determine cutting costs.

Here's an actual test that illustrates the point. Four Starrett Blades made an average of ten cuts each at an average time of two minutes and four seconds per cut. Another brand of hack saw averaged four cuts per blade, but the average time per cut was one minute and fifty-four seconds. If cutting speed was the only factor in economy the latter blades were the most economical to use. However, the actual figures showed that the cost per cut with Starrett Blades was almost one cent less per cut. Taking the cost of the blades as 10c. each, allowing 70c. per hour for labor and charging 80%. of the labor cost for overhead, the actual cost per cut made with the Starrett Blades was 7.6 cents, as compared with 8.3 cents for the other make.

The surest way of getting Hack Saw Economy is to use Starrett Hack Saws according to the Starrett Hack Saw Chart. Write for Chart "C" and Catalog No. 21 "C" also.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

ATHOL, MASSACHUSETTS
NEW YORK LONDON CHICAGO

42-C

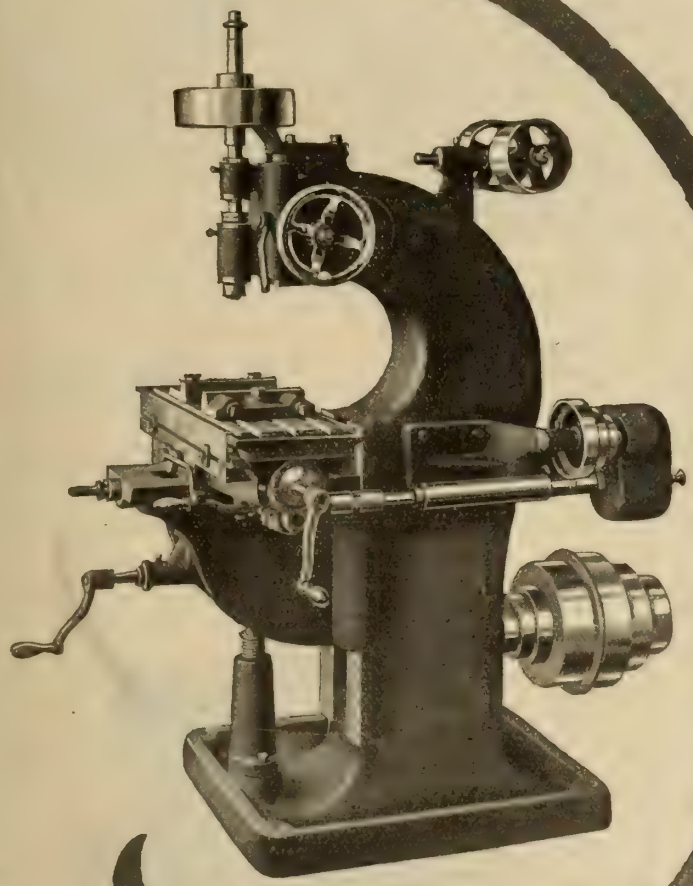


Starrett Hack Saws

BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity





Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

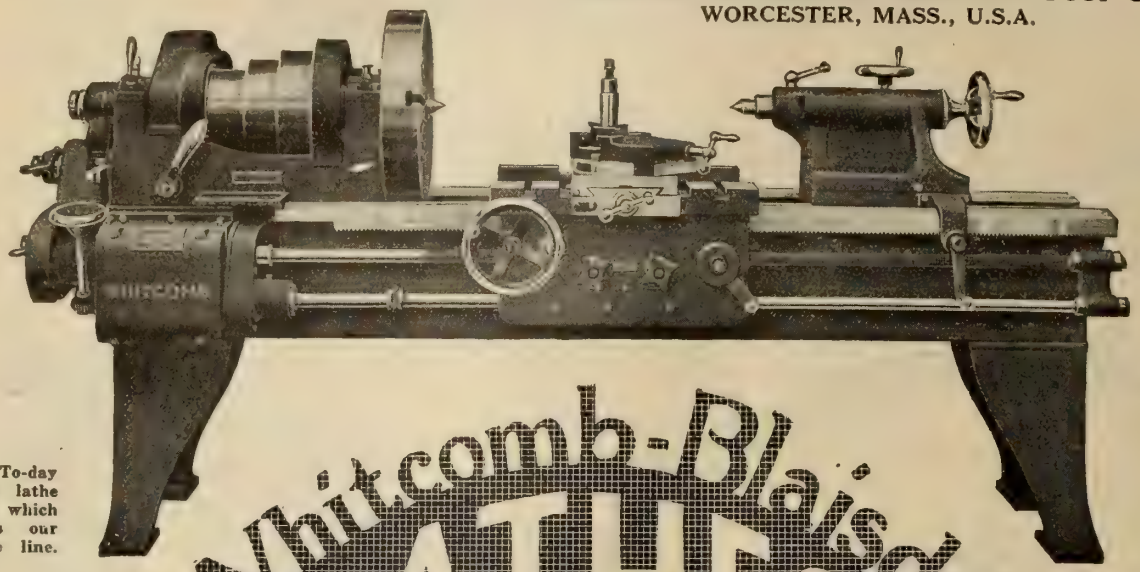
BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

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Adapted to all kinds of Rapid Manufacturing

WHETHER your lathe requirements must suit the rapid manufacture of intricate parts or versatile demands of modern tool room practice, one of the Whitcomb-Blaisdell Line will fit exactly your individual needs.
When you buy a Whitcomb-Blaisdell Lathe you get a big measure of service in return for every dollar invested. The entire line of W-B Lathes is distinguished for superior design, workmanship and material.
Rigid inspection and thorough working tests in our shops are your assurance of accuracy and dependability.

Whitcomb-Blaisdell Machine Tool Co.
WORCESTER, MASS., U.S.A.



Write To-day for our lathe Catalog which describes our complete line.

Whitcomb-Blaisdell LATHES

DUNBAR SPRINGS

ACCURACY ASSURED

You can always depend upon Dunbar Springs being accurate. Before proceeding with any order the first few springs are carefully tested and checked up for this very purpose.
Seventy-two years' experience making flat and spiral springs of every description enables us to furnish you with springs of the highest quality, that can be depended upon under all conditions.

Send blue prints for estimates.

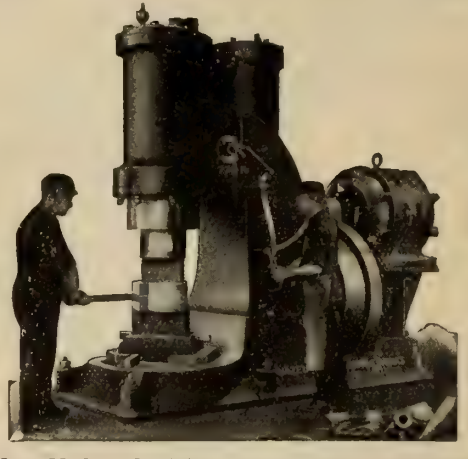
The Dunbar Brothers Co.
BRISTOL, CONN



The Nazel Air Hammer

(A Self-Contained Unit)

Noted for Its Blow and Control

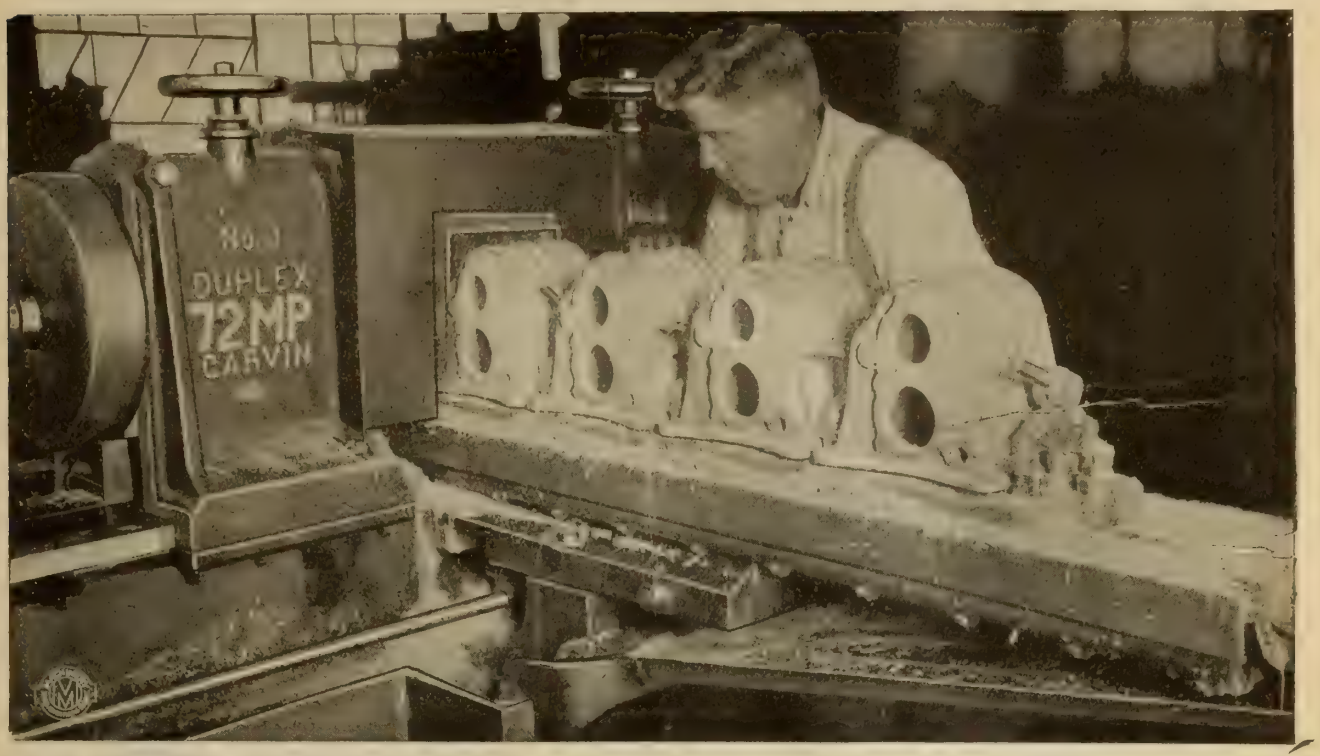


The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

Nazel Engineering & Machine Works
Dept. F., Philadelphia, Pa.

GARVIN MACHINE TOOLS



Milling two faces at once

GARVIN MACHINE TOOLS

Milling Machines
Profilers
Cam Cutters
Die Slotters
Screw Slotters
Tapping Machines
Duplex Horizontal Drills
Gang Drill Presses
4-head Right Angle Drills
Screw Machines
Cutter Grinders
Wrenchless Chucks
Surface Grinders
Duplex Slot Millers
Hand Lathes

The H. H. Franklin Mfg. Company at Syracuse, N.Y., realize the economy of a Garvin Duplex Milling Machine. With it they can face two sides of aluminum transmission cases at a simple operation. The first roughing cut removing ⅛ inch and a second finishing cut .010 inch. Production has exceeded 100 castings, milled complete, in 8 2-3 hours.

The operator says the work is accurate within plus or minus .0005 in. better than the plus or minus .0025 in. Incidentally, the operator is able to ream two holes in each case and remove burrs from the edges of the machined surfaces while castings are being faced.

This is one of the many Garvin Tools you can use to advantage. Let us send you the 340-page Garvin Catalogue.

The Garvin Machine Co.

Spring and Varick Sts., New York
Or your dealer can supply you

GARVIN

BUILDER OF BETTER MACHINE TOOLS G-11

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Photographs and data by courtesy of our customer.

This "Bliss" No. 5-S Toggle Press is shown producing a cooking utensil that will play an important part in feeding the new national army.

The wash basin illustrated is another of many things this press turns out. It is drawn from 30 gauge pickled and annealed sheet steel, three at once, size 11½ inches. Production on Power Presses varies widely according to the article and the operator's skill. In the case of this basin 1250 per hour is the average. Five years' continuous use without interruption for repairs is a characteristic "Bliss" record.

BLISS 1857

E. W. BLISS COMPANY

Main Offices: BROOKLYN, N.Y., U. S. A.

American Factories: BROOKLYN, N. Y. *and* HASTINGS, MICH.

BLISS 1920

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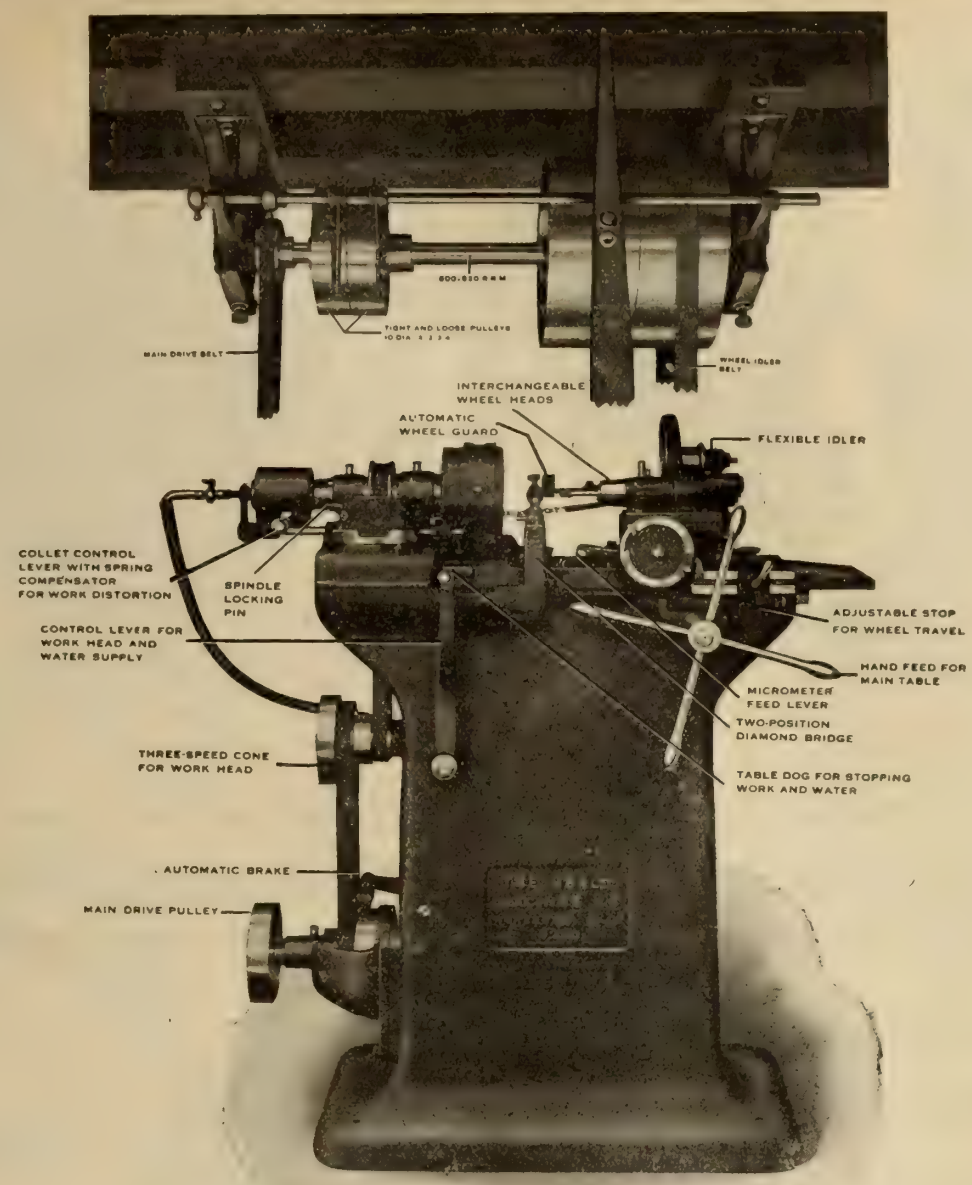
CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg.
CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg.

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LONDON, ENGLAND, Pocock Street, Blackfriars Road, S.E. PARIS, FRANCE, 100 Boulevard Victor-Hugo St. Ouen.

No. 17

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



FOR GRINDING SMALL, SHORT WORK

The Heald No. 85 is a new, simple productive machine for small, short work. It is designed so that movement of the pilot wheel to the right draws the wheel from the work and automatically puts on a brake, stopping the workhead and shutting off the water. It is furnished with a quick-acting collet with a capacity of 3/8" to 3" in diameter.

The table is provided with positive stops, enabling the operator to grind up to a shoulder. The machine is also equipped with a flexible idler, automatic wheel guard, water attachments and simple single countershaft.

THE HEALD MACHINE COMPANY

WORCESTER, MASS.

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STEEL CASTINGS

Mild Steel, High Carbon Steel, Manganese Steel, Chrome Steel

We are manufacturers of Steel Castings running from ½ lb. to 5000 lbs. each and are in good position to furnish prompt deliveries at moderate prices. Try us with your next order.

The William Kennedy & Sons, Limited, Owen Sound

ESTABLISHED 1860

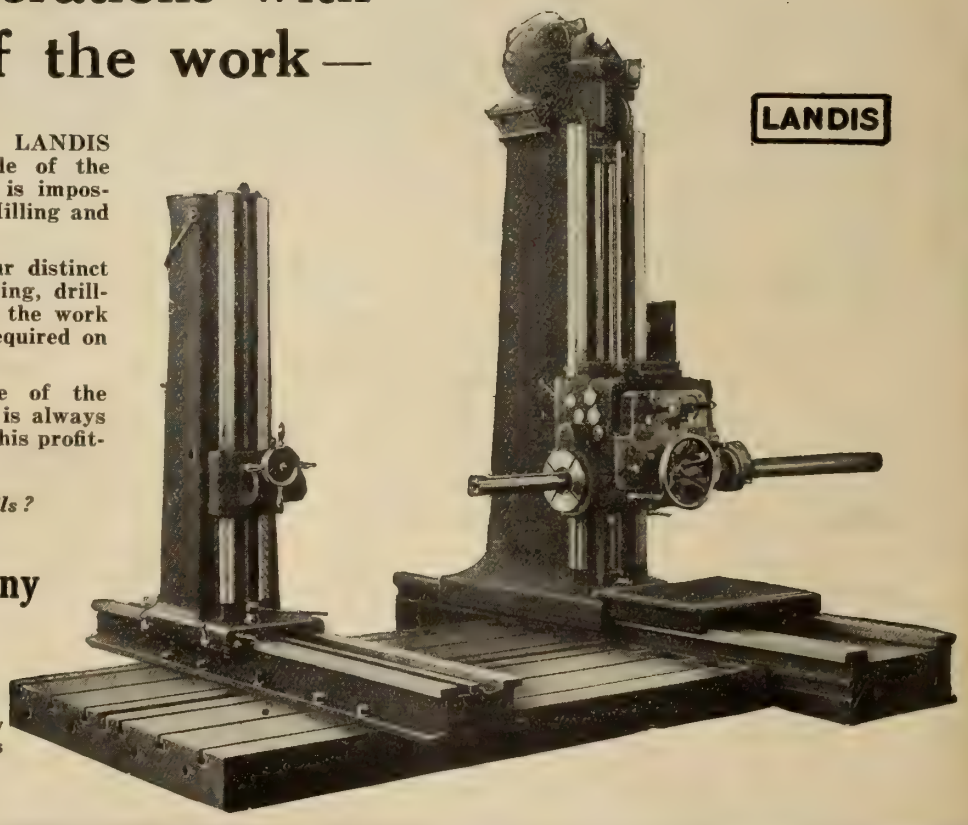
Sixty-four operations with one set-up of the work—

The job referred to is a typical LANDIS achievement—a striking example of the saving of time and labor which is impossible with the LANDIS Boring, Milling and Drilling Machines.

The job requires in all sixty-four distinct operations, including boring, milling, drilling and tapping. One set-up of the work—a heavy piece—is all that is required on the LANDIS.

Versatility is a strong feature of the LANDIS. Wherever installed, it is always busy. Ask us for full details on this profitable machine.

Why not learn the full details? Catalog on request.



Landis Tool Company

Waynesboro, Pa.

New York Office: 50 Church St.

Canadian Agents: A. R. Williams Machinery Co., Toronto, Winnipeg, Vancouver; Williams & Wilson, Montreal.



Murchey Chasers

Mean Quick Deliveries



Murchey Tools will cut your tapping and threading costs. **They will boost production 50%.** Another important feature is Murchey's **Quick Deliveries on Chasers.** This is a Murchey specialty. No waiting! We get your chasers to you when you want them. Why not use Murchey Tools to speed up your threading production?



Send for a Murchey Tap or Die on approval and give it a trial. You will then secure actual proof of its value to you.

Murchey Machine & Tool Company, Detroit, Mich.

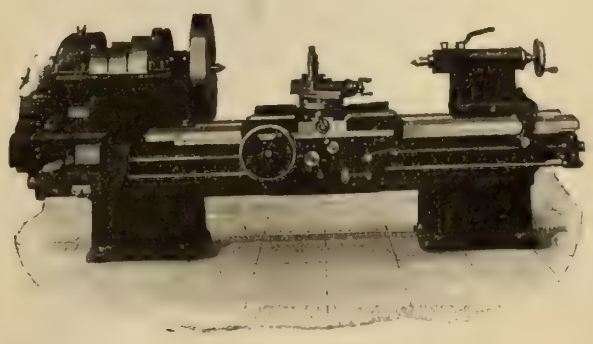
THE COATS MACHINE TOOL CO., Caxton House, Westminster, London, England, Glasgow, Newcastle-on-Tyne,
FENWICK FRERES AND CO., 15 Rue Fenelon, Paris, France

SIDNEY

Sidney for Service

Heavy Duty Engine Lathes

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



Specifications include 3-step cone, double brake gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sidney line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
H. W. Petrie, Limited, Toronto, Ontario

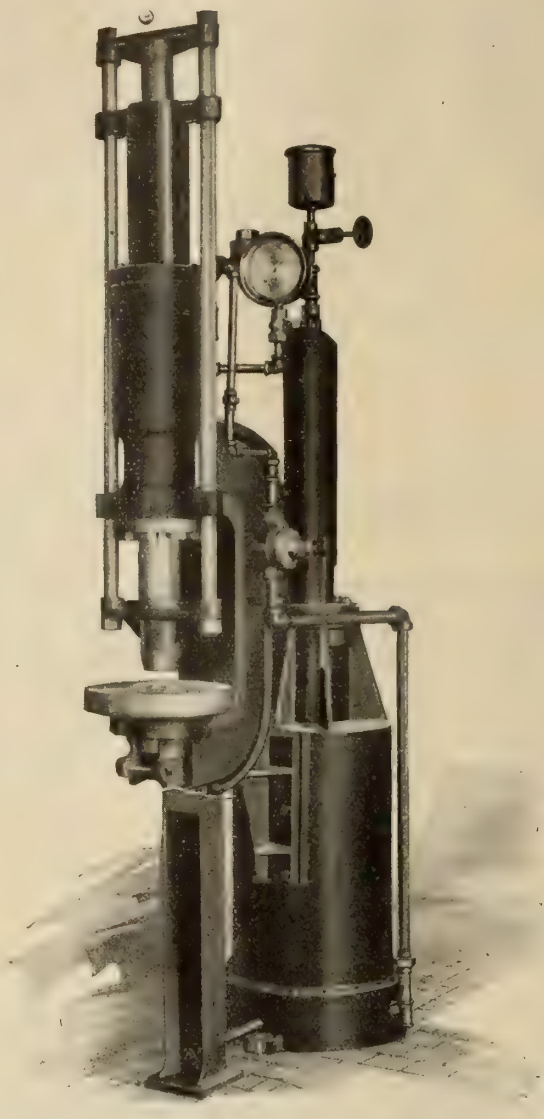
ORIGINALITY

is Characteristic Always of

"METALWOOD"

DESIGNS and

DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

METALWOOD MANUFACTURING CO.

High Speed Hydraulic and Hydro-Pneumatic Machinery

DETROIT, MICHIGAN

EXCLUSIVE SALES REPRESENTATIVES:

Canadian Fairbanks-Morse Co., Ltd., Montreal and Toronto; R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago; Fairbanks-Morse & Co., Inc., 30 Church St., New York City; Sherritt & Stoer Co., Inc., Finance Bldg., Philadelphia, Pa.

It's Their Time But It's Your Money

The moment one of your men continues working after a file has become dull you lose money, because the man will waste more time with the dull file than a new one would cost.

Teach them to turn in a file as soon as it becomes dull and get a new one. And specify the Standard *Famous Five* Files when ordering.





MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

for

Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
Air Compressors Vacuum Pumps

ROLLING MILL MACHINERY

Blooming Mills	Tin Plate Mills
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Structural Mills	Squaring Shears
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Continuous Mills	Bloom Shears
Tube Mills	Bar Shears
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Rolling Mill Pinions and Gear Drives

SPECIAL MACHINERY

Steam Hydraulic Forging Presses
Steam Hydraulic Shears
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FORGINGS

Large Engine Shafts—Piston Rods
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Carbon Steel—Alloy Steel—Bronze
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Carbon and Alloy Steel Forging Ingots

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MESTA MACHINE CO.

Pittsburgh, Pa. U. S. A.

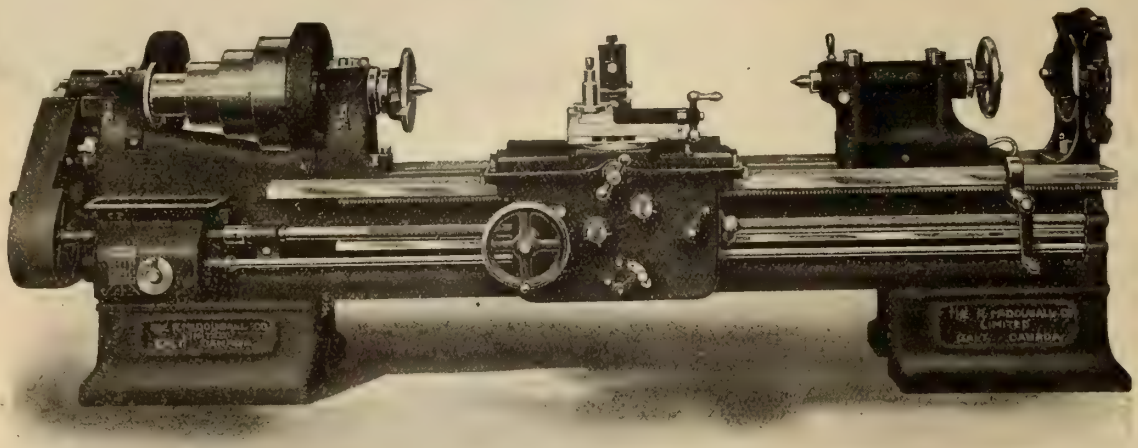
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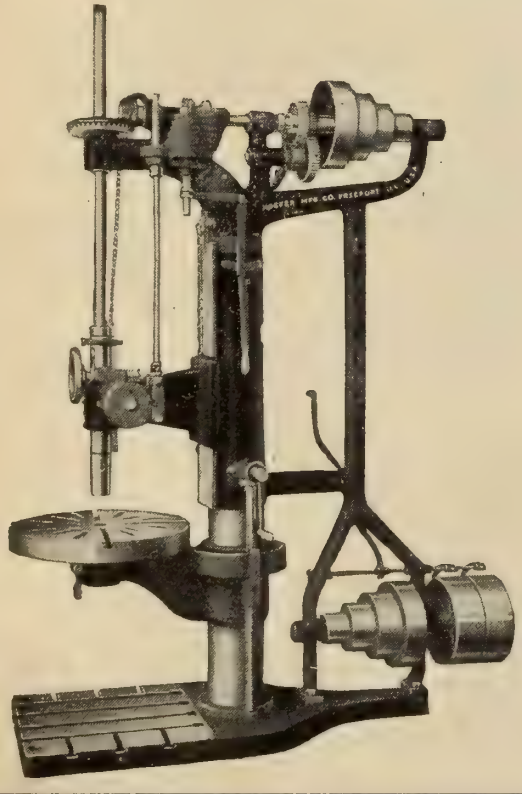


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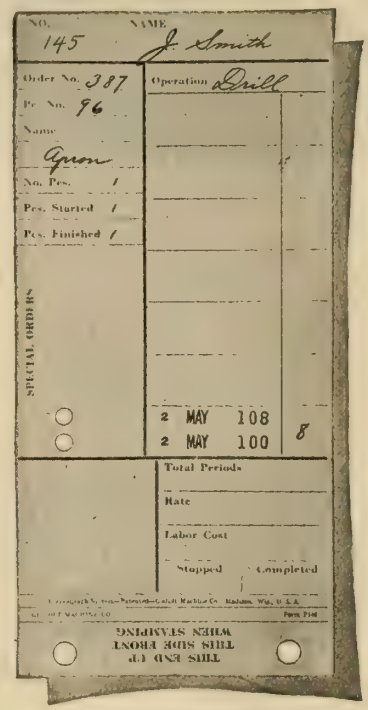
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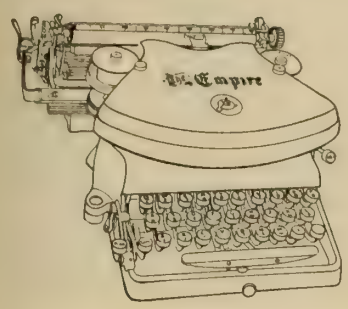
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XXIII. No. 3. January 15, 1920



Making the Empire Typewriter

Some of the Important Features of Construction are Discussed and Interesting Operations Shown

By J. H. RODGERS

IN the year 1844, C. W. and John Williams Commenced building sewing machines in Montreal. They occupied a small shop on Dowd Street, and from this humble beginning has grown the present organization of The Williams Manufacturing Co., Limited, with modern factories at Montreal and Plattsburgh, N.Y., and sales offices in Montreal, Toronto, Hamilton, St. John in Canada, and in New York and Washington in the United States.

In 1895, manufacture of typewriters was commenced in Montreal, and in 1897 this line was also added to the activities at Plattsburgh.

The Company grew rapidly in both quantity and quality of output, and in 1916 devoted almost its entire plant to the manufacture of time fuses for the British Government, making over 1,000,000 of these intricate devices. During the war, the Plattsburgh plant was also busy on munitions, and made many millions of time fuse needles.

Since the war, the company has developed new lines of manufacture, and is now making the Wedgerite Piston Rings in both plants, as well as gramophone woodwork and parts at Montreal.

Because of the exceptional character of the modern machine tool equipment purchased for war work, and having a splendid new five-storey building with 50,000 square feet of available floor space, this company is fully justified in looking forward to a bright future, and it is now considering several promising new lines of manufacturing development.

The company began the manufacture of the "Empire" typewriter in the year 1895. It is not the purpose of this article to go into the manufacture of typewriters in detail, but rather to dwell on some of the more important features of construction that makes the "Empire" equal in efficiency to others of more complicated construction.

The frames for the different machines are made on moulding machines, and the castings are all annealed before being machined. A special Pratt and Whitney pro-

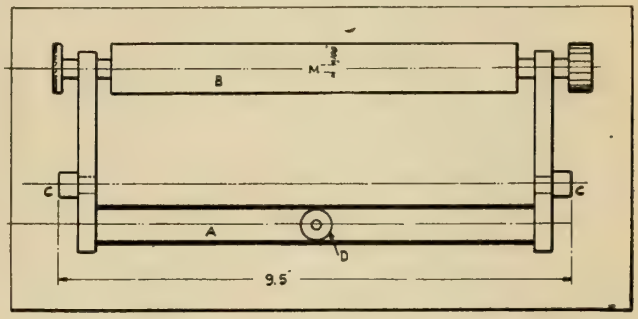
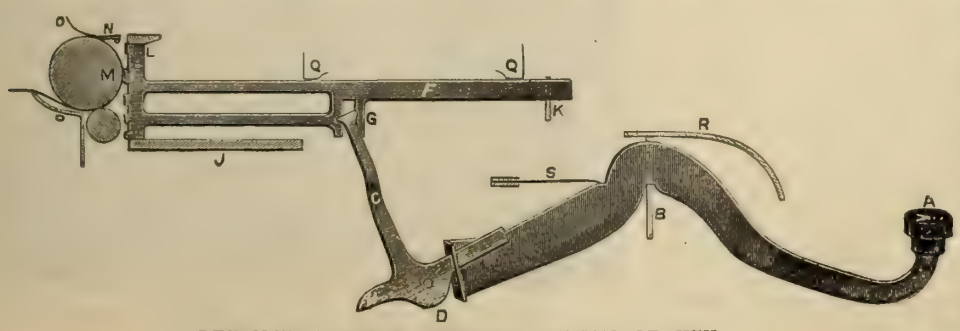


FIG. 1—ARRANGEMENT OF PLATEN AND STEEL GUIDES.

filing machine is used for milling off the various hubs and bosses. This machine is fitted with a long, small drum at the rear that serves as a driving pulley for the two vertical spindles, which are connected to the driving pulley by means of the mule drive. The different operating positions for the cutters are regulated by adjusting stops, located on the side of the frame, for controlling the vertical travel of the cutter.

The spindle head is operated laterally on the cross rail by means of a rack and gears operated by the handle at the front of the machine. The side movement is controlled by stops on either side of the cross rail.

The drilling of the frames is accomplished in several four-spindle machines, and the jig used is designed for drilling from all six sides—a total of 56 holes are drilled before the frames are removed from the jig. Drilling takes place after the frames have been japanned and baked.



DETAILED DIAGRAM—SHOWING ACTION OF KEY.

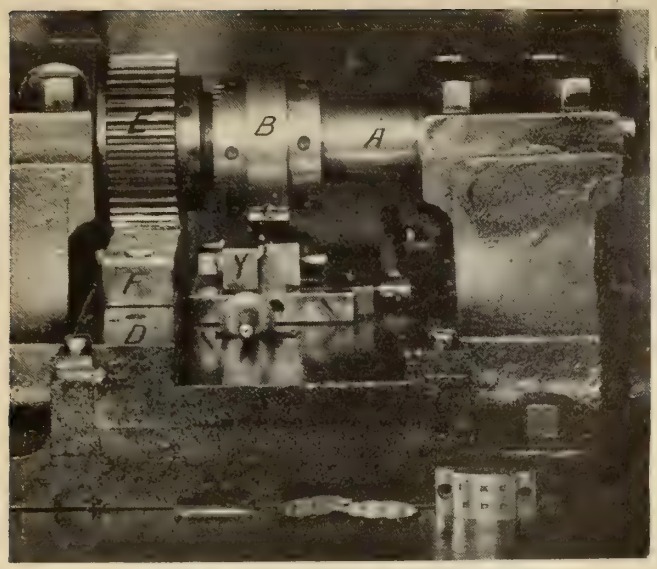


FIG. 3 TYPE ROLLING MACHINE.

All the small screw parts are made in the plant, and a number of Brown and Sharpe and Davenport automatics are installed for this purpose. All small screws and working parts on the machines are hardened, after which the screw heads are polished and blued by immersion in hot sand.

The type bars and key levers are given a special heat treatment, by immersion in a red-hot solution that leaves the parts with a clear, black, pleasing appearance, and free from any signs of warping, even though the parts are long and slender.

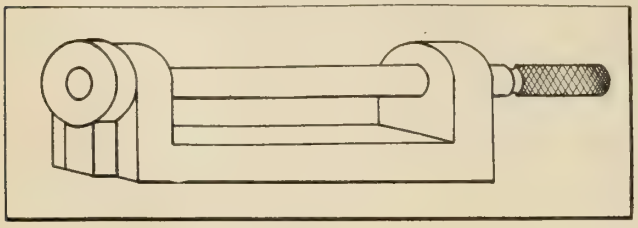
The assembly is done in stages, the machines passing from one operator to the other, each operator having a certain duty to perform in the assembly of the machine.

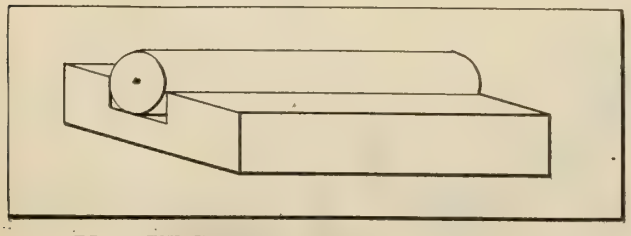
Type Alignment

The principal merits of the "Empire" design are simplicity, directness and durability. In the type action, which is the heart of a writing machine, there is only one intermediate between the key lever and the straight thrusting type-bar. This feature insures a powerful and accurate type impression and clear manifolding.

The type are held in alignment at the printing point by hardened steel guides, which maintain the type impression, both vertically and horizontally, and to determine the continued straightness of the printed line, the Platen "B," Fig. 1, which receives the type impression, is aligned by being guided by a fixed roll D positioned directly under the centre of the printing point. This novel arrangement prevents the possibility of any in-

FIG. 6—OIL STONING DEVICE.





FG. 7—FIXTURE FOR TESTING MASTER TYPE.

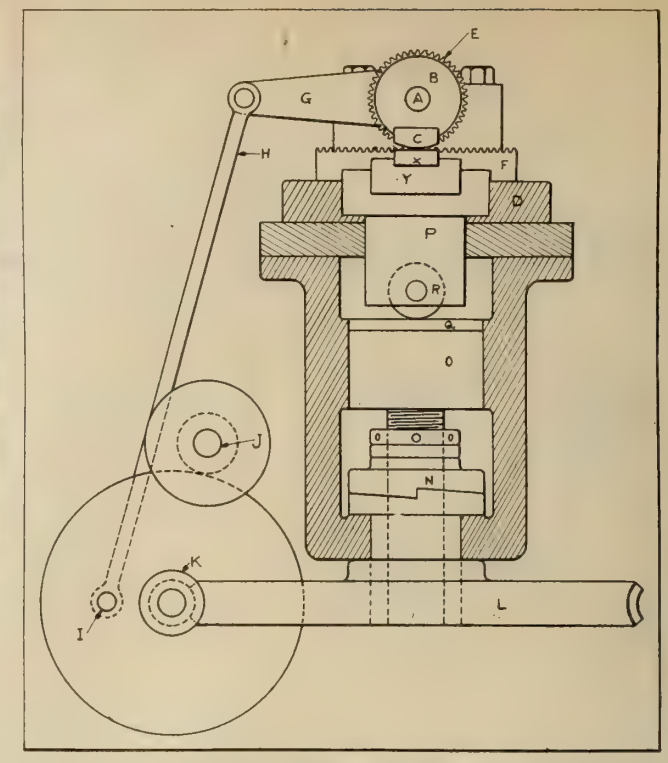


FIG. 4—KNEADING MACHINE FOR MAKING TYPE.

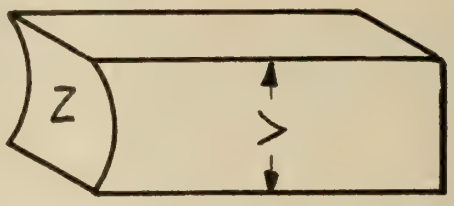


FIG. 5.

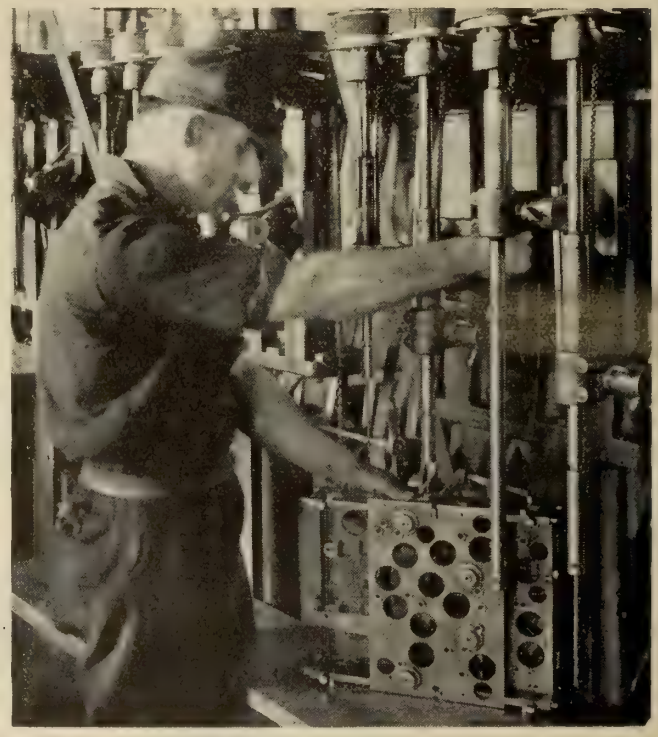


FIG. 8—TYPEWRITER MAIN FRAMES DRILLING JIG. 56 HOLES ARE DRILLED IN THIS FRAME.

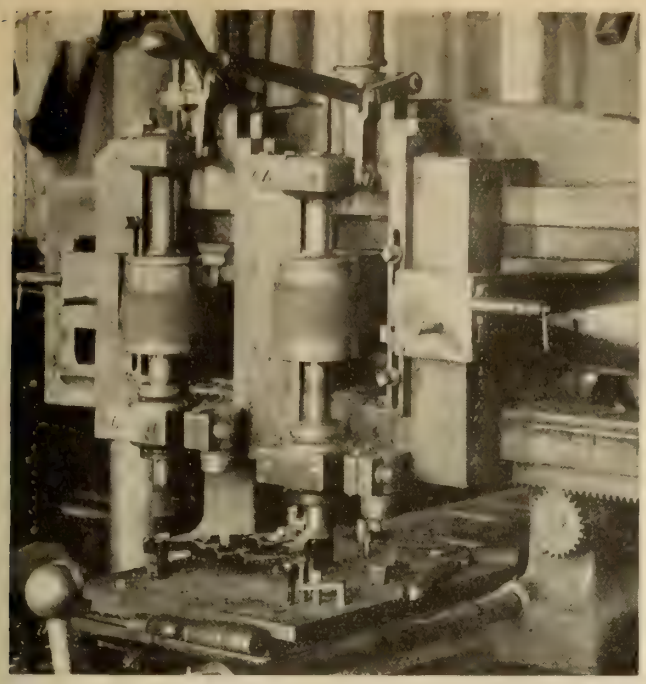


FIG. 9—PROFILING MACHINE MILLING TYPEWRITER FRAMES

accuracy being caused by wear of the carriage raceway or balancing mechanism.

The only requirement of manufacture to assure a constant printing line along the face of the platen is that the groove A, which positions the carriage for capitals or figures, be maintained parallel with the centre line of the roll or platen. This guide groove, not being subject to wear, determines the printing point correctly. Even should some wear occur in the balancing arm joints C, it would only cause a tilting of the letters in relation to the printed line, and this actual tilt would be reduced in the proportion of at least 85 to 1, as the length of the line between pivots is never less than 9½ inches, while the height of the letters is seldom more than .100 inches. It is, therefore, apparent that wear in the carriage will not affect the vertical alignment of the printing point.

The result is very different in the usual type of carriage paralleling device, in which the guide roll is fixed to and travels with the carriage, for any wear in the joints results in an increased inaccuracy of the position of the printing point as the carriage travels to either the right or left end of the raceway.

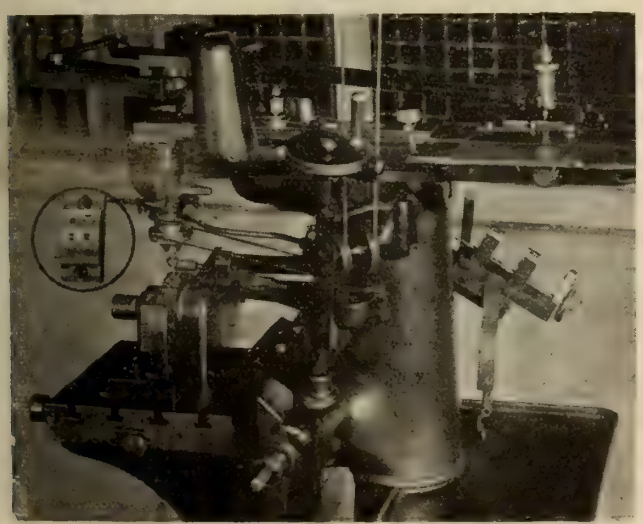


FIG. 10—SPECIAL GORTON ENGRAVING MACHINE ADAPTED TO MILLING TYPE MATRICES.

Rolling the Type Faces

In considering the manufacture of the type in the early days of the "Empire," it was found that the forming of the letters or characters was practically a secret process very carefully guarded. So it was necessary to design a machine for rolling or kneading the type faces. These type are made of a special soft grade of steel, which is case-hardened after machining. The blanks are punched out to approximate size, allowing sufficient material to force into the matrix of the kneading machine and produce the desired type. The face of these blanks is then polished to prepare the surface for forcing into the matrix or master die.

By referring to Fig. 4, it will be seen how simple the kneading machine is. Mounted on the rocker-shaft A is the matrix holder B, in which the matrix C is secured. This rocker-shaft is geared directly to the reciprocating table through the pinion E and rack F, both of which are of steel, heat treated. The pitch line of the pinion E is maintained constant with the pitch line of the matrix C at the bottom of the impressions or type faces, which insures that the travel of the matrix at this diameter is identical with the movement of the reciprocating table.

This table D carries the type X clamped in the type holder Y. The shaft A is oscillated through the rocker arm G connecting rod, crank pin I and drive shaft J, and this oscillation provides a true rolling motion between the matrix C and type face.

In order to force the type blank into the impression in the matrix, the driving shaft K carries the worm K, which engages worm-wheel L mounted on vertical shaft

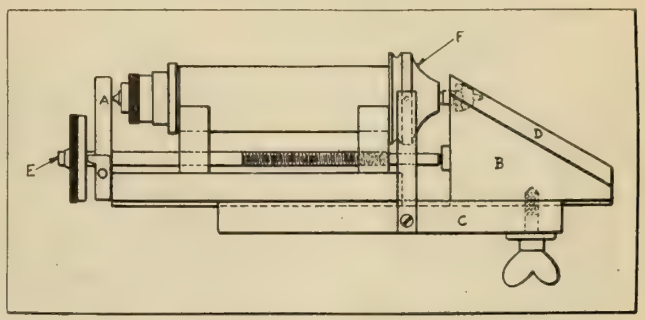


FIG. 11—FIXTURE FOR STONING CUTTERS.

M. This vertical shaft carries a double-face cam N, which lifts the slide O twice each revolution. This upward lift is communicated to the ram P through the hardened steel thrust plate Q and roll R. The type-holder being mounted directly on the ram, rises about .001 inch for each oscillation of the matrix shaft, and completes a type in thirty oscillations, the idle time for loading and unloading the type being about 15 or 1-3rd oscillations of the total time.

This machine takes the thrust of the rolling directly through the heavy bearings of the shaft and the yoke frame carrying the double-face cam, and an idea of the utility may be formed by the fact that it was found unnecessary to make any changes in the design, other than to increase the calculated speed of the drive shaft about 50 per cent., and one of these machines was used steadily for ten years without any repairs being necessary to the face cams or worm.

The making of the matrices for the type was an interesting problem, and at first master type were used, the blanks for these being made up of tool steel, as shown in Fig. 5, the radius N being slightly larger than the radius of the platen, and the depth of the master V being exactly equal to the distance between the capital and small letter on the type. The radius N was first milled, then ground true, and coated with copper. The

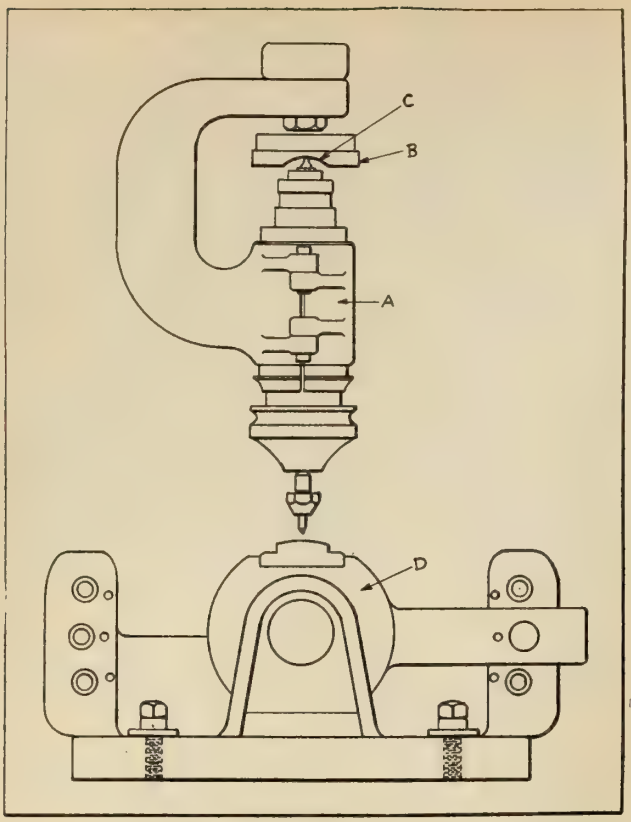


FIG. 12—ENGRAVING MACHINE SPINDLE.

Making the Master Type

lines to determine the outline of the character required were next laid out on the coppered face of the radius, using a micrometer height gauge, and an expert steel engraver cut the type to the lines, using the microscope as a check for height, width and alignment.

The masters were then carefully hardened, the faces of the type finished in the oil-stoning device, Fig. 6, to proper radius, and after examination under the microscope and passing a printing test in the fixture shown in Fig. 7, they were grouped together and forced into a blank matrix in the type-rolling machine previously described. This blank matrix was next dressed down to proper radius on the outside diameter, then hardened and used in the type rolling machine to produce the type.

Making the Matrices

While this process gave good results, it became apparent that the engraving of the master type required such precision and care, that even the most skillful workman could not remain continually on this class of engraving without undue strain to the eyes and nervous system. The method finally evolved was developed by adapting a Gorton engraving machine to the work. To provide for a roughing and finishing cut in engraving the matrix, two ball bearing grinding spindles were mounted in cylindrical quills, as shown in Figs. 10, 11, 12, these quills, being exactly concentric with the grinding spindles, interchange accurately in the hinged spindle carrier A of the engraving machine, the finishing cutter following the path of the roughing cut very evenly, and finishing the type faces to a smooth and accurate surface. The spindle quills were provided with a limited vertical motion, the spindle bearing sleeve being pressed upwards by a spring against the form plate B, bringing the ball point into contact with the curved surface C, which determines the radius of the type faces in the matrix. This curve C is not identical with the type face, but is a resultant curve, calculated to generate the proper curve, when used in the type rolling machine. The roughing and finishing cutters must run true, be exact as to angle of cut, width of point, and an exact even length from the top of ball point to point or face of cutter.

Grinding the Cutters

To fulfil these requirements, the cutters are sharpened by being mounted in the fixture, Fig. 11, which receives the spindle quill in the half bearings shown—the ball point being forced by the spring against the fixed stop A.

The stoning block B carried on slide C has the hardened bevel plate D, which determines the angular length of one face of the cutter. To feed the stone to the cut, a micrometer screw E, with dial graduated to .0005 of an inch positions the stoning block B in relation to the cutter. The four faces of the cutter are brought successively into parallel with the bevel plate D by a four position dial on the spindle drive sleeve F, controlled by the index lever.

In stoning the cutters, each of the four faces of one cutter is stoned to alignment with the bevel plate D, the other cutter quill is then substituted and cutter stoned without disturbing the setting of the micrometer screw. This operation leaves the cutting faces pyramidal and the points sharp. In order to form a cutting edge of a definite width, the bevel stoning block is advanced .0035 in. by micrometer screw E and two opposite faces are stoned down to the plate. This is repeated on the other cutter, and assures that the cutting points shall be true and even in width, angle and length. The type face is approximately .003 in. wide. The cutters being ready, a matrix is mounted in the holder D, shown in Fig. 11, and the depth of cut determined by the vertical feed dial and index.

Laying Out New Type

In originating, or laying out a new type or character, the following process is adopted:—

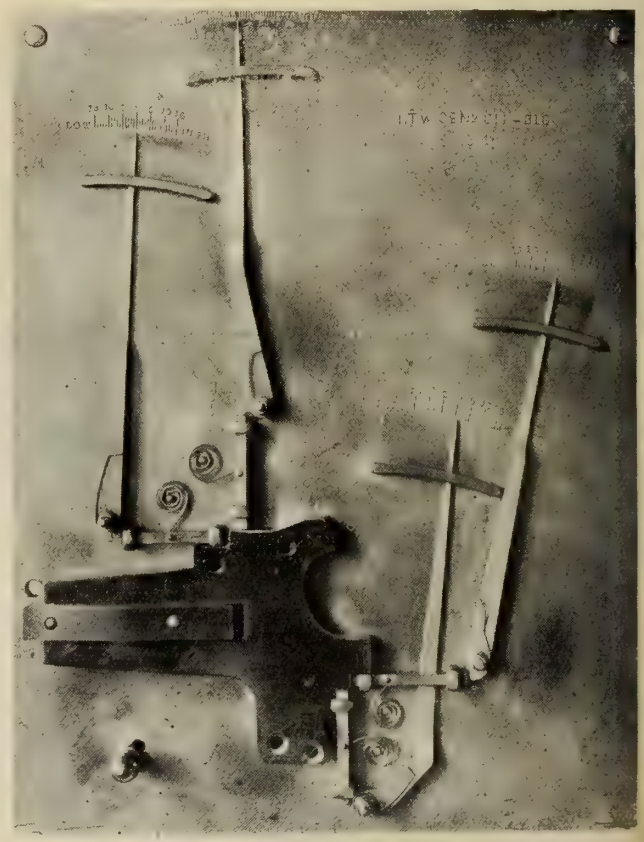


FIG. 13—REFERENCE GAUGE FOR TYPEWRITER CARRIAGE ENDS.

Section line paper charts are made, with fine lines spaced at .002 inch intervals. The letters are now laid out fifty times larger than required.

By using so great a reduction, it becomes easy to reproduce any required character, and many peculiarities of vision are discovered and easily corrected. For instance, a capital L must be made thus, L, in order to look plumb in the finished print; a small t must be inclined to the right, a small d very slightly to the left, a round letter must be slightly larger than one having square top and bottom, as o or e must be a little taller than n or m.

When a request comes in to make a type to match sample, it is enlarged directly by using the microscope fitted with Camera Lucida, tracing a rough outline on the chart and then correcting it to match the limit lines of the chart. These paper charts are next mounted on

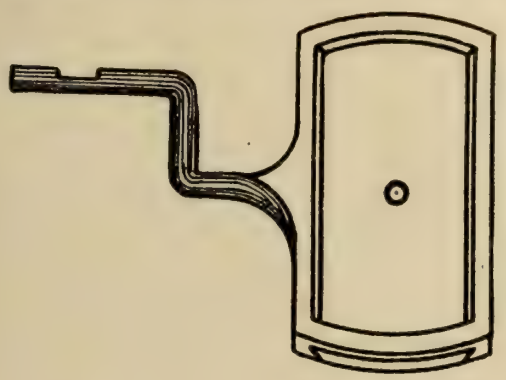


FIG. 15.

the copy table of the engraving machine and reduced three times to form the brass copy plates.

Anyone who has tried to follow a fine line with a vertical pointer knows how difficult a job it is. To make this operation more easy, the vertical pointer was replaced by a light steel frame, Fig. 15, carrying a thin glass slip which is marked on the under side with a small circle, the inner diameter of which is but slightly larger than the width of the lines on the chart. With this device it becomes an easy matter to follow any straight or curved line, as there is no pointer-shadow and the operator looks directly at the chart through the glass, instead of having to try and see two sides of the pointer at once, as when turning a sharp corner or angle. Having the master copy, as required, it is very easy to make duplicate type at any time without any special manual skill.

In the making of the Empire typewriter, attention is given to the world-wide distribution of the machine, and characters for many languages are continually required in typewriters going to foreign lands.

In repairing a drawbridge across the Passaic River, at Newark, N.J., it became necessary to remove a casting and pin from a granite pier. After several unsuccessful attempts to draw the pin, as narrated in Stone, the pin projecting down 3 inches into the masonry, it was found necessary to cut a trench in the hard granite so that the casting might be shifted laterally to one side for removal and replacement by a new and larger centre casting. This trench was 4 ft. long, 9 in. wide and 3 in. deep, extending under the old casting. The cutting of the trench would have been an endless task had it not been discovered that an oxy-acetylene flame chipped the granite quite readily and could be used under the old casting without damaging the balance of the masonry. The desired channel was thus quickly obtained. The flame was also used for cutting away the abutment back of the fixed span bottom chord to provide expansion clearance.

The manufacturer of a new chain is reported to have found a way to make chains that will not buckle. The flattened wire is put through a machine that loops it, forming links by bending it back and lapping it over in such a way that the links in the series cannot drop back and wedge, as sometimes happens in flat chains.

A master mechanic of the electric railway at Schenectady has invented a device that can be attached to any snow plow. A cutter spindle of wooden drums is mounted on one end of a regular snow plow. On the drum surface are numerous cutters or ice teeth of steel, seventy-two in all. As the drum is revolved, the ice melts away in its path. A motor on the floor of the snow plow cab drives the cutting device.

In sinking a mine shaft at Kendall, Montana, through old heavy timbering the wood was cut very handily by using a wood chisel with a cutting edge 2 in. wide and operated by a Jack-hammer drill arranged to work without rotation. This was used for cutting off logging, planks and ends of timber, which was accomplished rapidly and easily.

A gypsum process of dry scouring wool is said to have been discovered in boys' play; that while the developer's sons were playing on the sands of the Almagorda Desert, their greasy clothes were cleaned as if by magic. On investigation and experiment it was developed that gypsum of a high degree of dehydration absorbs the moisture present in wool, chemically breaks down the fatty and heavier materials adhering to the fibres and removes them along with the moisture.

What is believed to be a world's record for gliding with a dead motor was accomplished at Ithaca, N.Y., in a Thomas-Morse two-seater biplane. This machine flew to the head of Cayuga Lake, a distance of 35 miles, and having attained a height of 17,500 feet, the pilot switched off his motor and glided to Ithaca, at which point he still had 5,000 feet altitude. If his glide had been continued it is estimated that an additional 15 miles could have been covered, making a total of 50 miles without the use of his motor. The longest glide previously recorded was that of Capt. Raynham, according to "Aeronautics," when he glided from Brooklands to Hendon, in England, a distance of 22 miles.



"HOW AM I GOING TO SHOOT THE ONE WITHOUT HURTING THE OTHER!"

Canadian Machinery Drafting Course--Part XI

This Section Will Be Divided Into Two Parts, the First Being Devoted to the Discussion of "What is a Working Drawing" and Other Fundamental Principles Involved

By J. H. MOORE, Associate Editor Canadian Machinery

FOR the benefit of those readers who perhaps did not care to follow up the preceding and elementary plates connected with this course, we believe that a short explanation of what is meant by mechanical drawing would not be amiss.

The need of some means of illustrating to workmen the operations they are to perform is so self-apparent that it is not necessary to dwell on this point. The method employed, however, differs in some cases. A rough sketch is sometimes all that a workman has to go by, and even the sketch is not always available, in which case verbal instructions are merely given. This poor practice we are glad to say is dying out, for results have proved that verbal instructions may be all right in their place, but that their place is not where the making of some detailed piece of machine work is concerned.

In the up-to-date shop of to-day we are sure to find a drafting room where mechanical drawings of all kinds are prepared for use throughout the plant. What is this art of mechanical drawing? There are various ways of explaining the meaning of the term, but perhaps the two given below are as good as any.

Mechanical drawing is the art of exact representation by means of drawing instruments of precision. It differs from freehand drawing because it uses instruments, and, in general, aims to reproduce the object, not as it appears to the eye in perspective but in its actual relations to the space it occupies.

To put it in a different form, we might say that mechanical drawing is a term usually restricted to drawings representing machines, machine parts, and other objects used in the mechanical arts. In other words, a mechanical drawing is the language employed by the designer of machinery to convey his idea to others, who will be engaged on the building up of the idea.

So far in this course we have not touched upon the actual art of mechanical drawing, but have been simply leading up to it through the elementary plates which described the fundamental principles involved.

What is a Working Drawing?

Any workman who constructs a machine or makes machine parts from a drawing is said to work to drawings. On this drawing must be all necessary dimensions to allow its completion, which of course gives it its well-known term of a working drawing. The only difference between a working drawing and an assembly view of a machine for instance, is that while all dimensions are given on the former, the latter is merely an assembly to illustrate how the complete machine goes together, therefore requiring no dimensions. Of course, in some cases it is advisable to place dimensions on an assembly drawing, but immediately the first dimension goes on a sheet of this nature it becomes at once a working drawing.

We can now safely state that there are two classes of working drawings, viz.: assembly (or general drawings as they are sometimes called), also detail drawings.

As before stated, the assembly drawing illustrates to the workman the relation between and the positions occupied by the component parts of the structure no matter what it may be. Dimensions given on such drawings are usually only the leading ones, such as length over all, distance between important points, and so on.

Detail drawings, on the other hand, show the exact shape and size of every integral part. For this reason they are supplied with every dimension required by the workman, together with any additional notes that the designer or draftsman may consider necessary.

Detail drawings may be made so complete that they will be equally useful to the patternmaker, machinist, or even blacksmith. This policy is usually carried out in the smaller shops where expense is a big item, but in the larger shops the better policy of separate drawings for each trade is adopted. Only such dimensions are placed on the patternmaker's drawings that interest him, and so on. This latter policy pays in the long run, as fewer mistakes and speedier work is obtained.

Standard Drawing Practice

To give readers a standard drawing practice is impossible Were we to quote one drawing office method and suggest working to that we should only hopelessly muddle the student, so for the purpose of the course we can only suggest that you work to the style shown on each plate, acquainting yourself in the meantime with the different styles of drawings which may happen to pass through your hands.

It is often impracticable to make a drawing of a certain part full, or life-size. This is especially true when dealing with large machinery.

Scale drawings are then used, the object being drawn to some reduced scale. For example, suppose some object is 4 ft. long and it is desired to reduce it to 12 in. in length. This represents a reduction of ¼ or an equivalent of 3 in. to 1 foot. This scale would therefore be termed as 3 in. = 1 foot.

The triangular type of scale which we illustrated in an earlier portion of the course is much used in drafting practice. No doubt our students are supplied with a scale of this nature, and by this time have studied and mastered the various scales represented on it. If they have not done so they should at their first opportunity, for a good working knowledge of these scales is essential to accurate and quick work in laying out objects to reduced size.

In some cases when the size of his drawing is limited and the scale of reduction must not be too great, the draftsman has to resort to the use of a special scale not found on the triangular type. When this happens he can adopt two methods: First, he can purchase some other rules having a greater range of scales marked on them, or second, he can make a scale for himself on good stiff drawing paper or on thin Bristol board. Usually a draftsman engaged at the profession has, as a part of his kit, various rules on which are all the scales he will ever require, but again there are others who would rather make their own. Should students attempt to make a scale for practice, remember that the distances must not be marked according to the eye but by the geometrical method.

What is a Draftsman?

As a rule there are three classes, who take on the following rank: First comes the designer. He, as the name indicates, designs the structure or apparatus whatever it may be. Next in order comes the chief draftsman, who takes charge of such work as turned out by the designer and sees that it goes through the various steps to a successful completion. In many cases the chief draftsman and designer are rolled into one position, the same chap occupying both positions, while in other cases the chief draftsman is the high and mighty one, with the designer next in prominence.

Then comes the detailer, who takes the assembly drawings and makes up the details from them, calling for the proper material, parts, etc. As time goes on a good detailer can achieve the position of designer without any trouble.

Last comes the tracer, who takes the pencil drawings and makes tracings for reproduction purposes. His work in turn can be used to good advantage in preparing himself for detailer. It is more than probable that many of our readers are already acquainted with this routine, but it is for the benefit of others not so conversant with drafting room practice that we state these details.

As a general rule the apprentice starts by taking care of the filing system in the drawing office. From there he steps to the task of blueprinting, then to trac-

ing. Detailing comes next, after which comes the actual designing. The writer personally passed through the lot, and before reaching the coveted position of chief, used to think he was too blamed long on the other side lines, as he termed them. This personal note is placed in this article with a purpose, namely, to warn those who are almost too enthusiastic as to their own particular ability.

Looking back on the incidents at this late date, the writer can readily see why he was kept so long at each particular portion of the business. As the Chinaman said, "It allee comes out in the washee," so never be discouraged but keep on plugging.

Things to Watch

We will supose we have passed the duties of filing and blueprint making, and reached the stool at the tracer's table.

The necessity of carefully following out all instructions in making tracings cannot be too forcibly presented. Careless, slovenly work will at once create a bad impression, while careful, painstaking work will immediately place the tracer in favorable standing with his employers. Work slowly at the start until each subject is well in hand and thoroughly understood. True, speed is important, and will come later, but accuracy must come first.

From the commencement the student should remember that neat and accurate work is essential, that all lines, figures, and even the title must be clear and distinct.

There must be no doubt as to the meaning of the dimensions, or limits, if any are shown on the drawings.

Mistakes made on the drawing are easily rectified if caught before leaving the office, but it is a different proposition if they once reach the shop. Not only does the piece on which the mistake has been made become scrap, but the error may not be noticed until an attempt at final assembly is made. This not only necessitates a new piece being machined, but holds up production, thereby causing considerable dissatisfaction throughout the plant.

Another point to be guarded against is needless complication of a drawing. By that we mean that the student must not get into the habit of duplicating his dimensions on all views. Only place dimensions where absolutely necessary. This does not mean to be so stingy with your dimensions that you leave out various detailed dimensions which mean so much. When a drawing leaves the draftsman's hand marked complete, it should not be necessary to refer to him for further particulars.

Be Careful of These Points

Never write a fraction like this, 5/16. Always make the dividing line horizontal. For example: $\frac{5}{16}$ in. looks much better than 5/16 in. Watch this point for it has caused many an error. Suppose we had a dimension $1\frac{1}{16}$ in. Through carelessness we mark it 11/16. Which is it, $1\frac{1}{16}$ in. or $\frac{11}{16}$ in.? Catch the point?

Abbreviations are only used where lack of space prevents the complete word being printed. There are a few used at all times, such as diam. for diameter, rad. for radius, thd's for threads, and f for finish. These points will be taken up at a later date, however.

When the word drill is used it is taken to mean that the hole is put through the piece by drilling. Ream on the other hand means that the hole is finally finished by reaming. The word tap is well understood. For instance, a hole is marked 1 in. 8 tap. This would infer that a 1 in. 8 threads to the inch tap was to be used.

The word cored implies that finish is unnecessary, the hole being produced by a core in the mould. All cores are of course arranged for by the pattern-maker. The terms: shrinking fit, forced fit, driving fit, turning fit, and so on, always imply that the workman is to make allowance for the style of fit called for. These fits are a question of discussion as one plant may make different allowances from others.

f. all over, infers that the piece so marked has to be machined, or in other words, finished all over.

Should you desire to convey special information on your drawing, do not depend on abbreviations but write out your instructions in good plain English so that it cannot be misunderstood.

(To be continued)

SOME MORE PRIZE WINNERS

READERS interested in our drawing course are not sending in their work as promptly as we would like. To those reading this notice we request their co-operation.

Now that we have started on Mechanical Drawing, new students should be added to our list, for many have no doubt held back until the straight mechanical details were started.

The class of work coming in, while up to fair standard, does not deserve three prizes on each plate, so that we are only awarding such prizes as we think advisable.

Again we emphasize the necessity of letting us see your work. Winter is here and the long evenings at home are just what you need in preparing the various plates, so go to it, allowing us to see the result.

Following are the winners on plates Nos. 4, 5 and 6:

Plate No. 4—A. M. Richmond, 1120 16th Ave. West, Vancouver, B.C., Canada.

Plate No. 5—D. Rathwell, 12 11th Ave., Lachine, Que., Canada.

Wilfred Wandle, 89 Gowan St., Allandale, Ont., Canada.

Plate No. 6—Leonard Snary, 170 E. Superior St., Chicago, Ill., U.S.A.

Carl Rowson, Box 632, Port Hope, Ont.

Experiments to test the effect on the eye of different illuminants are described in the "Transactions" of the American Illuminating Engineering Society by Messrs. C. E. Ferree and G. Rand. They included various electric incandescent lamps—carbon, tungsten, tungsten with blue bulb—and a kerosene lamp. Results are plotted in terms of "time clear to time blurred" to indicate the degree of fatigue as in previous work. The results suggest that the color is an element of some consequence. The loss of efficiency of the eye, on the above criterion, was least with a tungsten lamp giving a "white" light, greater with a carbon lamp and a kerosene lamp, and highest with the lamp with a blue bulb. It thus appears that the least fatigue was sustained with the light approaching nearest to white.

Four Automobile Production Milling Fixtures

The Automobile Producing Field Demands Maximum Production in All Branches of the Business. Herein Are Four Examples of Fixtures Arranged for Use on Various Types of Millers

By J. H. MOORE

THE use of the milling machine as a rapid remover of metal is already too well known to need comment. The finest miller in the land, however, will not accomplish its intended purpose, if not properly equipped, both as to cutters and proper fixtures.

It's the same old story over again where a manufacturer purchases a machine with no actual conception of its possibilities. The writer, in passing through many a plant, has noticed some huge all-geared, motor-driven miller, with a miserable 3½ inch or 4 inch x ⅝ inch milling cutter, chopping away at a job that really belonged on a much smaller type of machine.

If readers doubt this statement, let them look around, when they will be surprised to find that, unfortunately, there is a great deal of truth in the remark. Of course, the writer speaks of the average machine shop and not the type of automobile manufacturing concern of the present day.

In a plant, such as the Willys-Overland Co., of West Toronto, it is absolutely essential that production reaches the maximum point. This means that every conceivable fixture that can be devised to facilitate the product is brought into use. In this respect, the milling machine is not forgotten.

The millers are so arranged to receive certain operations, each operation being right up to the capacity of the machine. No small work is placed on a large-sized miller, for that would show lack of judgment on the part of the production engineer.

Every fixture is designed to handle the product just as speedily as the machine will turn it out. To illustrate what we mean by efficient fixtures, we show four different views of milling fixtures used on work for the Overland Four car.

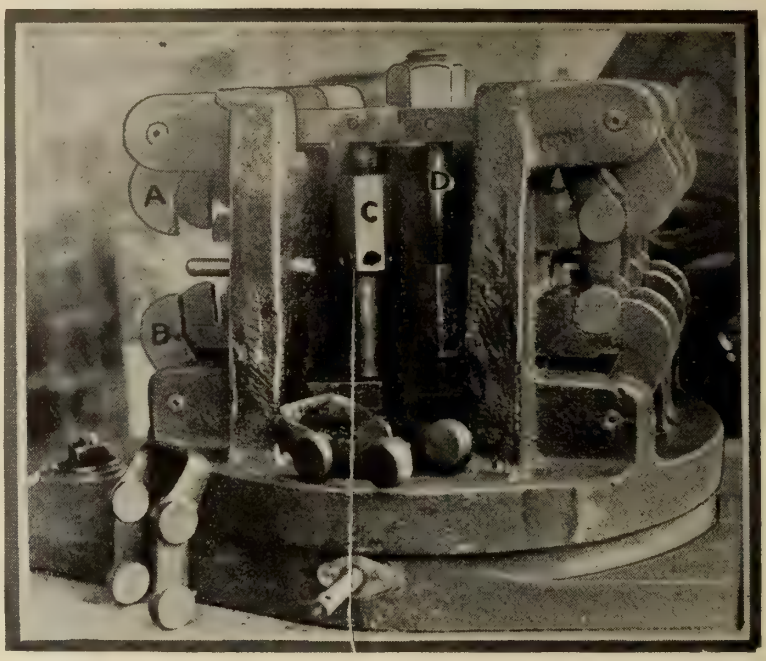


FIG. 2—AN INTERESTING JIG USED ON A LINCOLN-BECKER MILLER.

Sample Examples

The first of these, Fig. 1, illustrates a fixture used on a Ford-Smith Miller. The operation is known as milling the brake support spring bracket, and consists of milling both faces on these brackets.

The fixture is so arranged that it revolves in this way, coming under the classification of a semi-continuous milling fixture.



FIG. 1—MILLING FIXTURE FOR BRAKE SUPPORT SPRING BRACKET.

While the machine is performing its operation at A, the operator is unloading, or loading, at the other station B. In this way lost time is reduced to a minimum. The rest of the fixture is so self-apparent that no comment is made. Four pieces are accommodated on the jig at one time.

Another fixture on the same principle is illustrated at Fig. 2. This operation is known as milling the rear spring shackle. The work is accomplished on a Lincoln-Becker miller, with a gang of eight cutters. As before, four pieces are accommodated in the jig, four cutters being used on each shackle. Attention is called to the novel method of griping the work. Serrated jaws, A and B, etc., are operated on the fulcrum principle, holding the shackle firmly in position, the tightening being accomplished by two centre studs, as shown at C and D. To allow readers to form a clear conception of the shackle itself, we have placed two in the foreground of the photograph.

A Duplex Fixture

The next fixture illustrated at Fig. 3 represents a rather unusual milling arrangement on a Garvin duplex miller, the operation performed being that of milling the two pedal shaft bosses on the transmission gear case. Only one boss is shown at A, the other being on the other side of the case. The case is held by means of a quick action clamp, operated from the handle B. Here is

an example where it paid to install a duplex machine, to accommodate the work, finishing at one set-up, rather than placing on a regular type machine, with two set-up's. Greater accuracy is also obtainable with a machine such as shown, for with two set'up's on an ordinary miller, the workman might possibly fail to clamp the work accurately, throwing the two faces out of alignment. When purchasing machinery of any nature, it pays to thoroughly study your problem.

The remaining photograph is shown at Fig. 4. In this case the work is of a very light nature, therefore placed on a small Pratt & Whitney milling machine. The operation is that of cutting the keyways in the taper end of the rear axle shaft, and advantage is taken of this taper for clamping purposes.

No actual clamps are used, the taper on the shaft providing its own clamping surface. The fixture A is provided with two taper holes, of similar taper to that on the axles. The method of loading the jig is self-evident. The axles are placed in these taper holes, and the operation commenced. The action of the milling cutters pulls the axles up securely into the holes, thus holding the work securely. As can be noted, two axles are accommodated in the fixture. This is an example where extrem simplicity can be combined with efficiency in the designing of any fixture of similar nature.

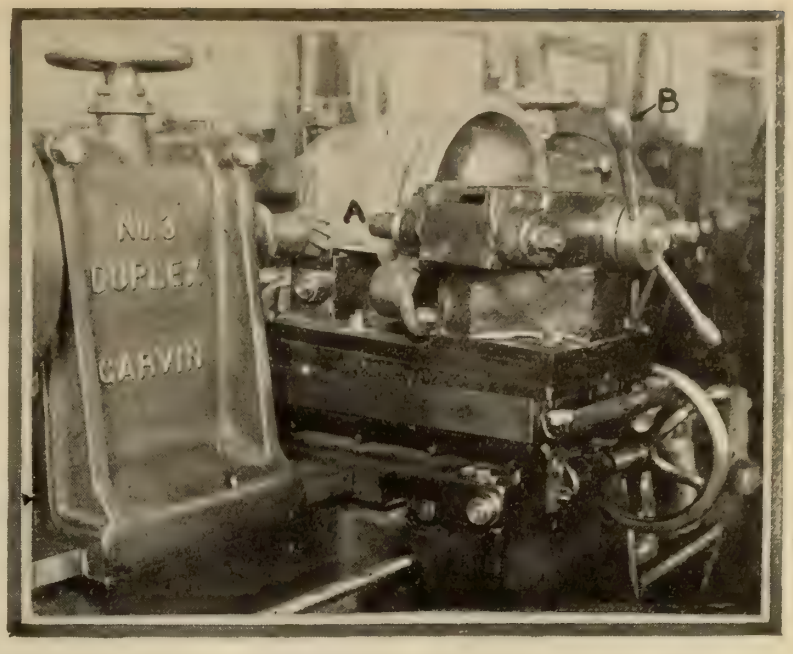


FIG. 3—AN EFICIENT DUPLEX MILLING FIXTURE.

A NEW PLANT FOR TORONTO

The Canadian National Carbon Company, Ltd., and the Prest-O-Lite Co. of Canada, Ltd., have jointly purchased the westerly ten acres of the property at the south-west corner of Bathurst and Davenport Road in Toronto, as a site for a large new manufacturing plant.

The new plant, which is to be erected at once, will consist of two buildings, one of which will be 80 feet wide by 400 feet long, two storeys high, with one section 80 x 80 three storeys high, to be occupied by the Canadian National Carbon Company, Ltd., while the second building for the Prest-O-Lite Company will be 80 feet wide by 400 feet long and two storeys high.

The heating plant will be housed in a separate structure, 50 ft. x 60 ft., and will have room for installation of additional boilers for future units to be added.

All the buildings will be of reinforced concrete frame, flat slab floors, mushroom type columns on 20-foot centres, steel sash and brick curtain walls.

Each building will have two freight elevators, and all toilet accommodations and stairways will be contained in towers erected outside of buildings, thereby removing any obstructions which might interfere with manufacturing operations.

Arrangement is provided for special rest rooms for female employees, shower baths, a dispensary with competent medical attendant to look after any injuries to employees, restaurant with modern equipped kitchen, in charge of a competent chef, where meals will be cooked and served to employees at bare cost.

It is expected that the plant will be ready for occupancy in May, 1920, and everything possible will be done to get it ready by that time.

At the present time the two companies are operating five plants at different locations in Toronto, but owing to the large demand for their goods have been unable to fill orders for some time past, and propose now to get facilities which will enable them to take proper care of their customers.

Mr. R. H. Combs, who has been general manager of the Prest-O-Lite Company for the past three years, and who was also recently appointed general manager of the Canadian National Carbon Company, states that his companies expect to employ about five hundred people as soon as the new plant is ready to operate, and that the facilities provided by these first two units will take care of upwards of 700 employees if needed. "We have secured enough ground," said Mr. Coombs, "to enable us to put up six such units as the two which are now being built, but before adding new units, both the present units will have a third storey added as the buildings are being erected to carry three full floors."

In addition to the large plant described, Mr. Combs states that the company will erect in the spring a new acetylene gas plant in Toronto or immediate vicinity to take care of the greatly increased demand for compressed Prest-O-Lite gas for welding and cutting, and that a large new storage battery warehouse and assembly plant will be erected at Winnipeg.

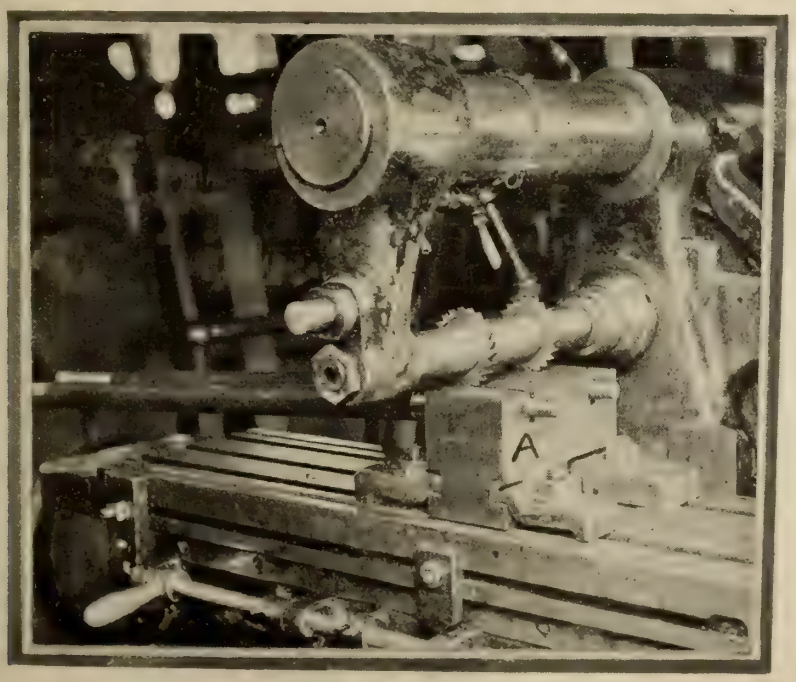
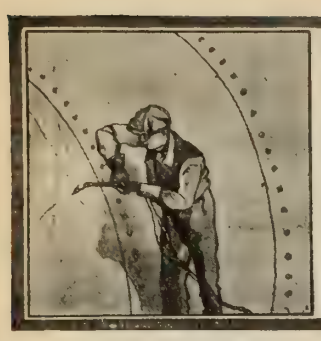


FIG. 4—A JIG THAT REQUIRES NO HOLDING BOLTS.



WELDING AND CUTTING



Fusion Welding Applied to Drop Forgings *

By S. W. MILLER

IN connection with the application of fusion welding processes to drop forging, a number of questions have to be considered before a decision can be made as to their use. The principal ones are as follows: First, can any fusion process be applied; second, if so, what process should be selected; third, will a forging reclaimed by welding be satisfactory to the customer; fourth, will a welded forging give as good results as one not requiring welding; fifth, will the cost of welding be greater than that of a new forging? It would appear clear that the answers to some of these questions are not within my province, as I cannot decide, for instance, whether a welded piece, no matter how good the job was, would satisfy the customer, nor can I decide as to the relative costs of welding pieces and new forging. What I propose to do, therefore, is to merely present my ideas as to the possibilities of producing certain results by welding. I am not concerned with the third and fifth questions.

There are two methods of fusion welding which are applicable to the repair of drop forgings. Each one has its peculiarities, limitations, and advantages. They are the oxy-acetylene and the metallic electrode or (electric). The melting temperature is maintained in the former case by the combustion of acetylene in the presence of oxygen, which gives the highest flame temperature known, about 5,000 deg. Fahr. In the second method the melting temperature is obtained by using the electric arc drawn between a metal electrode and the pieces to be welded. The temperature of the arc so formed is higher than that of the oxy-acetylene flame.

I believe it will be generally found that the oxy-acetylene process is more applicable to the reclaiming of drop forgings than the electric, especially where the defects are small, because, while the electric process is considerably cheaper (the cost of operation being only about half that of the oxy-acetylene), yet there is greater liability with the electric process.

*A paper presented before the sixth annual convention of the American Drop Forge Association, Pittsburgh, June 14. The author is proprietor of the Rochester Welding Works, Rochester, N.Y.

Characteristics of the Two Methods

In order to make clear the effects of welding, it should be considered that the heat of the welding flame or arc is very high and that there is a strong tendency to burn out, both from the welded piece and the weld itself, such elements as carbon, manganese and silicon, so that the weld is usually of very different composition chemically from both the original material and the welding rod. A material commonly used for oxy-acetylene welding is steel wire containing about 0.10 per cent. carbon, 0.15 per cent. manganese, and phosphorus and sulphur less than 0.04 per cent. These may be considered the usual maximum figures, although there is considerable variation in different welding wires. For special purposes other wires may be used, and some of these will be considered later. With the above wire, the carbon will be reduced in the weld to about 0.05 per cent., the manganese to about the same amount, while the sulphur and phosphorus will remain about as they were, so that such a weld is a quite pure iron casting. If properly made, the weld material will have an ultimate strength of about 52,000 lb., a yield point of about 25,000 lb., and an elongation of about 20 per cent.

The chemical composition of wires used for metallic electrode work (electric welding) varies widely. One of the best contains about 0.15 per cent. carbon, about 0.50 per cent. manganese, and sulphur and phosphorus not over 0.04 per cent. each. In passing through the arc in the form of a vapor as it does, there is naturally a great opportunity for the metal to lose its carbon and manganese and to become oxidized. Such metal in the weld will contain about 0.03 per cent. carbon and about 0.2 per cent manganese, the sulphur and phosphorus being practically unchanged. Its tensile strength will be about 55,000 lb. per sq. in., the yield point nearly equal to the tensile strength, and the elongation about 3 per cent.

The effect of the heat on the material being welded is different also in the two processes. With the oxy-acetylene method, the temperature is not so high nor is it so local, the results being that the heat effect extends a greater distance from the weld, and, as the heat has to be applied longer, the coarsening of the grain near the weld is greater than with the electric method.

The quality of material being welded should also be considered. If it is a plain carbon steel, the higher the carbon content, the greater the injury, by welding to its physical characteristics. The writer's experience leads him to believe that material up to about 0.5 per cent. carbon can be satisfactorily welded, provided it is properly heat treated to remove the grain coarsening. By this he means that there is no permanent damage to the material. He does not mean necessarily that the welded piece will be satisfactory, even if the weld be sound. This is a matter that will be considered later.

It is, therefore, evident that three things have to be considered in deciding as to the quality of a welded piece: First, the effect on the piece itself; second, whether the weld will be sufficiently strong and otherwise suitable, and third, whether heat treatment can be applied to improve the qualities of the welded piece and the weld. The answers to these questions evidently depend on the results desired.

If heat treatment is to be applied, some consideration should be given to the effect of this heat treatment on the welded piece and the weld. In an examination of the effect of such treatment on oxy-acetylene welds made in material containing about 0.18 per cent. carbon, the writer found that there was a difference of about 300 deg. Fahr. between the refining temperatures of the material and the weld, the latter being made with wire of the composition above referred to. This is accounted for by the difference in carbon content, and also by the fact that the weld is a casting which requires a higher refining temperature than a forging of the same carbon content in order to obtain the best results. Therefore, when welding material of this kind is used, a double heat treatment is necessary, a high temperature, about 1,700 deg. Fahr. for refining the weld, and a lower one, about 1,450 deg. Fahr. for refining the original material. It would seem advisable from this to provide a welding material which in the weld will require the same refining temperature, and which would have the same physical characteristics as nearly as possible as the material being welded. Whether this is possible or not is a question which has never been decided to the writer's

knowledge. It would depend largely on the nature of the original material. It would appear possible to increase the carbon in the welding wire so that in the weld there will be the same carbon content as in the piece, but another difficulty is introduced, which is a practical one. Such welding material is difficult to handle, and unless extreme care is used, the weld will be full of laps and oxide films, and it will be more dangerous than one made with low carbon material. Of course, careless welding with any material will make laps, etc., in the weld. Another solution may lie in the direction of using alloy steels, such as vanadium. These make welds free from oxide, and in which the carbon is largely preserved, but they are, unless annealed, exceedingly brittle. As a matter of fact there has never been sufficient demand for such materials to warrant any research in connection with them, but the writer feels that the time is at hand when this and similar investigations will have to be carried out.

As illustrating the effect of heat treatment, part of a weld was heated to 1,550 deg. Fahr. quenched in oil, drawn at 800 deg. Fahr. and cooled in air. The weld, of course, contains less carbon than the material welded, so that more ferrite is shown in the weld, but it is easily conceivable that for certain purposes such a weld would be entirely satisfactory. This is an illustration of the line of investigation that must be followed in order to determine whether welding in any particular case may be permitted.

Effects of Heat Treatment

It has been found that the heat treatment such as outlined above increases the ductility of sound oxy-acetylene welds made with ordinary materials. Of course it cannot improve defective welds. More work will be required to determine the amount of improvement, and in what directions it takes place, not getting thorough fusion at the beginning of the work. In other words as the arc is drawn between a rather heavy mass and the electrode, the former requiring some time to be brought to the fusion point, the beginning of the weld is liable to be imperfect, while with the oxy-acetylene method the piece can be brought to the melting point before any metal is added, thus insuring thorough fusion. These points then should be considered in deciding which process should be used. There remains for discussion, therefore, only the fourth question, which refers to the quality of the weld itself and the effect of welding on forging. The more important of these is the quality of the weld.

To begin with, it should be understood that the writer is not advocating and has never advocated, the indiscriminate use of welding processes. His belief is that for many purposes a welded piece is just as good as one that does not need welding, but he also believes that there are many cases where a welded piece will not give satisfactory results, and in those cases he advocates very strongly that the pieces be scrapped. The reason for this lies in the nature of welds. A fusion weld is a casting, and, no matter by what process it is made, and no matter how good it is, and no matter to what heat treatment it is subjected, it cannot have all the qualities of a forging, so that, where a heat-treated casting will not give good and safe results, a welding process should not be used.

It is known that nickel increases the tensile strength of oxy-acetylene welds, but at the expense of ductility. Welds made with such material are also liable to contain numerous gas pockets probably due to the nickel present.

With regard to electric welds, the writer has not yet found it possible to improve their elongation by any method of heat treatment. The large amount of nitride of iron present in such welds does not seem to affect their strength because they rupture along the grain boundaries, even when there is no appearance there of any oxide or nitride films under the highest power of the microscope. The writer believes that such intergranular brittleness is due to ultar-microscopic films of oxide of iron, and is not aware of any way of eliminating these at the present time. It also does not seem to make any difference what material is used for electrodes. This problem will undoubtedly be solved, but it will take time and patient investigation.

Electric welds are also subject to defects, but clean electrodes and careful welding help to eliminate them.

Less Successful With Alloy Steels

With regard to the welding of alloy steels, the writer has very little information. In his shop he has not found good results in the few cases in which he has used it. It is evidently foolish to expect that a chrome nickel-steel heat-treated forging can be satisfactorily welded, even with the same material as that of which the forging is made, and, owing to the sensitiveness of alloy steels to heat treatment, he is at present very dubious of the results.

The question of cost enters into all this work to a very large extent. It might pay to repair drop-forged automobile axles by any welding process because of the expense of the forging, while it certainly would not usually pay to repair a small lever. Also the results in the case of the axle would be entirely satisfactory where, for example, a corner of one of the spring pads did not fill out in the die, because there is a surplus of strength at that point, and in the writer's shop similar repairs have been frequently made by both processes. Axles broken in the middle by collisions have been welded and many other repairs have been made which are considered perfectly safe and which have never given any trouble in service.

There is one thing which the writer would strongly urge, which is that those responsible for the welding made sound welds. It is rather remarkable how few welders, according to the writer's experience, are capable of doing this, and he has found that even welders who are supposed to know how to do good work have never been trained to make reliable and uniform welds. As illustrating this, the writer knows of one test in which two welders of more than ordinary ability and experience welded five test pieces each. The average tensile strength of these ten pieces was somewhat over 46,000 lb. (not per sq. in.). An examination of the fractures showed lack of proper fusion and other imperfections which accounted for the low strength. Another welder who had been specially trained then made a test piece with the same welding material, which broke at 56,000 lb., the weld being free from imperfection. To show what can be accomplished, the writer has a record of 15 welds made in ½ x 3½ in. material, the test pieces being machined all over, which gave the following results:

	T.S.	Y.P.	Elongation in centre in. P.C.	Elongation in 5 in. P.C.
Maximum	53,300	37,100	28	26
Minimum	50,600	32,100	17	10.6
Average	51,900	33.180	23	15.6

As showing what can be done with somewhat better welding material, the following are the averages of three pieces made under the same conditions as before:

	T.S.	Y.P.	Elongation in centre in. P.C.	Elongation in 5 in. P.C.
Average	53,100	37,600	31.1	20.7

Foreign Matter Impairs Results

In making electric welds, the conditions are such that it is difficult to get them free from films of oxide, slag pockets, etc. It must be remembered that everything in the electrodes goes into the weld, and if the electrode is imperfect and contains slag and dirt, the weld will also contain these same impurities. Further, the tremendous oxidation undergone by the iron as it passes through the arc is detrimental to the quality of the weld. This does not mean that this method of welding is not suitable for many purposes, because it is, and is successfully used. The writer uses it every day for such purposes as filling up holes that have been drilled wrong, for filling up worn key seats, for replacing metal where too much has been removed in machining, and in many other places where its use is entirely satisfactory.

The advantages of the electric weld are its low cost and the speed with which it can be made. Its principal disadvantage has been referred to before, and that is its brittleness. There are many places where this is not detrimental, and if there is enough suitable work to warrant the installation of an electric welding outfit, its use will be found economical. One matter which should be watched closely in connection with electric welding is the effect of the high temperature and its sudden application to steels containing 0.4 per cent. carbon.

To be continued

Wants Oil Pump.—S. Zographakis, of the Hellenic State Trade Commission, Drummond Building, Montreal, has an inquiry from Greece for the installation of a small oil engine pump assembled.



WHAT OUR READERS THINK AND DO



Another Comment on Recent Letter by H. H. J.

We Would Especially Like to Hear From Foremen or Superintendents on This Subject, as So Far We Have Heard Only the Workman's Side of the Question

REFERRING to the letter from H. H. J. in your issue of December 18, and to the answer to that letter in the December 25 issue. I should like to give you my own views on this subject.

To come straight to the point, I may say at once that I agree both with H. H. J. and with the writer of the second article.

Naturally I cannot give you my own name for publication as it might result in my losing my position, so I will elect to be known as H. A. S., which might mean, "Here's Another Story."

Taking H. H. J.'s letter first, I think he is undoubtedly exaggerating when he says that practically none of the shops in Toronto give the young man a proper show. At the same time, while I do not think that they are all as H. H. J. describes them, I do believe a considerable number of them fail to treat their apprentices fairly. Perhaps the discussion does not really concern apprentices but as I have almost finished my time and can thus still be classed as one, it is this side of the subject that most interests me.

To illustrate my contention I will mention the case of a friend of mine who had started in as an apprentice machinist and in due course was put on a lathe to learn its operation. Being a smart, industrious fellow he soon mastered the work and asked to be moved to another machine. The boss, however, refused to move him and told him to remain where he was. This, naturally, did not suit my friend so he went to the superintendent and again asked to be changed to another machine. "What did your boss say?" was the superintendent's query. My friend told him and at once received the abrupt reply: "Then stay where you are and be satisfied."

A few days later he decided to make an application still higher up and so he interviewed the manager. The latter, who was quite a decent type of man, called in the superintendent and asked him his reasons for refusing to change the young fellow over to another machine. Imagine my friend's surprise when he heard the reason given as follows: "B's a good man on that lathe and has learnt the work he's on thoroughly. Our production is better than ever since he has been in the work, so why change him for someone who may only spoil all our work?"

The manager hummed and hawed at this, but my friend did not get moved and so had to quit to seek other fields. Why? Was it because of lack of ability? On the contrary it was rather the reverse, which goes to prove, as H. H. J. says, that it does not pay to be too good at your job. Here is a case in point where to my mind an ambitious apprentice got a raw deal and could not help himself. As he said: "I went in to learn the machinist trade complete, and not merely run a lathe." This case happened not in some far-away town but right here in Toronto.

I know of another case in which another friend of mine went into a Toronto firm to learn the drafting business. He was getting along extra well and had been highly complimented on his progress, when suddenly he was asked to get out at two weeks' notice. He had a contract but not for any stated period. Naturally he was discouraged and asked why he had to go. It took him some time to find out, but at last he heard that a returned soldier was being brought in, at no cost to the firm, as the Government was paying him, and because of this another ambitious young fellow had to step aside. So disgusted was he that he started to work in a garage at ordinary and everyday repair work, while if he had been given a proper chance he might some day have been a good tool designer.

Lastly, I would like to add a personal instance to this letter and tell a story about myself. I, too, am in the drafting business, and, as stated before, almost out of my time. I have tried earnestly to deliver the goods, have read CANADIAN MACHINERY for many years, and found it helpful in various ways. To put it in another way, I have not wasted my evenings reading useless trash but have read only good, technical matter.

The result is that I have been given good work by my chief draftsman, who is a prince in every respect, but here comes the rub.

His superiors are by no means of the same calibre, as the following incident will show.

"Harold," says the chief the other week, "I'm going to give you a real good increase at once, for you really deserve it." "Thank you," I said, and looked in my next envelope for the extra salary, but, alas, only two dollars a week was added. I was very much disappointed. If this was the chief's idea of a good increase I had another opinion.

My suspicions, however, were all wrong, for the chief came to me of his own accord and said: "Harold, I'm sorry but the manager would not stand for any bigger increase. I told him of your ability, but it did no good. My advice to you is to finish out your time with me, then get out. In the meantime I will show you all I can."

Imagine these words coming from a chief, who, fine fellow as he was, had not the power to fix the value of his men under him. All this in Toronto, where the young man is suppposed to get a show.

In conclusion, the member of your staff who wrote the answer to the first letter is right in this respect, that even if conditions are such as I've described them, we should not lose heart, but plug away, for time will, I positively believe, alter these conditions. The young man's value is beginning at last to be realized in many plants, so here's hoping for the day when the fellow who really is willing to work will get a fair chance.

REPLY TO A QUERY

CANADIAN MACHINERY a short time ago received the following query: "Can you tell us how to roll flat stock from round wire of all sizes from No. 1 to No. 12. Our rolls are ground true and parallel, and are set with opening parallel guide on entrance side of rolls and set square with rolls both ways, also a close fit for the wire. The wire is cut and straightened to lengths, with no guide on discharge side of rolls. The flat stock will not come out straight,

and light or heavy reduction in thickness seems to make no difference. Can you solve our problem?"

CANADIAN MACHINERY at all times endeavors to answer their reader's queries, so we got in touch with one of our correspondents who is well familiar with this line of work. Following is his answer:

Answer to Roll Query

Rolls for reducing small, round sections, such as making round wires into flats, should be made in the regular type of rolls for making flat iron or steel bars—having grooves and tongues. The sides of the groove should fit the wire tightly when it is inserted in the first pass. This prevents the wire from spreading and also prevents it from rolling over in the pass. The wire being prevented from spreading sideways, the metal is made to deliver straight as all the work on the metal is exerted at a right angle to the direction of rotation, providing that the rolls are parallel both axially and horizontally and the guides set correctly.

There also should be a close-fitting guide on the discharge side, the latter to be about 18 inches long and having a top piece to keep the metal down as it leaves the rolls. To keep such small, thin sections straight while they are hot, it is best to have them run from the rolls into a narrow trough. Referring to Mr. Leeman's difficulty in getting the rolled wire to come out straight on the discharge side, the writer would say that rolling small narrow sections on plain both sideways as well as at a right angle to the direction of rotation.

The metal spreading in two directions at the same time makes the bar take a curved path, it being difficult to get straight bars under these conditions, especially when their cross section is round. Would suggest that you have a narrow and long guide on the discharge side of rolls, also keeping both the entering and discharge guides as tight as practicable.

See if one of your rolls is crossed from an axial standpoint, as one neck may be worn more than the other; a 1-64 of an inch crossing would curve the metal leaving the rolls. If there is any room between the housing and bearing brasses put a small tin liner on the side toward the curve of the bar, the object being to cross one of the rolls as to cause the bar to straighten up as it leaves the rolls. If any further difficulties are encountered the writer would suggest that you consult your roll-turner, as, being on the ground and knowing the conditions that obtain in your mill such as regards engine power, diameters of rolls, methods of heating and handling the rolls, all of which factors have a most important bearing on rolling problems and also difficulties encountered. The man on the ground can, as a general rule, work to better advantage in overcoming difficulties than a person six hundred miles away, as he is familiar with the working conditions in the mill. In conclusion, will say that for the general run of rolling small sections that cool quickly, grooved rolls will be found to be superior to all others and give the best satisfaction.

Another thing that has a most important bearing upon the curving of small bars which lose their heat quickly is to keep the metal when it goes from the furnace to the rolls from touching any floor plates, as in the latter case the cold part of the bar resists the rolling pressure more than the hot part and makes a curved bar.

LAMP BRACKET FIXTURE

By G. Barrett

CANADIAN MACHINERY readers will no doubt be interested in this fixture to turn automobile lamp brackets on the lathe. These brackets are of malleable iron and were usually done by a box tool on a drill press and threaded with a threading attachment, but proved to be a very poor job.

The bracket shown in view Fig. 1 is first centred in a drill press by using the centre drill Fig. 3, which needs little explaining, as the reader will see by placing the lamp bracket with the two ends located in the tee slots of drill table, then pulling down drill spindle till the bush A comes in contact with the end of bracket to be centred. This bush is made to slide on the drill shank and has an elongated hole at B which is to allow for tightening the grub screw to hold centre drill, also keeping sliding bush from falling off through the tension spring.

Fig. 1 shows plan view of bracket ready for operation, which is turning and threading the parallel end. This bracket is driven by a spiral plate A, Fig. 1, which is clamped to the face plate, the turning and threading fixture is bolted to the cross-slide, and the bracket is turned by the tool B, then the cross-slide is brought forward to a stop C, this bringing the chaser D to its working position. The threading is done by placing the feed nut in mesh as in ordinary screw cutting, and pulling on lever E till the rear slide F comes to stop G.

This tool slide, which carries chaser, is shown more plainly in the enlarged side view, Fig. 2, and it will be seen that the slide is brought forward by the lever A, which works on to a shaft, this shaft having a pinion keyed in the centre to mesh in small rack B which is fastened to the tool slide by small fillester screws.

The operation is very simple and is done by a specialist, and no doubt there are lots of other jobs around the country in which a fixture like this would be used to advantage.

Brockville Has New Industry.—Early in the spring, J. Gill Gardner, president of the Board of Trade, will erect a new foundry in Murray's Fields. It will have are lots of other jobs around the country in which a fixture like this would be used to advantage.

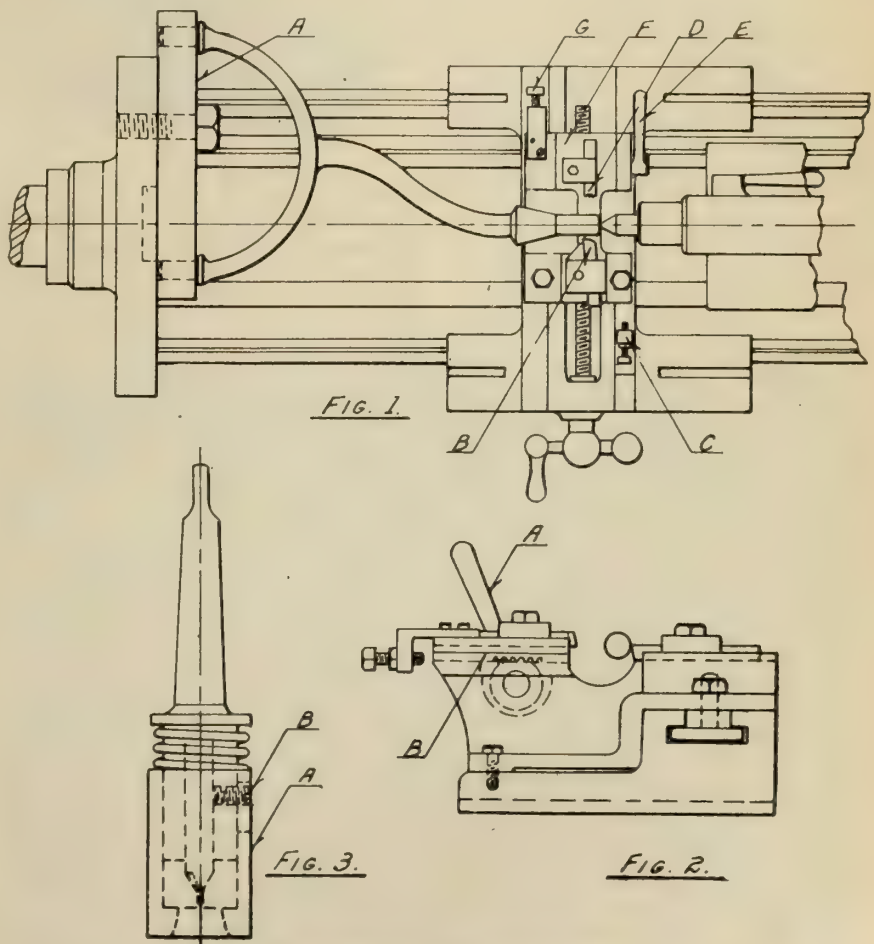


FIG. 1. FIG. 3. FIG. 2.

ASSEMBLY AND DETAILS OF THE FIXTURE.



DEVELOPMENTS IN SHOP EQUIPMENT



ALL-GEAR DRILL PRESS

The Danber-Kratsch Co., of Oshkosh, Wis., have recently placed on the market a new upright drill press, known as their "Wisconsin" 20-inch All-Gear Driven Upright Drill Press.

The machine is shown in the accompanying illustration.

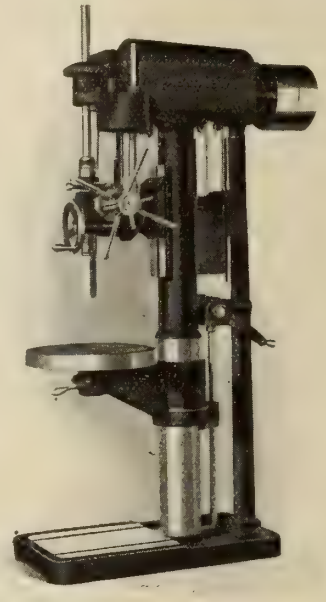
As will be seen from the cut, the old type of cone drive has been discarded and replaced by a geared head single pulley drive. This eliminates all shifting of belts to get the different speed changes required. The drive for the machine consists of four pairs of semi-steel and rawhide gears. These gears are engaged or disengaged through friction clutches by means of the single operating lever on the left-hand side of the machine. There are no sliding gears in the gear box, so that the speeds may be instantly changed from one to another, without shock or jar, by a single movement of the clutch lever, while the machine is running at full speed. The clutch gears in gear box are mounted on roller bearings, so that it is unnecessary to run gears in an oil bath. The end bearings of gear shafts are bronze bushed, and are lubricated from the outside by means of oil cups. The drive from gear box to spindle is through a pair of bevel gears.

The column is reinforced by the straight back-strut, which supports the back end of the gear box, and also relieves the column of all bending stress induced by the pressure of the drill. The lower cylindrical end of the column is ground to carry the table support.

The base is made heavy enough to properly support the machine, and also provides space for any work to be drilled on it. Base has two Tee slots for bolting work to it.

The table support is made in the form of a box section. This is clamped on the column by a single clamping screw, operated by means of a hand lever. The table has four Tee slots. The centre hole in the table lines up exactly with the drill spindle, so that a boring bar may be used in spindle, if desired, for boring large holes. Table is clamped in its support by a conveniently-located hand lever. The elevating screw, for raising and lowering the table is placed at the back of the machine so that the table may be swung at right angles, entirely out of the way of the column on either side, for drilling work on the base.

Both table and base are provided with large oil trough for properly taking care of cutting lubricant. Balance weights for both spindle and sliding head are placed between column and back-strut, and run on guides, so that they are easily accessible. The machine is equipped with a sliding head and all-geared



ALL GEAR DRILL PRESS.

power feed. Also has handwheel feed and a large pilot wheel for quick return of spindle or sensitive feed for small drills. The spindle is made of high-carbon steel, and has ball thrust bearing at its lower end. It has four changes of feed for each spindle speed. There are four spindle speeds on the machine shown. If desired, a two-speed friction counter-shaft may be furnished, this giving eight spindle speeds.

All gears used on the machine are properly covered to keep out dirt and to protect the operator. Machine may be equipped with tapping attachment, if desired.

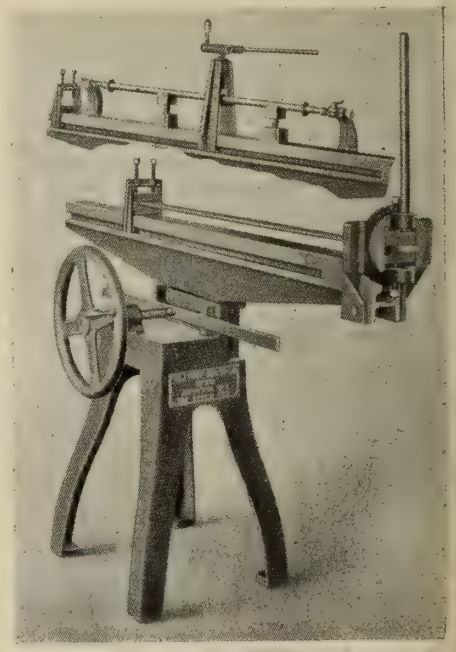
STRAIGHTENING MACHINE

The W. J. Pine Machine Co., of Kenosha, Wis., have placed on the market a machine which they believe to be a new departure in the machine tool line. Every user of cold-rolled steel knows the difficulties they have to contend with in its use. It is full of kinks and twists, and the usual method employed is to hammer the convex side of a kink to drive it in, but this only draws the grain on the long side longer, and if the kink is reduced at all there must be additional kinks of lesser degree. It is impracticable under present methods to use cold-rolled flat or square stock, where one edge or side is to be broken the full length owing to tension of all surfaces which, when broken, causes the stock to bow. Cold-rolled flat stock could be used to advantage for a great number of purposes where it is now impractical, if a practical means for straightening were at hand.

With this machine devices are at hand for doing this work in the only way practical, that is by pressure on the long side of a kink which contracts the long grain and expands the short grain.

The upper bar is a testing table on which stock is laid to find the kinks; it is then placed under the pressure screw, which is convenient for the purpose, as illustrated in the photograph. When used to take the twist out of stock, one end is clamped on the parallel under yoke vise, and the other end in the twisting head vise.

The machine provides a convenient means for doing innumerable operations that come up in machine shops in general. Such as offsetting connection rods and bars, bending irregular shapes in forms or dies, where pressure is used. Four sizes are being built which apply mainly to the length of the testing table. The four sizes with their principal specifications are as follows:

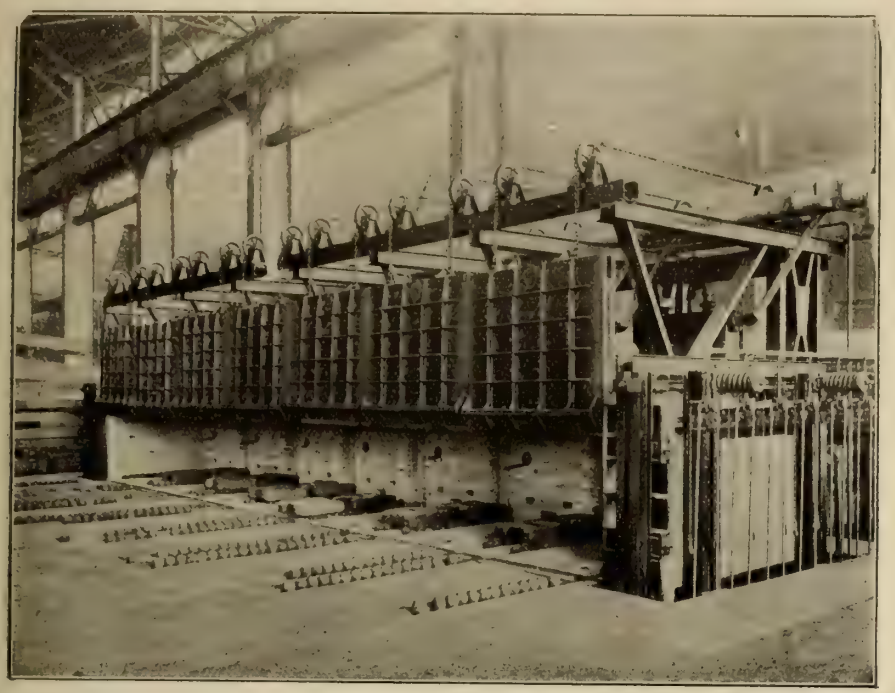


VIEW OF STRAIGHTENING MACHINE.

	Number 1	Number 2	Number 3	Number 4
Length—Testing Table	6 feet	8 feet	10 feet	12 feet
Width—Testing Table	4 inches	4 inches	5 inches	5 inches
Hand Wheel Diameter	18 inches	18 inches	18 inches	18 inches
Straightening Screw	1⅛ x 12½ inches	1¼ x 12½ inches	1⅜ x 16 inches	1⅜ x 16 inches
Straightening Table	16 x 8 inches	16 x 8 inches	20 x 12 inches	20 x 12 inches
Vise Jaws	1½ x 4 inches	1½ x 4 inches	2 x 5 inches	2 x 5 inches
Distance between Centers	4 feet 8 inches	6 feet 8 inches	8 feet 8 inches	10 feet 8 inches
Approximate Weight	750 pounds	900 pounds	1200 pounds	1400 pounds

SIDE-OPENING FURNACE

The W. S. Rockwell Company of New York, have placed on the market a new type of side-opening, heat-treatment furnace. This furnace was developed to heat treat material varying widely in shape and size.



FRONT VIEW OF UNDERFIRED SIDE-OPENING HEAT-TREATMENT FURNACE, SHOWING ONE DOOR OPEN.

This furnace is 36 ft. wide. Stock approximately this length may be placed in the furnace for heat-treatment, or the furnace may be partitioned off into individual chambers 5 ft. 9 in. wide or multiples thereof. Thus, while one chamber was heating stock say 5 ft. long, the other part of the furnace could be heating stock either much longer than 5 ft. or smaller. The furnace has proved so advantageous in operation that it is now being widened to provide a working chamber 105 ft. wide in the clear, the length remaining the same. This increased width will provide facilities to anneal and heat-treat the largest shafts and similar pieces handled in this forge shop.

The doors can be raised or lowered independently of one another. They are operated by compressed air and counterweights. They are dovetailed and form guides within themselves that prevent the escape of hot gases. The roof is constructed of flat tiles, avoiding the thrust caused by the ordinary arch construction.

Oil or gas may be used as fuel. Combustion takes place in a series of combustion chambers located under the hearth, the hot gases from which pass into the heating chamber in such manner as to insure a uniform application of heat to the material in the heating chamber. The location of the combustion chambers under the hearth insures a hot bottom and the best of heating conditions. Some of the gases in the heating chamber are siphoned back into the combustion chambers, insuring a complete circulation and uniformity of temperature throughout the heating chamber.

The heat in the spent gases is also utilized. The spent gases, as they leave the vents, circulate through the preheaters shown at the rear of the furnace and arranged above the vents. The air in these preheaters thus returns through the burners the greater part of the heat in the spent gases that would otherwise be lost. The fuel consumption in this furnace is extremely low, due to the efficient application of the heat and the utilization of the waste heat ordinarily lost.

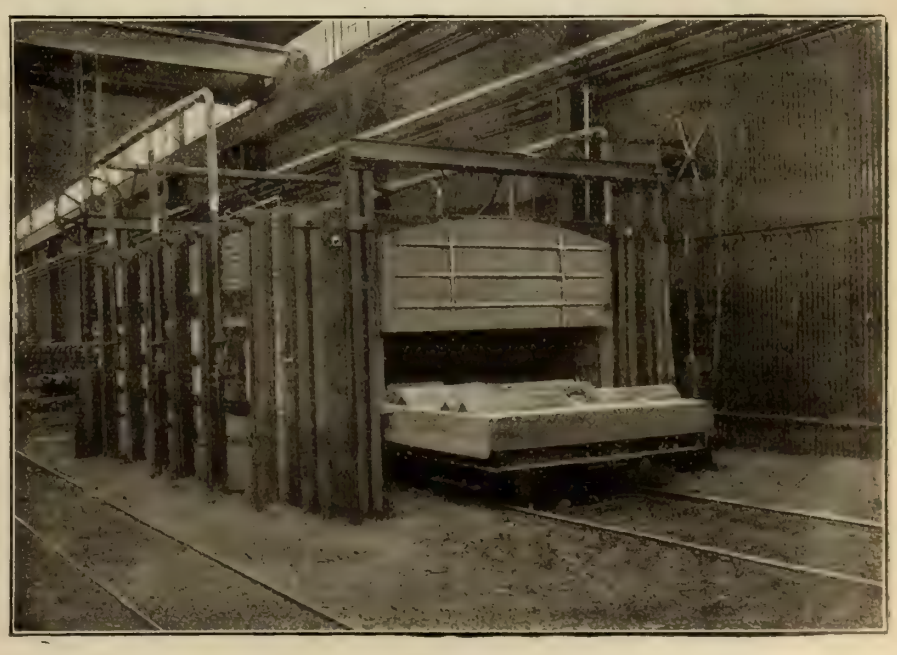
Provision is made for the convenient control of the burners from above the floor level at the rear of the furnace.

Expansion of the brickwork, or of the furnace as a whole, is taken up by heavy springs shown at the side of the furnace. The overhead trusswork has been so divided as to prevent any distortion, due to the heat in the furnace.

If the pieces to be heated are small, they may be placed on the floor of the furnace, or if they are large and rather unwieldy, heavy cast steel trucks may be used, upon which the pieces are supported above the floor level, special provision also being made to take care of the expansion of the pieces within the furnace.

This side-opening furnace is equally good for heating long, fairly light rods. These may be laid directly on the furnace hearth and pulled out one at a time for quenching or other treatment. The doors may be opened only enough to permit of a piece being withdrawn, thus conserving the heat in the furnace. Doors are easily controlled by the air hoist door-lifting mechanism.

MUSKEGON, MICH. — The steamer Petoskey, about whose safety grave fears were entertained, arrived safely at Muskegon, after a very severe passage from Milwaukee. The vessel encountered very heavy ice, and was prevented from making the harbor after she arrived off the port by a very heavy blizzard. The passengers and crew suffered no ill effects from their experience.



CAR TYPE ANNEALING AND HEAT TREATING FURNACE—OIL OR GAS FUEL.

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Something For Nothing

IN THESE days of high fuel costs it is no cause for surprise that consumers will carefully study any means of getting better results from the fuel they use. There is plenty of room for legitimate methods of fuel conservation, the efficiency of the average steam plant being of a very low order. Unfortunately, the situation also gives opportunity to the charlatan who is anxious to benefit humanity by a wonderful preparation, which gives heat value by being merely sprinkled on the fuel. The peculiar part of it is that they are able to not only sell the stuff to supposedly hard-headed, though frequently gullible business men, but to get signed statements claiming that the stuff does what it is supposed to. These quacks and their fuel-saving nostrums appear from time to time in different parts of the country. They flourished a brief space and vanish, only to re-appear far from the scene of their former labors.

The basis of all fuels is carbon. The composition of coal is carbon, hydrogen, oxygen, nitrogen and ash. The proportion of carbon varies with different coals, but may be taken as being from 75% to 90% of the total. The heat value of coal, which means the heat available from the combustion of one pound of coal, is anywhere from 9,000 to 14,000 British thermal units, depending on the relative amount of carbon, hydrogen and ash. Oil fuel has a higher heat value than coal, owing to it being without any ash content. It runs as high as 22,000 British thermal units to the pound.

In a recent case we have seen, the vendor of one of these heating compositions claims, by the use of his preparation, to have raised the heat value of the fuel by 50%, and have lowered the ash content of the fuel. Now the ash content of a fuel cannot be lowered. It is there. What may happen is that some ash will fuse at a lower temperature than others, and a higher proportion of unburned carbon may be carried off by it. Providing that the furnace was working at its best efficiency, the only way that heat could be added to the fuel would be by adding some chemical of a tremendously high heat value. Hydrogen has the highest heat value of any chemical, and that is already contained in the coal, and furthermore, could not very well be applied in the form of a solution. Common salt will make a pretty flame when thrown on the fire, but the added heat is nil. In fact, it will probably extract heat in changing its state. There is nothing to back up the claim of added heat value in the case we mention that would receive any consideration from an enginer. If any one comes to your factory trying to sell a compound that will cut the coal bill in half, insist on him bearing the expense of a properly conducted evaporation test by an independent engineer of recognized ability. If the seller is willing to do this, then enquire into the cost. If anyone buys a cheap compound, or a dear one, for that matter, with the idea he is going to save half his fuel bill, or one-quarter of it, he must be of a high susceptible nature, and a good subject for a gold-brick artist.

The Exchange Situation

AMERICAN firms doing business in Canada have made a very fair move to overcome the handicap to their business by opening bank accounts in Canada.

The business going from Canada was being discounted in payments anywhere from eight to eleven per cent.

The way to overcome this was simple. Open a Canadian account, accept Canadian money at par, in the certain knowledge that the tremendous wealth and resources of this country are sufficient to bring the exchange rate back to normal.

Canadian people do not like to have their money sausage-machined in United States or in any other country.

Canadians feel that there is real security behind their coinage, and do not relish the inference that carrying Canadian bills or silver is nursing a white elephant.

U.S. firms that are opening accounts here, and accepting payments of accounts at pare are showing in a concrete way that they have confidence in Canada's ability to right the exchange situation.

In other words, they have confidence in the common sense of the Canadian people to see that growing more and producing more is their one sure way out.

They have confidence in the common sense of the Canadian people to see that shutting down on production by shorter hours and less effort is going to be a funeral rather than a festival.

Canadian people enjoy the confidence of these U.S. merchants. It is a compliment to the worth and strength of this country to have an exchange rate of from 8 to 11 per cent. waived in our favor.

Canadian people should come right up to scratch and demonstrate fully that this confidence is well placed.

Wet and Dry At Once

IT seems to be the aim of the Governments of this country to please the people. That may be another way of stating that the least government the people have the better for them.

The people of Ontario voted on the booze idea. The result was that John Barleycorn was led to the edge of the village and pointed in the direction of the wilderness.

The Dominion Government, on the other hand, probably heard of the thirsty throats and depleted cellar bar rooms. Hence they make it possible for the Quebec people to reach over and pour booze into Ontario.

Ontario votes dry and goes dry and pleases the drys.

Ottawa makes Ontario wet and pleases the wets despite the 2-to-1 vote.

Give all the people what they want seems to be the slogan nailed to the Government offices in this country.

Beware Working in Closed Garages

By CHARLES C. PHELPS

DID you ever stop to realize that working in a small, closed garage with the engine of your car running is like gambling with death? The newspapers have reported several cases of persons collapsing and perishing under such circumstances before aid could reach them. This should serve as a warning to all car owners. Unfortunately it is easy to forget the warning on a cold winter day when you are pottering around the car and have closed the door and windows of the garage, and have started the engine running, perhaps to secure a little heat from the muffler and radiator.

There is no mystery about the cause of disaster lurking in the closed garage. It is the deadly gas carbon monoxide which is mixed with the exhaust gases from the engine. Even small quantities are disastrous; in fact, this gas formed the principal constituent of one of the worst of the poison gases used in the war.

The U.S. Bureau of Mines recently issued a technical paper dealing with the vitiation of garage air, in which it was stated that air containing as little as one-fifth of one per cent. of carbon monoxide will cause a man at rest to collapse within an hour. Experiments made to determine to what degree air in a closed garage is vitiated by running a four-cylinder engine of 30 horsepower, proved the presence of dangerous proportions of carbon monoxide in the most distant parts of the garage after running the engine less than a half hour, while near the exhaust muffler the air was extremely unsafe after the engine had run 15 minutes. These results were secured with various settings of the throttle and spark.

The worst feature of carbon monoxide poisoning is that there are likely to be no symptoms to serve as a warning. Collapse comes suddenly, while the running engine is constantly making the air still more poisonous; hence everything is in favor of the victim perishing before help could arrive.

Always open the doors and windows of your garage before starting your engine, or better still, take the car out into the open and you will thereby avoid exposing yourself to a very real danger

Production in 1930!

A WRITER, with a rather facetious turn of mind, has a story in a recent number of *Engineering*, in which he describes a motor car being turned out in batches of 10,000 at £50 each. The story is dated 1930, and released for publication now, no doubt, in order that people may hold their automobile orders for the new car.

The manner in which automobile production has been brought to a science, and turning out of parts speeded up to a tremendous rate, also has the tendency to open the door to the writer who sees in this age of specialization the opportunity to lead in the absurd and the ridiculous.

So when the mechanical specialists of the automobile world find writers having their little fling at them and at their work, they will simply have to grin and bear it. Such is fame.

The Business Paper

AN association of railway executives undoubtedly represents the most capable and progressive business men on the continent. Practically all of them have worked their way up from minor positions and they know every phase of labor, business and public opinion. They should know it better than any other class in the community.

Recently the Association of Railway Executives of the United States wanted to lay before the country the fundamental facts of the railway situation. They selected a number of newspapers for this purpose. Out of the total number, 42 were purely trade and technical newspapers.

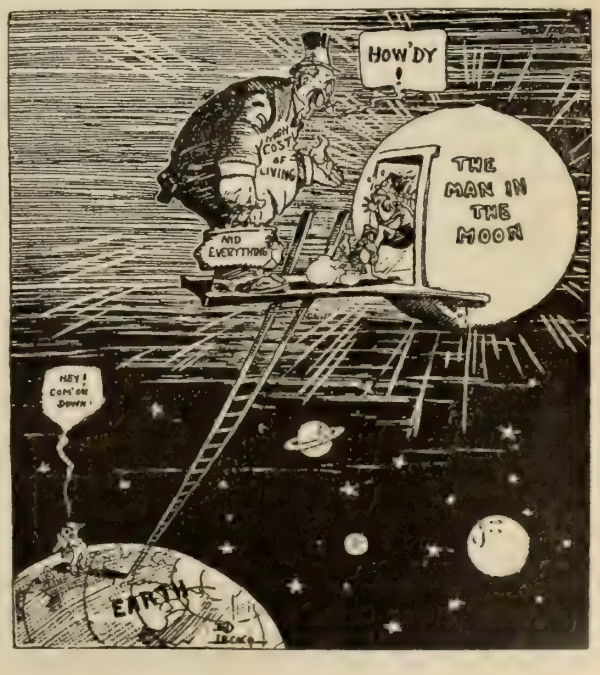
This is one more experience which we commend to the attention of the Dominion Government which employs M. E. Nichols at a bigger salary than he ever earned before, as Director of Public Information. The two daily newspapers which Mr. Nichols directed went insolvent. Mr. Nichols reported and passed his report to the Government that business newspapers were of no public value and were not entitled to admission to the newspaper mails. Should such a man, who is so far behind the times, be retained at such a high salary and in so important a public position?

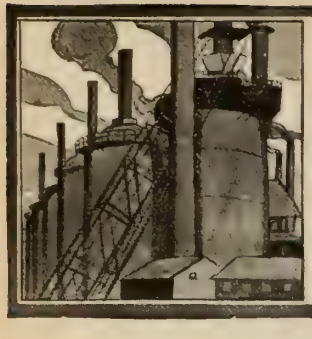
WHILE going through the fitting shop of a large engineering works the manager noticed an apprentice, who was holding his hammer close up to the head, in an unworkmanlike manner. The manager remonstrated with him in this fashion: "Look here, my lad, that's no way to hold a hammer. When I see a man holding his hammer by the end of the shaft I pay him $30 a week. If he holds it half way up I pay him $20 a week, and when its held higher than that I pay him only $10 a week. Do you get me?" "Yes, sir," replied the youngster; "but you might tell me where I should hold it. I only get $5 a week."

A good way to test a suspected mica plug is to lay it on top of the cylinder after dark, taking care not to have the insulated terminal in contact with any metal parts except the high tension current lead. The engine is then run on the other cylinders and the inside of the spark plug watched to see if sparks jump between the insulator and the plug body, instead of between the points. If a short circuit exists, it will be easily detected by the minute sparks plainly evident in the darkness. It is sometimes possible to test a plug out in the daytime by shading it from the light in some manner, as with a black felt hat.

A new microphone to collect sounds and convey them to the ears of partly deaf persons by almost invisible wires is so compact that it can be worn under a man's necktie.

For the production of cheap electric power, briquettes and certain by-products the Government of Victoria is planning to develop immense deposits of brown coal, estimated to exceed 20,000,000,000 tons.





MARKET DEVELOPMENTS



Prices Show No Tendency of Resting

Increases Marked Up in Several Lines—Big Shipment of Galvanized Offered at 9.50, Brooklyn—Automatic Output Sold Up to February, 1921

A NUMBER of machine tool builders in United States have taken steps to protect their business against the handicap of the exchange rate. They have opened bank accounts in Canada. In this way Canadian payments are accepted at par, and the funds are left here in the meantime or invested in Canadian securities. Payments for machine tool equipment often run into large sums of money and the exchange rate was becoming a serious anchor to the transaction of business.

There seems to be no limit to which the price of material will go. Just this week one Toronto warehousing concern got an offer of 500 tons of galvanized sheets at Brooklyn, the price being 9.50 per pound. To bring this shipment to Toronto would raise the price to very close to 12c, which would mean that the warehouses would sell out at between 13½ and 14c per pound. The material would also have to be inspected, and it might decrease by this process. Compare this with 7.50, the selling price in Toronto as recently as July of 1919, and one has some idea of the trend of prices. The present quotations in Toronto are around 9.50 to 10c, with delivery slow and material very hard to secure.

There is a good volume of business now in almost all lines, such as machine tools, supplies, etc. Kindred lines also report good business. Stock-taking is occupying considerable time just now, and in some places this has been the first opportunity of cleaning out the remainder of the war supplies.

One of the makers of a fine line of automatic machinery has notified Canadian sellers that their present delivery schedule stands at February, 1921, the time in between being fully occupied in turning out business now on the books.

BETTER SUPPLY OF MATERIAL WOULD HELP MONTREAL BUSINESS

Special to CANADIAN MACHINERY.

MONTREAL, Jan. 15.—The ratification of the peace treaty is an event that the entire world has been waiting for for many months, but it remains to be seen whether this incident will have any material effect upon general business. It has been accepted by trading interests generally that the actual passing of the treaty was just a question of time, and manufacturers and dealers here do not anticipate any radical change of existing conditions as a direct consequence of this welcome but long-deferred political consummation.

Greater Production Necessary

The pivot upon which the steel trade swings at present is that of delivery. The prospects for a betterment of this condition lies in the greater production of the mills. For some time past the steel strike in the States has interfered with the operation of many of the mills and dealers here have experienced considerable difficulty in getting material through from American points. This has had the effect of aiding Canadian mills, and reports are showing the greater local activity that has developed during the past several months. Consuming demand is of a steady character and reserve marks many of the steel inquiries. Dealers do not anticipate any marked increased demand as a result of peace but are looking forward to a very good year in all lines of activity. It is generally conceded that impetus will be given to export trade now that the world is again on a peace basis. The gradual adjustment of labor troubles will be the principal factor in greater production and incidentally a lowering of the high prices now prevailing. This latter condition is, however, a question of intensified output and little or no decline is looked for before the early or middle summer. Dealers here are quoting a warehouse price of $4.25 on steel bars against a mill price of $3.75 Pittsburgh.

Improvement Showing in Scrap

The market in scrap has revived a little since the first of the year, but the activity so far is not pronounced. The local trade in foundry business is well maintained but the supply is not large and prices remain firm. Local dealers are better pleased with the prospect of a return to normal trade with the States, but the question of exchange is still a deterring factor. Slight fluctuations have taken place in some lines but quotations are invariably firm and subject to individual sales.

Under the inquiry that is coming to hand there appears a good prospect of a steady improvement in the demand for different classes of machine tools. There is, from time to time, inquiries as to certain articles that can be made here in Canada, and it is presumed that agents of foreign countries are looking about for manufacturers that can take care of their needs. If existing plants are not in a position to handle the particular product required it is not unlikely that, in some cases, factories would be established. A good demand still exists for standard equipment but dealers are often unable to meet the wishes of their customers in this matter of delivery. Considerable business has been done of late by Canadian firms as a result of the exchange rate now prevailing. Supplies are still moving in good volume.

MONTREAL.—It was stated by Maj. P. A. Curry, the new general manager of the White Star-Dominion Line, that there would soon be two new passenger ships on the St. Lawrence route. These ships will be named the "Regina" and the "Rimouski."

STEEL PRICES ARE GOING HIGHER YET

Several Lines Have Been Moved to a Higher Level Since First of Year

TORONTO. — House cleaning and stock taking are among the chief pastimes in the machinery trade this week. There are instances where it has never been possible, owing to the amount of business that has kept coming, to get the war stock all out of the premises. This refers especially to supplies and certain lines of small tools.

There seems to be no let-up to the tendency for prices to go higher in many lines, especially where iron and steel enter into the bargain.

It is no family secret to state that galvanized sheets are scarce. In fact, scarce hardly describes the situation. The scarcity of the article threatens to blow up all the price regulations that have been in force for some time past. If a firm must have galvanized material in order to go ahead, and if that firm is fortunate enough to find some material for sale, then it is as plain as day that they must pay the price. Here's a little happening of a day ago that shows how prices have taken to the upper registers. A Toronto warehousing firm received word of a lot of 500 tons of galnections in Chicago stating that they had received work of a lot of 500 tons of galvanized iron for sale at a certain point near New York. The price on these was quoted at 9.50c per pound, and it was further stated that the sheets had not been inspected. They were a lot that had been left over from a war contract and they might or might not be good all the way through. If a person were to bring these to Toronto and pay duty, freight, exchange, etc., the price would not be far from 11.80 or 12c by the time the deal was over. This would mean a warehouse price of something between 13c and 14c if there were anything in it for the handlers. Buyers who have been over in the States recently say that prices that are being quoted in Canadian warehouses right now are better for the buyer than those asked in the warehouses in the States at the present moment.

Tubes, both lapweld and seamless, took a five per cent. jump, which is now charged to the trade.

The price of plate continues to be quoted about the same, but prices are largely nominal. Buyers do not like to admit that they are paying premiums, but as a matter of fact there is a lot of premium business crossing the line from Canada now. One case that CANADIAN MACHINERY heard of was where a tonnage running into some two or three hundred tons, was placed at 3.25. Of course, for this price there is a correspondingly good service in the matter of delivery, which was promised in 60 days —in reality the promise was a guarantee. Sixty days is not quick delivery as a general thing, but just now it is in the remarkable class.

As long as price is not the determining factor premiums can be easily asked and collected if the material is forthcoming. It is simply a case of passing the increase on to the last buyer. Hence the scarcity is doing its bit in keeping up the high prices.

The Canadian steel mills are booked well ahead. They are not able though, to handle anything like the volume of urgent business that is being offered in the Dominion at present.

The Machinery Market

When it is stated that some of the standard line of machine tools are advising deliveries now of February, 1921, some idea may be secured of the business that is booked ahead. No, we did not make a mistake there. It says February, 1921, and that is correct. However, there are ways known to the trade whereby these dates can often be improved a little for a bona fide and urgent sale.

A number of American makers have taken to the idea, started a week or so of opening a bank account in Canada to overcome the exchange situation. They make it possible for the Canadian buyer to make his dollar buy a dollar's worth, and the arrangement means quite a bit to the customer here, when the present rate of exchange is taken into consideration. American firms found that they were handicapped so seriously by the exchange situation, and the chances seem to be that there will be more of this done in the future.

A nice volume of business is being done in small tools and supplies, not from any particular concern, but from a wide range of firms. The trade learns that one firm in this district, following extensive tests that are being carried on now, will place business in large quantities in accordance with their findings.

Although dealers as a general thing are not protected by the makers of drills and other small tools, they report a very nice trade in these lines, at their own stock prices, regardless of what the same material can be secured for at the factories. Some of the dealers are having a thorough house cleaning now of what they have on hand, and finding out just where they stand in regard to slow-moving lots. There is little doubt but that a close search will show there is material from the war days in the stock yet. Chances are that the trade will be advised, and a movement forced. If the worst comes to the worst there are some sizes that will make a shipment to the scrap heap.

Turkish emery is once more on the market in fairly liberal quantities, and is bringing a better price than the American product which was in use here during the absence of the Turk stuff. Plating material is coming in fairly. Potassium carbonate, if any is to be secured, sells now at about $1.25 to $1.50 per pound. There were some large stocks of it held in this country when the war started, which were largely brought here from Germany. With the exhaustion of these the scarcity set in. During the war what was turned out in United States was the property almost exclusively of the War Department, and never came on the open market. An improvement in this line is looked for.

An important industrial announcement is that the General Fire Extinguisher Co.'s business will henceforward be carried on by the Grinnell Co. Inc. Both these companies are sufficiently well known in the fire appliance, sprinkler, and steam piping and fitting fields to make description unnecessary. The new company will carry on all the lines formerly handled by the two concerns, including a complete engineering and constructional service for industrial plants.

POINTS IN WEEK'S MARKETING NOTES

Orders have been placed in this district for plate at as high as 3.25 with a sixty-day delivery guarantee. The 2.65 price is still good, but nothing is promised in the way of deliveries at that price.

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One Chicago firm wired a Toronto warehouse this week offering galvanized sheets at Brooklyn 9.50 per pound. To put them in here would bring them up to almost 12c. They were not guaranteed or inspected.

—

Most of the machinery and supply houses are busy just now taking stock. In several cases this is the first chance they have had to get things in shape since handling war material.

—

A shortage of trained men at some of the steel mills is a factor in keeping down production.

—

Some of the U. S. steel mills are not selling far ahead in the open market, preferring to look after the best of their old customers and employ the rest of their capacity on premium business.

—

Crane manufacturers are booked for some months ahead. Some Canadian business has been placed.

—

It is expected that U. S. railroads will be in the market for equipment as soon as turned over to their owners by the Government.

—

Dominion Bridge, Montreal, is spending a large amount on equipment, one estimate being around the million mark.

CRANE BUILDERS ARE BOOKED UP WITH BUSINESS FOR MONTHS TO COME

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 15. — A remarkably good business is being done in all lines of metal-working machinery. Taking cranes as an example, the business which has been done in the past few weeks has been sufficient to fill up some of the crane shops for months and they are hesitating about accepting much more business at present prices on account of the advancing cost of steel. An Ohio company has taken a very large amount of crane business, including orders from the Algoma Steel Corporation of Canada, the American Rolling Mills Co., Middletown, Ohio, and the Follansbee Bros. Co., Wheeling, W. Va., which is building a new sheet mill at Toronto, Ohio. The Westinghouse Electric & Mfg. Co., Essington, Pa., near Philadelphia, has bought 12 overhead cranes for additions to its plant and will within the near future be a large buyer of machine tools. The Westinghouse Company built its Essington plant during the war to make turbines and auxiliary equipment for the Emergency Fleet Corporation. Since the war the company has branched out into the manufacture of land turbines also, and now it has been decided to consolidate all of the company's manufacturing in this line at Essington. The buildings occupied for this purpose at East Pittsburgh, Pa., will be vacated and used by the company for manufacture of electrical equipment. A part of the machine tool equipment will be moved to Essington, but a great deal of new equipment will be bought for both East Pittsburgh and Essington plants.

Roads Due To Buy

In view of the return of the railroads to private operation on March 1 and the probability that extensive purchasing of rolling stock will be made, it is significant that car manufacturing companies are expending their facilities. Comment has been made in these reports on the buying done recently by the American Car & Foundry Co. for its various plants. Now the Midvale Steel & Ordnance Co. has appropriated nearly $2,000,000 for extension of its car shops at Johnstown, Pa., and about $500,000 of this amount has been expended for machinery, such as forging presses, bolt and rivet machines, punches and shears and machine tools. The American Locomotive Co. still has quite a lot of equipment to buy for its various plants. The American Bridge Co. has recently bought plate-working machinery for its Trenton, N.J., plant, where steel for ships is being fbaricated.

The Dominion Bridge Co., Montreal, Que., has been seeking heavy tools, such as planers, boring mills, etc., in this market, and has made several large purchases. It is reported here that its appropriation for new or used equipment is about $1,000,000.

The New York market has not been extremely active since the first of the year so far as large projects are concerned, but the volume of business in small orders is very satisfactory, and much in excess of what has usually been expected at this season. The Empire Cream Separator Co., Bloomfield, N. J., is about to buy a list of tools to increase its output of cow-milking machines and cream separators.

BELIEVES CONDITIONS ARE DUE TO IMPROVE IN PITTSBURGH DISTRICT

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 15. — With pig iron and steel so extremely scarce the matter of production is the chief item of interest in the trade. The indications have become more favorable. Of particular importance is the showing made by the compilation conducted by the "Iron Age" of the production of pig iron month by month. The report for December shows that production in that month was at a rate of 6½ per cent. greater than the rate during November, and the steel works furnaces and merchant furnaces, which are reported upon separately, showed approximately the same proportionate gain. The rate of production January 1, moreover, is shown to have been about 6 per cent. greater than the average rate during December, so that the improvement is progressive. Nor does the improvement stop there, for it is well known that there was a very considerable coke shortage even on January 1, and thus as this coke shortage is gradually relieved production will increase still farther. On January 1 there were some furnaces banked from lack of coke. Others, and quite a number, were running slack, with their insufficient coke supplies, rather than bank entirely. Still others were idle, but merely awaiting a coke supply in order to blow in Supplies of coke have been increasing and it is the common expectation that the supply will be nearly, if not quite, normal before the end of this month. As to the general future no fears need be entertained, for with the many by-product coke ovens built in the past few years, nearly all the old beehive ovens surviving, there are more ovens than enough to make coke for all the blast furnaces in existence. Prevailing coke prices are very profitable, while the average of $11 advance in pig iron in the past seven months makes it that the furnaces could offer still higher prices for coke if further temptation needed to be put in the way of coke operators to make coke and to get the labor necessary to do so.

The remarkably favorable nature of the pig iron report is made apparent when it is recalled that early in December, on account of the acute fuel shortage, it is common expectation that pig iron production in the month would be at a lower rate than in November, while instead of 6½ per cent. increase is now shown. The reason the furnaces did so well in the face of a coke shortage was that during November production was still being restricted by the iron and steel strike. Practically all of the strike had disappeared before the middle of December. The item is of no consequence, but it may be mentioned parenthetically that last Thursday the strike committee met in Pittsburgh and formally called the strike off. Original strikers remaining would be chiefly men whom the employers did not wish to take back on account of nationality, ignorance of the language or disposition to make trouble rather than do good work.

Another favorable indication as to steel production in this quarter of the year is that in the past ten days the valley steel mills have been large buyers of heavy melting steel scrap, for deliveries over 60 to 90 days, when movement in scrap market just before the holidays had been supposed by dealers to have represented about all the scrap the mills felt they would need for the quarter. Apparently their expectations as to labor and fuel supplies have so improved that they count upon larger output of steel than when the original plans were laid. The buying sent the market up $1 to $2 a ton, heavy melting steel being now quotable at $26 to $27, delivered Pittsburgh and valley districts.

Holding Down Prices

As recounted in last report, on December 30, Chairman Gary of the Steel Corporation made a public statement, in which he reiterated the Steel Corporation's policy of holding down its steel prices to the March 21 or Industrial Board schedule, thus removing any doubt as to whether the Steel Corporation would abandon the policy at the end of 1919, for which year the price stabilization program had originally been arranged.

Since then definite proof has been furnished of the Steel Corporation practising what it preaches, in that the unfilled tonnage statement made public last Saturday shows 1,137,036 increase during December. This represented approximately 87 per cent. of capacity for the month, while shipments may be estimated at 73 per cent. of capacity, so that the bookings were 159 per cent. of capacity. None of the corporation's bookings were at above the March 21 prices, unless in the case of export business, and export business does not as a rule figure largely in the unfilled tonnage statement. The statement shows that in December the corporation subsidiaries sold more than 2,000,000 tons of their steel products. This is in striking con-

trast with the action of some independent producers who nominally adhere to the March 21 prices, in that they have not announced definite advances, but do not sell at all. Many producers have been selling at advanced prices, which have been obtainable for early deliveries, but the total of sales at advanced prices, in point of tonnage, is very small by comparison with the Steel Corporation's sales of more than 2,000,000 tons in a single month at the stabilized prices.

With this situation obtaining, consumers of steel who are greatly in need of material will pay extra or premium prices only for a short period ahead, as they would be placed at a disadvantage by comparison with their competitors who secure their supplies from the Steel Corporation.

Steel Production

Taking the steel industry as a whole, the rate of production is now about 80 per cent. of capacity and the rate is increasing steadily. There remains some labor shortage, but the situation is improving, while the men at work are becoming more accustomed to their jobs. As the strike waned there was much shifting of employment, and some new men were taken in, so that many men have had to be trained. Coke is still scarce, but production is increasing at both by-product and beehive ovens. Coke is almost invariably scarce around holiday time, and usually becomes relatively plentiful after the middle of January. An illustration of this was furnished in the winter of 1912-3, the average price of spot furnace coke in December, 1912, being $4, while January showed an average of $3.85 and February an average of $2.60, representing a drop of 35 per cent., the open market conditions enabling the price to reflect the improvement in supplies.

Prospects now are that by March 1 the steel industry will be operating at 90 per cent. of capacity or better, whereby there will be much more steel available than during the past four months.

A remarkable thing about this steel market situation, when steel is so extremely scarce, is that the steel mills do not have full order books by any means. On an average they are not sold nearly as far ahead as they usually are when industries generally are so active. The Steel Corporation is, of course, sold farthest ahead. Its unfilled tonnage, Dec. 31, as just reported, was 8,265,366 tons, equal to its output in about 6½ months, running at capacity, but some of the tonnage is for far-off deliveries, against construction jobs, and in some products the corporation still has a little unsold output in the second quarter. Then there are some large independents that have been selling scarcely at all of late, most of their present obligations being tonnage deferred from 1919 by the strike. One large interest would be practically out of orders by April 1 if it did not sell between now and that date. Its sales will be made in due course, chiefly or wholly to regular customers, to whom in many cases it has already made definite promises. Then there are the mills that have been charging premium prices, and, of course, they could not sell very far ahead at such prices, even if they wanted to. If the railroads come into the market there will be a moderate amount of rolling space for them.

The Week's Events in Montreal Industry

Lorne C. Webster, of Montreal, has been appointed a Senator, to succeed the late Senator Landry, of the Stadacona district. Senator Webster has had little experience as an active politician, as he has devoted most of his time to commercial undertakings.

William Ross, general superintendent of the Phoenix Bridge and Iron Works, Montreal, died suddenly on the street last Saturday, following an acute attack of heart trouble. Mr. Ross was returning from work when stricken. He was nearly seventy years of age, and had held the position of general superintendent of the Phoenix Works for the past twenty-three years.

After several weeks of suppressed anxiety as to the fate of the "Canadian Spinner," the tension has been much relieved by the latest report to the effect that the vessel, with the ice-breaker Montcalm as a relief ship, will succeed in clearing the ice this week and reaching the port of Sydney. It is not thought that any serious damage has been done to the vessel.

Intensified operations in the Cape Breton coal regions of the Dominion Steel Corporation has resulted in the mining of increased quantities of coal. Official statements gives the production for the month of December as 312,891 tons, an increase of over 40,000 tons over the corresponding month a year ago. Officials of the company state that every facility is being provided to bring the mines up to maximum capacity.

The power plant and the machine shop of the Record Foundry and Machine Company at Moncton, N.B., was destroyed by fire last week. The stove plant was not damaged, but about 100 men will be out of work until a new engine can be installed. The fire originated from an explosion of an oil tank, in which springs were being hardened. The loss will be over $60,000.

In connection with the American Association of Port Authorities, it is interesting to note that a change has been made in the way of news distribution in the monthly bulletin that has recently been issued from the office of the secretary, M. P. Fennell. Formerly, the issuing of the bulletin was an annual affair, so that the new departure will provide current news to the members within a more reasonable period.

City and Board of Trade officials of St. John, N.B., have decided to memorialize the Federal Government to commence early operations in the development of improvements and extensions to the port, to take care of the rapidly increasing trade to this country. In addition to breakwater extensions and increased accommodation as to ship berths and grain elevators, the installation of a wireless station came into discussion and this will probably be included in the program submitted.

That the Canadian Government Merchant Marine is losing no opportunity to develop new trade routes is shown in the arrangement that has just been concluded to establish a direct service between Canada and Brazil.

At the annual meeting of the Dominion Marine Association held last week at the Windsor Hotel, Montreal, the Hon. C. C. Ballantyne briefly reviewed the activities and achievements of the C.G.M.M. After dwelling on the accomplishments of Canadian yards in the construction of freight vessels, the Minister stated that the department had under consideration the building of several passenger ships for operation by the Government service. If the proposal is adopted, these vessels will be built in Canadian yards and with Canadian material, as far as possible. In addition, it was intimated that this departure might be followed by the construction of naval vessels if a naval policy is decided on.

The Marconi Wireless Company of Canada, Limited, has recently formed a subsidiary company known as Scientific Experimenter, Limited, for the manufacture of a product closely associated to their present activities. This work will be in the character of what might be classed as amateur and experimental telegraph and telephone apparatus, and other lines of practical toys distinctly different from the commercial appliances now being made by the parent company. The Marconi factory will be utilized for the manufacture of the new product, and branches will be established in the leading Canadian cities for the sale and distribution of the amateur apparatus.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon..2.25% to 2.75%	$37.00 to $40.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	6 50
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$25 00	$24 00
Electro copper	24 00	24 00
Castings, copper	24 00	24 00
Tin	65 00	60 00
Spelter	11 50	10 75
Lead	9 50	8 75
Antimony	11 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00

	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

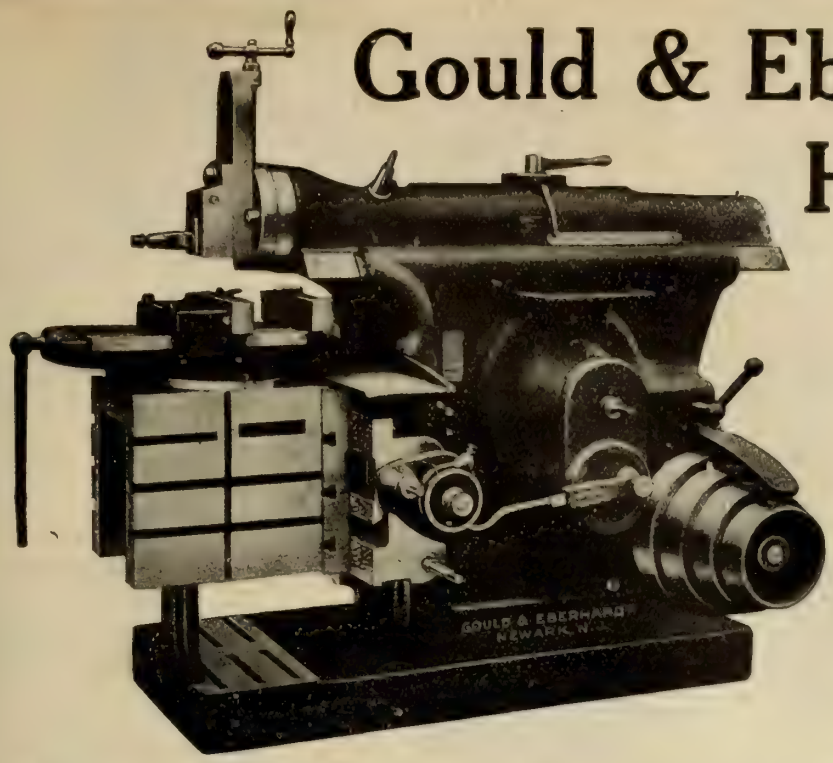
Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net



Gould & Eberhardt High-duty Shapers

16" - 20" - 24" and 28" sizes

Ask for Catalog and details describing the exclusive features.

We can give early delivery

The A. R. Williams Machinery Company Limited

Halifax, St. John
Montreal, Winnipeg, Vancouver

64 Front St. West
TORONTO

Acid Electric STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

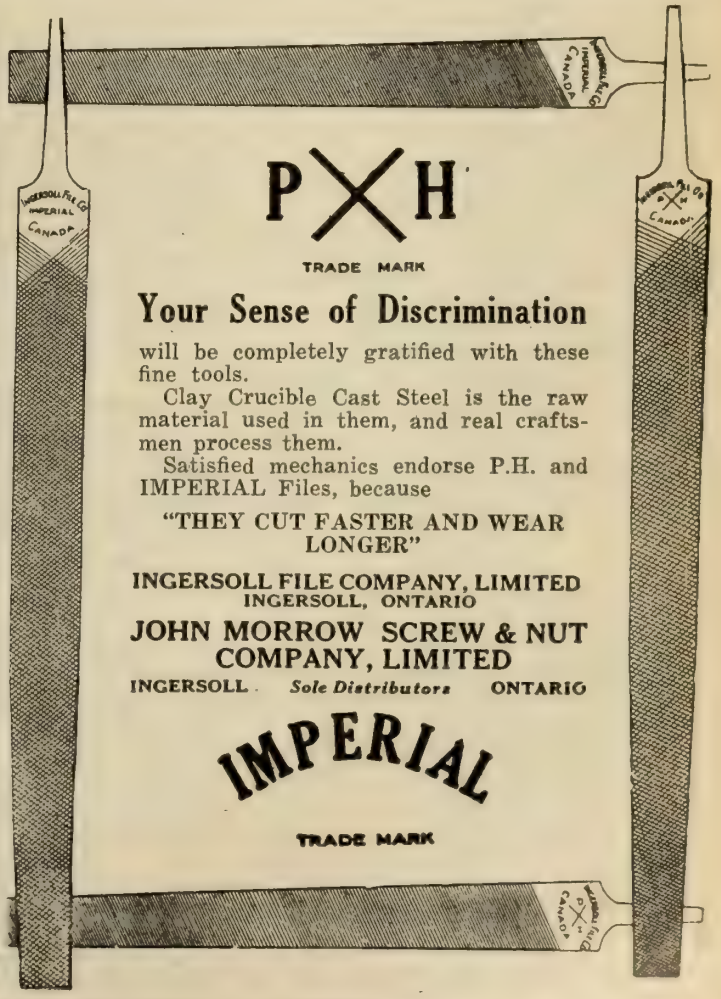
Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal
Head Office: 187 Delisle St. MONTREAL
Phone Victoria 1462



P X H

TRADE MARK

Your Sense of Discrimination

will be completely gratified with these fine tools.

Clay Crucible Cast Steel is the raw material used in them, and real craftsmen process them.

Satisfied mechanics endorse P.H. and IMPERIAL Files, because

"THEY CUT FASTER AND WEAR LONGER"

INGERSOLL FILE COMPANY, LIMITED
INGERSOLL, ONTARIO

JOHN MORROW SCREW & NUT COMPANY, LIMITED
INGERSOLL *Sole Distributors* ONTARIO

IMPERIAL

TRADE MARK

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 25
Premier, 10¾ oz.	....	9 65
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 00	.....
1½ in.	30 00	26 50
1¾ in.	32 00	26 50
2 in.	31 00	26 00
2¼ in.	35 00	28 00
2½ in.	43 00	32 00
3 in.	48 00	40 00
3½ in.	.....	41 00
3½ in.	60 00	42 00
4 in.	75 00	56 00

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

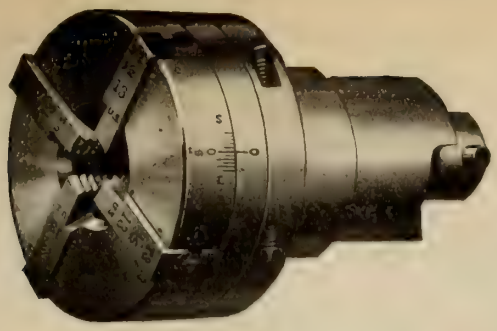
Cut sheets, ½c per lb. extra.

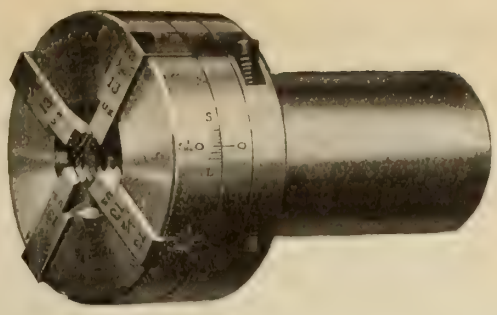
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

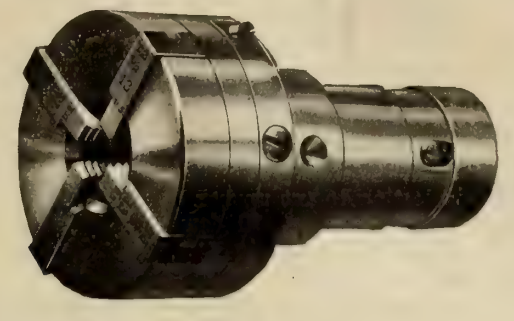
Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head best adapted to the work.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

MERIT AND DEMERIT MARKS FOR C.P.R. MEN IN NEW BRUNSWICK

The January Bulletin of the C. P. R., New Brunswick district, gives the following details of merit and demerit marks for that district in the past month:

5 Merits—Detected a car with two numbers stencilled on same.

5 Merits—Detected broken rail.

5 Merits—Good service rendered in making repairs to train line and thereby avoiding delay to a car.

5 Merits—Valuable assistance rendered in making repairs to disabled car.

Demerit marks are given as follows:

Night agent, 5 demerits—Neglected to intercept foreign empty as instructed, permitting it to return empty to connection when required for loading.

Night agent, 5 demerits—Billed out a loaded car as an empty.

Boilermaker, 10 demerits — Faulty workmanship on tubes of engine.

Car checker, 20 demerits—Responsible for loaded car with seals intact to be sent forward as an empty.

Car checker, 5 demerits — Permitted three cars to go forward without being properly sealed.

Checker, 10 demerits—Loaded a case of blasting caps without necessary authority and without a loading record. Shipment went forward without waybills.

Clerk, 5 demerits—Neglected to call attention to those concerned to wired instruction, re icing car of fruit. Car went through on Sunday and not re-iced, resulting in heavy claim.

Clerk, 5 demerits—Neglected to deliver switching order to yard foreman, resulting in delay in switching industrial track.

Clerk, 2 demerits—Permitted foreign car to be returned empty to connections when it could be used for traffic offering.

Clerk, 3 demerits—Duplicated three red card symbols.

Conductor, 2 demerits—Booked incorrect engine number when registering at end of run.

Conductor, 5 demerits—Neglected to see that hand brakes were properly set, causing car to be derailed.

Conductors (2), 1 demerit—Neglected to furnish check of cars in outlying sidings as directed.

Custom clerk, 2 demerits—Duplicated red card symbol.

Fireman, 5 demerits—Faulty handling of engine causing drawbar to be broken.

Engineer, 5 demerits — Ran through junction switch main line.

Engineer, 5 demerits — Ran through switch when making yard movement.

Engineer, 5 demerits—Improperly disconnecting motion of engine when transmission bar pin was lost.

Fitter, 2 demerits—Neglected to register on time clock.

Fireman, 30 demerits—When called for train at McAdam was found to have gone to St. John without obtaining leave.

Fireman, 5 demerits—Caused delay to train by sleeping in after accepting call.

Fireman, 5 demerits—Faulty handling of engine, resulting in breaking drawbar strap on engine and causing delay to train.

Operator, 5 demerits—Violated fourth paragraph of Rule 208.

Trainmen (2), 5 demerits — Did not see that doors were properly secured before moving coal car, resulting in damage to ice house.

Trainmen (2), 5 demerits — Violated fifth paragraph, Rule 104.

Trainmen (2), 7 demerits—Responsible for damage to cars by not having clear understanding with other members of crew of switching movements to be made.

Trainman, 10 demerits — Caused derailment of engine by neglecting to clear derail.

Trainman, 10 demerits—Took his name off spare list and booked himself up in regular car to which his seniority did not entitle him.

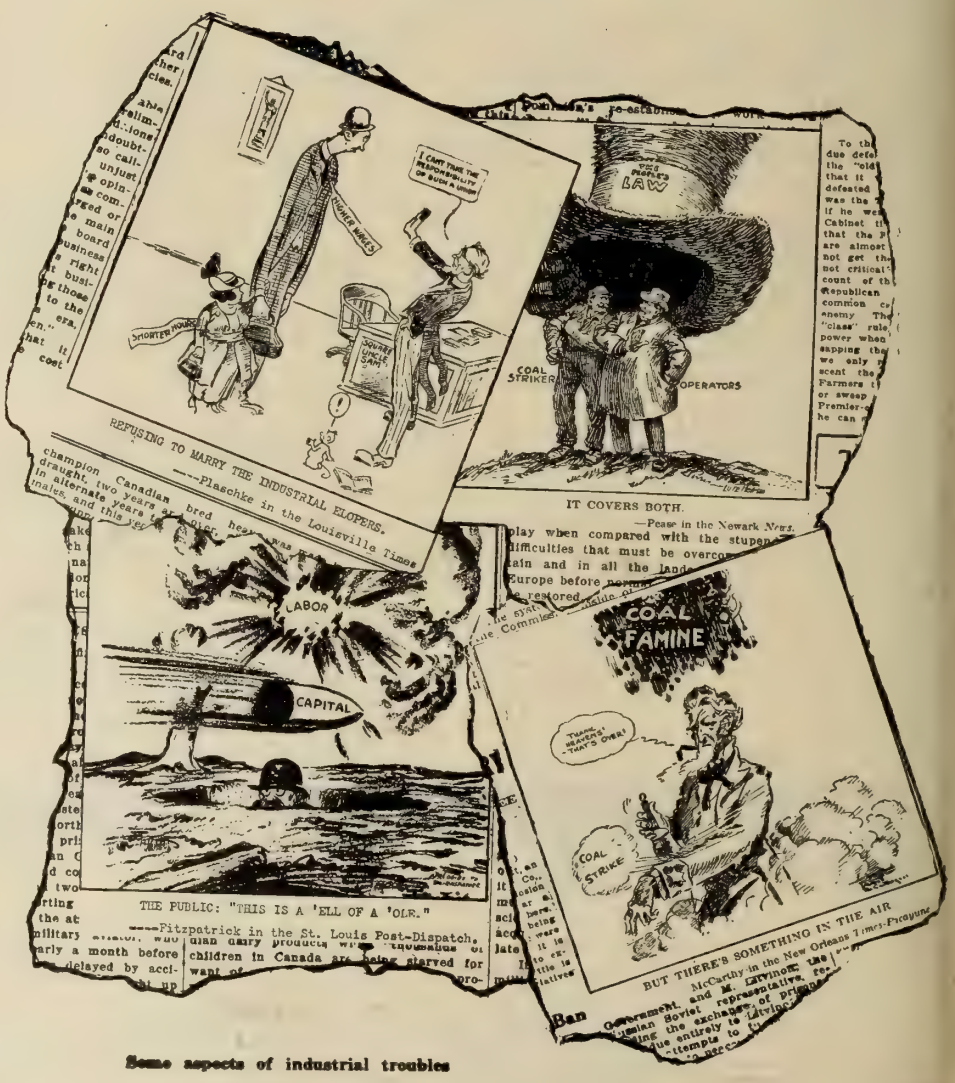
Trainman, 10 demerits — Responsible for damage to cars when switching by neglecting to set up hand brakes.

Yard foreman, 10 demerits—Responsible for damage to car of machinery while switching.

Thirty thousand acres of land will be submerged by the construction of a mammoth dam in South-eastern Australia, the object of which is to form a great irrigation reservoir. Work has started on the structure, which will be located in the Murray River, a short distance below the confluence of a Mitta Mitta Creek with that river. It is estimated that the project will cost $8,000,000 to complete. Approximately 43,560,000,000 cubic feet of water will be impounded.

The total length of the dam will be 3,601 feet. This will comprise three sections: an earthen dam, 2,700 feet long; a concrete spillway, 740 feet long, and an outlet works of the same material, 161 feet long. At some points the dam will be nearly 100 feet in height. The foundation will extend down to a stratum of granite, 34 feet below the surface of the earth.

Only a comparatively small portion of the dam will be situated in the river bed proper, as the greater part will extend across an alluvia flat on the left bank of the stream. In constructing the earthen dam, a concrete core wall will be built, and covered with stone to reinforce the dirt embankment.



REFUSING TO MARRY THE INDUSTRIAL ELOPERS.
—Plaschke in the Louisville Times

IT COVERS BOTH.
—Pease in the Newark News.

THE PUBLIC: "THIS IS A 'ELL OF A 'OLR."
—Fitzpatrick in the St. Louis Post-Dispatch.

Some aspects of industrial troubles

Aikenhead's

"Simplex" 2-Speed Hoist

THIS genuine Speidel Two-Speed Chain Hoist is the best you can use with cranes and other hoisting machines. Made in 12 sizes. Blocks with capacity up to 1,600 lbs.—one man can lift full load. 20,000, 30,000 and 40,000 lb. hoist—2 men can lift full load.

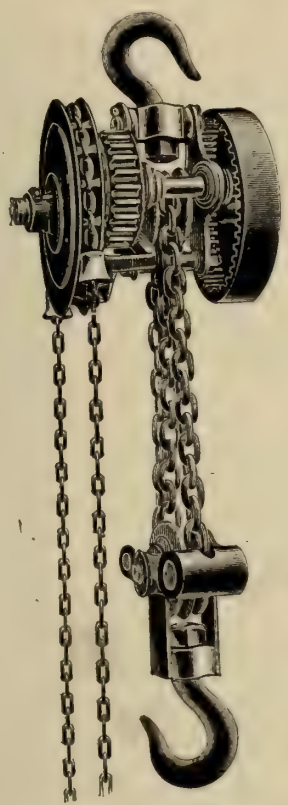


Fig. 1
Hoist showing Lower Block in Position for Regular or Slow Speed.

MOREOVER, the ability of this Speidel Hoist to operate at two speeds results in a saving of much time when handling small loads, as these can be hoisted at double speed. The two speeds are secured by locking the lift chain to the chain wheel of the lower block by means of an ingenious arrangement, protected by patent, in the lower block.

The lift chain is both guided and protected by means of a guide roller; it cannot jump off the sprockets of the lift chain wheel. Nor can it stick to the wheel. This too common a trouble is eliminated by means of a stripper which runs up through the narrow groove of the wheel.

Write for particulars of other important features.

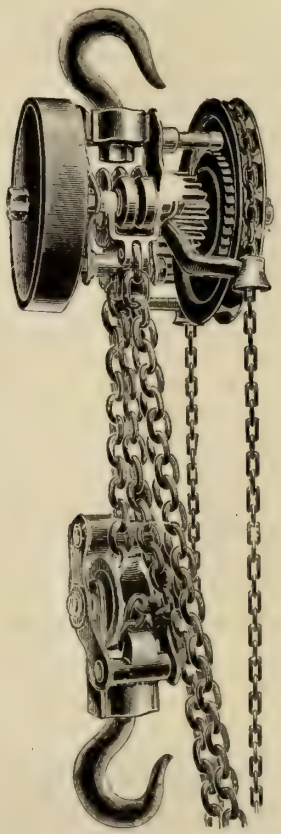


Fig. 2
Hoist showing Lower Block in Position for the Fast Speed.

Aikenhead Hardware, Limited

17 Temperance Street - Toronto, Ont.

If interested tear out this page and place with letters to be answered.

What Inspection System is Adopted in Your Plant

By J. H. Moore

THE modern manufacturer looks upon the inspection of his product as the sine qua non of manufacturing perfection.

Some years ago, the value of a proper inspection system was not fully appreciated, but since the need of interchangeability has made itself felt in the industrial world, the old regime has changed for that of the new.

It is hardly necessary to champion the cause, for its benefits are so self-apparent. Suppose it was our intention to manufacture linotype machines. Roughly speaking, there are about 3,600 parts to one of these machines. Some of the portions are of such peculiar shape, that to make them similar without jigs and fixtures, would be quite a difficult matter, in fact, almost impossible. These fixtures are made from special gauges, which ensures absolute interchangeability to the product. Thus, we come to the point where we can safely state, that to obtain an interchangeable product a certain routine must be gone through. First, we must consider the best method of manufacturing the product, the various operations through which it must pass and so on. Having settled these points, the next step would be the preparing of special fixtures to ensure maximum production, with the liability of inaccuracies reduced to a minimum. Reaching this point we could then safely guarantee product to be interchangeable.

To obtain this much to be desired condition, it is essential that a plant have a first-class inspection department. You note, we say, a first-class department, for an inspection department to be a success must not only have the best of tools and gauges to work from, but must employ the very best skilled mechanics obtainable. The very word, inspection, according to Webster, means a strict or prying examination, or to use another expression, the act of looking closely at any object to detect any error.

The Duties of Inspection Dept.

The duties of any inspection department depends greatly on the nature of the product and the management of the plant. In some cases the work is so arranged that the departments are subdivided to handle only certain parts of the finished product. Where this condition exists, the inspectors are, or should be, specialists on the particular portion they inspect.

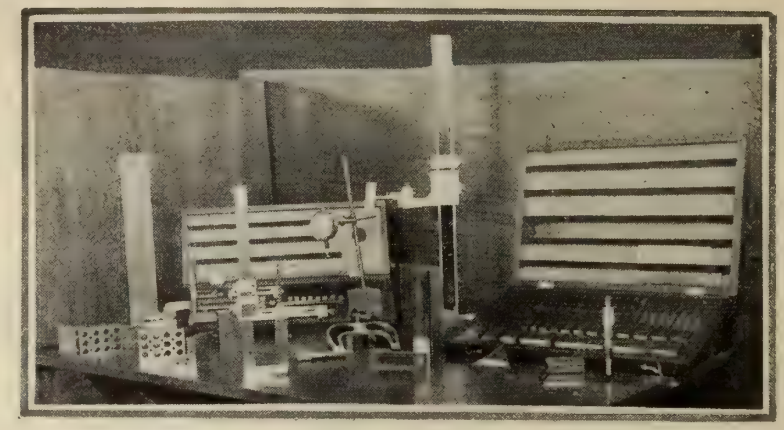


FIG. 1.--ILLUSTRATING SOME OF THE GAUGES, TOOLS, ETC., AS USED IN THE INSPECTION DEPARTMENT.

It is the tool-room inspection department, however, that we particularly wish to discuss in this article, so for illustrative purposes, we will quote the method adopted by the Machine & Stamping Co., Ltd., of Toronto, in this regard:

All jigs and fixtures made in this plant must go through the inspection department before being passed on as fit for use. Every dimension is carefully checked by skilled mechanics, who are supplied with the very finest tools and gauges obtainable. Time is no object. Each man is placed in a position of trust. His duties are to see that the work passing through his hands is perfect, otherwise the error must be remedied at once. The inspectors feel the responsibility incurred by their position and tackle their work earnestly and painstakingly which is as it should be. The result, of course, is a foregone conclusion. The men in the tool-room realizing the close scrutiny which their work passes through are doubly careful, having no desire to be found in error, and classed as poor mechanics. Thus everything works in close harmony to a satisfactory conclusion.

To illustrate some of the tools used in the department spoken of, we show, at Fig. 1, a layout of various gauges, etc.

It is hardly necessary to comment on these tools individually, for many of them are used quite often by our readers in their daily task. We might, however, call attention to the height gauge, fitted with an indicator head which reads to a tenth of a thousandth. To the right of the picture is shown a set of Johannsen gauge blocks which, no doubt, are a familiar sight to the man working in the tool-room. It was impossible to include even a small portion of the tools used, but felt that at least we should show one group.

Some Examples in Jig Work

The same condition held sway in the photographing of the style of jigs passing through the department. We could not attempt (even in a dozen photos) to illustrate all the various types used, but the group at Fig. 2 will at least show a few of the fixtures that have been passed upon as correct.

At the extreme left of photo is shown a jig for a piece known as a brake lever. The fixture is made to accommodate the lever in such a way that the portion of lever marked A can be turned to its proper diameter. The work is held in the jig by centralizing jaws, together with an equalizing clamp on top which can be plainly noticed at B on the swinging top. The portion is bored and threaded to suit the spindle of the lathe on which it goes.

The central fixture is one used to gauge the gear shift housing shown at extreme right. There are 18 holes in this piece, and each hole must match up exactly to the fixture. The need of very accurate work is readily realized when each piece must pass through such a procedure before being marked O.K. We may, at some later date, take up in detail other interesting jigs and their uses, as adopted at this plant.



FIG. 2.—A FEW FIXTURES WHICH HAVE PASSED INSPECTION.

Announcement !!

MORROWS AT INGERSOLL

The pioneers at Twist Drill making in Canada, who always made—not cheap drills—but *good drills,* have now perfected something better, *High Speed Twist Drills of really wonderful performance.*



A demonstrator—an expert on Drill Tempering—will go into your plant if desired to show you, without cost to you, what these *Morrow High Speed Twist Drills will do.* If you are trying for maximum production on difficult work, write us at once.

If these Morrow High Speed Drills will do for you what they are doing in some of the large auto manufacturing plants *then* you want them.

Morrow High Speed Drills will positively give you *more holes* with less re-grinding than you can get with other makes.

JOHN MORROW SCREW & NUT CO., LIMITED

INGERSOLL -- -- CANADA

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Dominion Trade Figures. — The total trade of Canada for 1919 was approximately $2,350,000,000. The figures are very close to those of the year previous. For the first eight months of 1919 total trade was less than 1918 by only about $16,000,000.

Canadian is Vice-President.—The International Steel Workers' Union have made the first Canadian vice-president of the organization. He is Ernest Curtis, of Sydney, C. B. Mr. Curtis is at present on a tour of the country, which will include visits to all Canadian branches of the Steel Workers' Union.

New Foundry For Guelph.—Guelph is to secure a large industrial concern, a branch of a Cleveland house. The firm is Henry Miller Foundry Company, Ltd., of Cleveland, and they will occupy the building lately occupied by the Sherer-Gillett Company on the Victoria Road. They will add to the building considerably. The firm manufacture heating apparatus.

Welland Canal Contract.—The Government will shortly take up consideration of the Welland Canal contracts, which were suspended during the war. They were continued later on a cost plus basis, but this arrangement terminated at the end of 1919. The Cabinet will consider the most advantageous way of continuing the work, by contract or cost plus basis. There are four sections on which nothing has been done.

Canada Steel Does Well.—The Steel Company of Canada is enjoying a period of unequalled prosperity, and the earnings for this year will, it is expected, be the best of any in Canada's steel history. Orders are on the books sufficient to keep the mills operating at capacity for the next eight months, and the export orders due to the situation in the States are large and profitable.

Employment Managers Meet. — The Employment Managers' Association held a meeting recently in Toronto at the office of the secretary, 190 University Avenue. It was decided that in the near future an open meeting would be held, at which Mr. Philip J. Reilly, president of the Employment Managers' Association of the United States, and Employment Manager Dennison, Framingham, Mass., would address the newly-formed Toronto association.

Alloy Steel Plant Goes Ahead.—The company that has absorbed the Lake Huron Steel Corporation, known as the Alloy Steel Company, is going ahead with its plans. It was announced recently that the officials would be drawn from the leading steel plants of Canada and the United States. A new charter will shortly be issued, and the names of the corporation and its officials will be made public in an official statement issued to the press of both countries.

Grand Trunk to Build Cars. — The Grand Trunk will shortly start work on additions to their car shops in London, which will accommodate an increase of the present staff of 100 per cent. From 800 the personnel will be raised to 1,500. This is according to a statement by Mr. Fouse, the master car builder, who made the announcement that the company had appropriated $1,000,000 for shop extensions in Canada, and London would benefit considerably.

CHANGES MADE IN THE DODGE WORKS

Announcement is made that the Dodge Co., of Mishawaka, Ind., have taken over the business of the Dodge Mfg. Co. Canada. About the year 1886, the Canadian patents for the Dodge Wood Split Pulley were sold to Samuel May & Co. The first month's business was in April, 1886, and, according to records of the works, it amounted to $2.66. The growth of the business since that time has been remarkable. Since the death of Samuel May, some two or three years ago, the ownership of the Canadian business has been largely held by Chas. F. Wheaton, who has been associated with Mr. May and his succeeding company, the Dodge Mfg. Co., Ltd., since its inception. It is a matter of regret that Mr. Wheaton's health has not been of the best, and no doubt this has had something to do with the organization of the Dodge Mfg. Co. of Canada, which absorbs the Dodge Mfg. Co., Ltd., and all its interests.

The present officers of the new organization, Dodge Manufacturing Company of Canada, Limited, are: M. W. Mix, president and treasurer; D. J. Campbell and C. F. Wheaton, vice-presidents; Charles F. Morse, the company's counsel; secretary, Charles Endlich, and W. C. Caulton, assistant secretary, treasurer; E. H. Ahara, manager of production. Mr. Shand, who has been superintendent at the Toronto works for a number of years, will have charge of local operations in Canada.

English Capital Buys Steel.—The Dominion Steel Corporation, at its annual meeting, received the resignation of Commodore J. K. L. Ross, and confirmed the appointments to the London Advisory Committee of the following: Viscount Furness, Sir Wm. Beardmore, General the Hon. Sir Newton Moore, Henry Steel, Benjamin Talbot and Col. W. Grant Morden. These men are all associated with the English interests who recently bought 50,000 shares of the corporation's common stock.

Ballantyne Discusses Plans. — Speaking at the annual dinner of the Dominion Marine Association, Hon. Mr. Ballantyne said that the Government had under consideration the building of 15,000-ton passenger liners, in connection with the Canadian National Railways. Speaking of the operation of the Canadian Merchant Marine, he said that the working of the ships had resulted in a handsome profit. He thought that Canadian builders could handle any building of war ships the country might need.

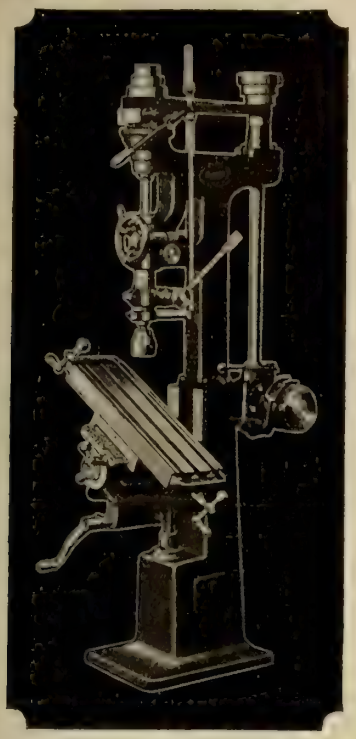
The Guelph Chamber of Commerce has organized an industrial committee to work in conjunction with the Board of Directors in an effort to secure new industries for the town. The members of the committee are: W. H. Burgess, chairman; J. B. Abler, vice-chairman, and G. M. Yates, secretary. The committee are at present investigating four applications from industries which wish to come into the city, and they are also contemplating the formation of an industrial company, which would erect factories for new concerns if they desired it.

New C. N. R. Sleeper.—The first of a series of eighteen new sleeping cars which are being built in Canada was inspected recently by D. B. Hanna, president of the company, accompanied by A. J. Mitchell, vice-president; M.H. McLeod, vice-president in charge of operation; Mr. Walter Pratt and Mr. George Smart. Mr. Hanna expressed himself as very well satisfied with the car. The car weighs 164,000 lbs. and special attention has been paid to the insulating against cold and heat, and prevention of telescoping in case of collision.

Pulp Mill for Sherbrooke.—Mr. B. C. Howard appeared before the Sherbrooke Town Council requesting exemption from taxation and a special rate for surplus power which he would purchase from the city's unused supply. The company will be capitalized at $1,500,000 and will be called the Howard Pulp & Paper Company. The mill will require about 3,000 to

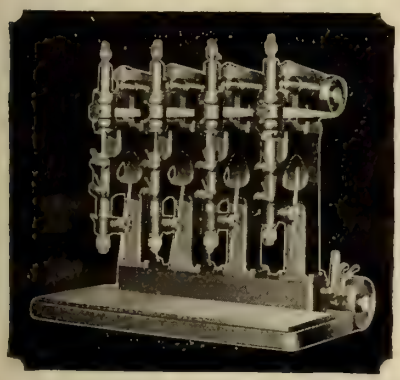
Demco Dependable Drills

DEMCO Drills represent the highest attainment in this type of equipment. They incorporate many improved features and refinements and are built to the highest standards. The perfect balance of all moving parts and the ball bearing equipment give ease of operation and long life without vibration. The combination of two or three features as found in some Demco machines effects a great saving of time and speeds up production appreciably. Read the following descriptions and then write for the new Demco Catalog.



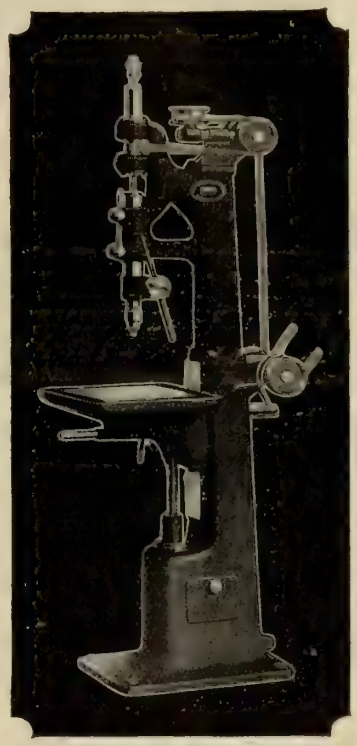
No. 40

A compact combination-milling, drilling and tapping machine which is a great time and labor-saver. Especially adapted for the quick and accurate production of jigs, dies, tools, etc. Change for different operations is made almost instantly without shifting belt. Wick oiling system on main spindle is an exclusive feature of this machine.



No. 34

Four-spindle bench type drill with all moving parts carefully balanced and equipped with annular ball bearings. Made with 1, 2, 3 or 4 spindles Incorporates a number of Demco improvements and is capable of a large volume of high quality work.

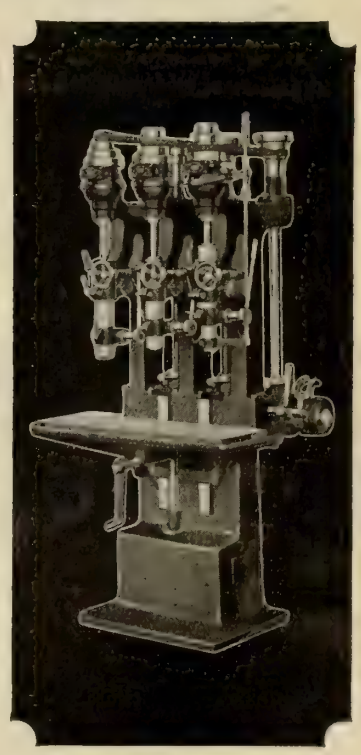


No. 38

A drilling and tapping machine which combines facilities for drilling at high speed and tapping at low speed. Change is almost instantly made, without shifting belt. Made in 1, 2, 3 or 4 spindles. Wick oiling is also a feature of this machine.

NO. 36

Heavy model floor type ball bearing drill having every facility for high speed and accurate production. A rigid, compact and wholly practical machine that is used to great advantage in the busiest factories. Made in 1, 2, 3 or 4 spindles.



Garlock-Walker Machinery Co., Limited

Toronto - Ontario

Agents for

The Demco Machine Tool Co.
Cleveland, Ohio.

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"HAWK" BRAND STEEL



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"HAWK VANADIUM"
TOOL STEEL

Remarkable in its glass Hardness, Toughness and Cutting Efficiency.

Will give twice the cut of a regular tool steel at one grinding.

Order "Hawk Vanadium" for your End Mills and cutters. Once known—always used.

Large Stock. Prompt Shipment.

Write for full particulars to

Hawkridge Brothers Company

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303 Congress Street, Boston, Mass
Storehouses Malden Mass.

STEEL
OF EVERY DESCRIPTION
SEND US YOUR ENQUIRIES.

3,500 horse-power, and will employ about 100 men at the start. The mill be built on the banks of the St. Francis River, with easy access for the tracks of the four railroads running through Sherbrooke.

TENDERS

The Department of Public Works is calling for tenders, to be received up to Feb. 5, 1920, for a postoffice building in Calgary, Alta. Specifications can be obtained from the Chief Architect, Ottawa; Resident Architect, c/o. Receiver General's Building, Calgary, and Builders' Exchange, Winnipeg, Toronto and Montreal, and Postoffices, Brandon and Winnipeg.

Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO (MADE IN CANADA) **SANITARY DRINKING FOUNTAIN**



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself.

"Puro" saves 35% on water bills, too. You can attach it in a few minutes.

Tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:
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18 St. Alexis St. Montreal, P.Q.

CATALOGUES

We have received an advance copy of a very interesting catalogue issued by A. A. Jones & Shipman, Ltd., Leicester, England.

Universal grinders; plain grinders; internal grinders; cam operated, automatic internal grinders; automatic radial grinders, and all necessary accessories and equipment for grinders are shown.

Sizes range from the heavy type to the usual lighter styles. The catalogue is well-laid-out and full of interesting information to those engaged in the machine tool line.

STEEL PRODUCTS BUILD AT BRANTFORD

Extension To Foundry That Will Be Completed And In Operation Shortly

At Dominion Steel Products, Ltd., Brantford, construction work has been started on a new foundry building, 100 ft. x 160 ft. This foundry will be equipped with two cupolas, also with a 16-ton capacity air furnace. The air furnace is being installed for the casting of heavy steel mill rolls, also the rolls for rubber-working machinery. The company expect to have this foundry in operation in approximately eight weeks. Its capacity will be about 15,000 tons of castings per annum. Steel Products have purchased and will shortly install an electric furnace, for the smelting of all types of non-ferrous alloys, with a capacity of about 300 tons of castings per annum.

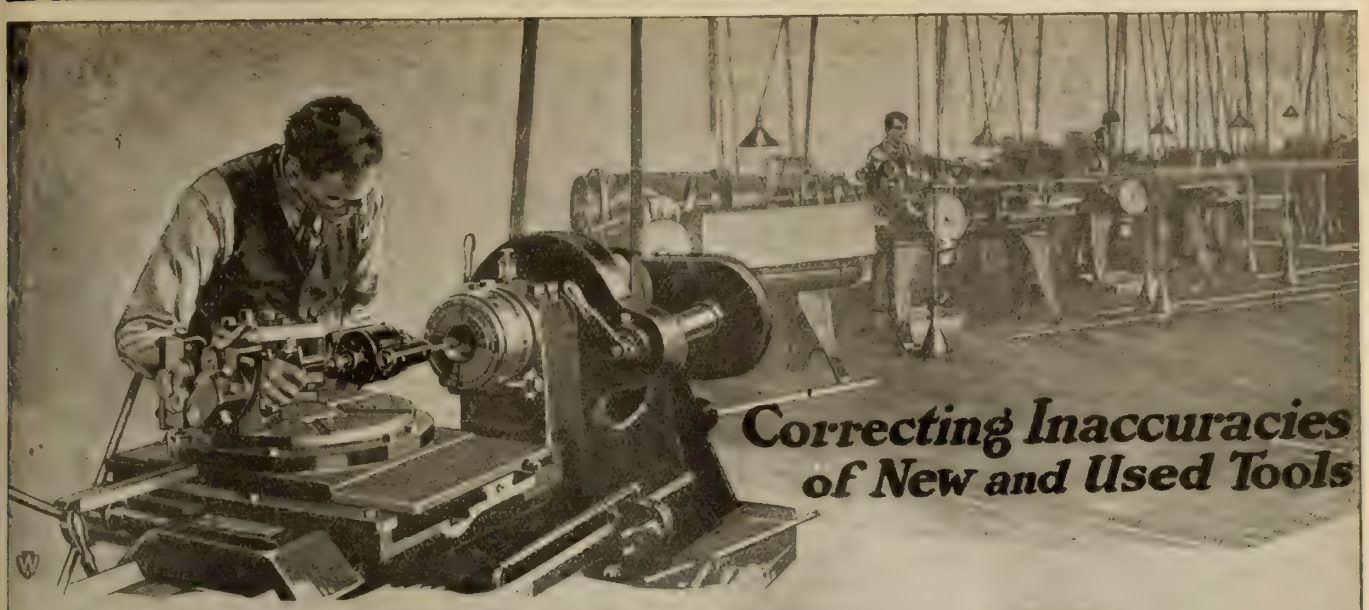
The Davis-Bournonville Company, of Jersey City, N.J., have issued a bulletin on lead burner outfits. They illustrate an outfit with a lead burner torch, having bench control, city gas connection, and an oxygen cylinder with pressure regulator. Another arrangement is with torch bench control, the torch being connected with a Davis acetylene generator and oxygen cylinder with pressure regulator. A third outfit has the torch connected to hydrogen and oxygen cylinders, each cylinder being fitted with its own pressure regulator and pressure gauge. Some interesting facts and hints are given in the accompanying text relative to the art of lead burning. The bulletin should be of interest to those doing this class of work.

MARINE

NEW YORK.—The Newark Bay Shipyard has been acquired by the Submarine Boat Corporation from the United States Emergency Fleet Corporation. The Newark Bay Company have been operating the yard under a lease. The yard cost to construct $15,000,000.

HALIFAX.—The captain of the tern schooner G. H. Murray telegraphs from Cuba that the schooner has been wrecked on the Coloradoes Reef and is a total loss. The schooner was built at Comeauville, N. S., last year, and was bound from Havana to San Domingo with a cargo of sugar. The crew are believed to be safe.

QUEBEC.—The Davie Shipbuilding Company, at Lauzon, has resumed operations with about 1,000 men. Before closing down, the works employed about 1,500 and will again employ that number when in full operation. There has been no change of management in the plant, the rumor that the Canada Steamships Co. had taken it over not being substantiated. It was stated by officials of the Davies Company that the Canada Steamship Lines had merely endorsed some financial papers.



Correcting Inaccuracies of New and Used Tools

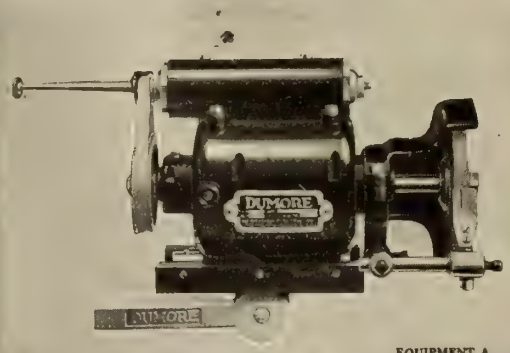
GRINDING chuck pads true with the spindle of the screw machine is a positive, easy method of obtaining accuracy when you have a **DUMORE**. War-time production has told heavily upon machines and tools—your own shop verifies this—and the change back to a peace basis demands a start with efficient equipment.

Your products are always as good as your tools—never better. And the accuracy of your jigs, dies and gages depends upon your facilities for grinding them. Close limits can be obtained only from a grinder having both speed and balance. That's why the **DUMORE** carries a dynamically balanced armature and operates at speeds ranging from 10,000 to 50,000 R. P. M. Chatter-marks, taper and bell-mouth are positively eliminated.

Now is the right time to put your tools in shape. Let your dealer demonstrate right in your own shop what a **DUMORE** grinder will will do for you.

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EQUIPMENT A
or general tool room use. ncludes High Speed Internal Spindle A with reach 3 inches. 30,000 R.P.M. omes fully equipped. /eighs 17½ pounds.



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

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TEN DAYS' TRIAL.—If your dealer or jobber does not have them we will send you one. Try it ten days. If not satisfactory, return to us and we will refund your money. We also make the GREB RIM TOOL.
THE GREB CO., 318 State St., BOSTON

LUFKIN
SCALES
All standard patterns, also Combination Steel Scales and Reference Tables, carrying DECIMAL EQUIVALENTS OF FRACTIONS AND WIRE GAUGES, TAP AND DRILL SIZES OF ALL STANDARDS.
Handy and Durable
THE LUFKIN RULE CO. OF CANADA, LTD.
WINDSOR, ONT.

WANTS MACHINERY TO GO TO INDIA

Vestry House,
Laurence Pountney Hill,
London, E.C. 4,
20th December, 1919.

The MacLean Publishing Co., Ltd.,
Toronto, Canada.

Dear Sirs:

We have recently become associated with a timber concern in India in connection with which we shall be placing orders for a considerable amount of machinery. We enclose a note giving brief particulars of what is required in the first place.

We are writing to you to know if you would kindly place this enquiry before one or two good makers of this class of machinery. We have been through your export numbers of CANADIAN MACHINERY but find no mention of woodworking machinery makers.

If you can assist us in this matter we shall esteem it a great favor.

Yours faithfully,
J. A. MARTIN & CO.

Particulars of Saw Mill Plant

The trees to be felled will be of a minimum girth of four feet and timber to be subsequently sawn will include sleepers of the undernoted sizes:

9 ft. x 10 in. x 5 in.
6 ft. x 8 in. x 4½ in.
5 ft. x 7 in. x 4½ in.

It is also desired to make use of all the timber in the trees and provision must be made for sawing the timber into scantlings, plans, rounds, etc.

Saw mill for felling trees by direct action of steam.

Truncated saw mill with alternate right horizontal blade by direct action of steam.

Alternate vertical saw mill for straight sawing, with several straight blades, carriage supporting and carrying the timber.

Saw mill with endless blade with double carriage, the blade passing in the middle of carriage.

Circular bladed transporting saw mill.

A new type of strike has been started at Minto, N.B. The United Mine Workers, who are at present waging a fight with the Minto Coal Co., took over 100 families away from Minto to Cape Breton.

The strike was the result of the failure of arbitration in a wage dispute between the company and its men, who asked a 10 per cent. increase. In calling the strike, the Labor leaders announced that they did not propose to follow the old strike plan of keeping the men in idleness and paying them from union funds; instead, they found jobs for them elsewhere.

It was at first proposed to make a general exodus to Alberta; but later, some of the families were sent to Spring Hill, N.S., and the remainder to Cape Breton.

OBITUARY

Mr. Francis W. Cornish died in his 77th year at the home of his son, Prof. George Cornish of Toronto University. For forty years Mr. Cornish was a marine engineer on the Great Lakes, and during part of the time was chief engineer of the Government cruisers Petrel and Dolphin. At the time of the Northwest Rebellion, he was chief engineer of The Princess, one of the best known vessels on Lake Winnipeg.

PERSONAL

The Keystone Manufacturing Co., Buffalo, have appointed the Louis C. M. Reed Company, No, 258 Broadway, New York, as their export managers. The latter company has just been organized upon the return of Louis C. M. Reed, its president, from a two years' trip around the world in the interests of Keystone goods. Mr. Reed is well known in the world of export, having spent most of the past twelve years in circling the globe in the interest of American hardware and machinery lines.

The Swiss journal, "Die Elektroindustrie," gives particulars of a process for removing the temper from hardened steel. The piece to be softened is placed on a plate of iron at red heat and covered by a plate of cold iron. After the whole has cooled the piece of steel, whatever was its previous quality and degree of hardness, is detempered completely, and can easily be worked without its quality having undergone any change by, for example, decarburization. The method is specially applicable to the unhardening of tools, more particularly punches and dies. Tests have given excellent results, and the method has the advantage that shaped pieces of steel do not show any shrinkage after treatment.

A new method of treating the positive electrodes of primary batteries, with a view to introducing metallic oxides as depolarizers, has been invented in France. The electrode consists of a shallow plate of copper or iron presenting numerous conical points to the alkaline element in the cell. The edges of the plate are bent so that it becomes a form of shallow box into which the depolarizing oxide is introduced. This material is mixed in a powdered state with a suitable alkaline hydrate or alkaline earth, and introduced into the interior of the box formed by the positive and a zinc plate as negative. The whole is sealed with rubber, a small vent being inserted to allow for the escape of gases, and cased in metal stiffening bands.

SHAPER ATTACHMENT

The Stockbridge Machine Co., Worcester, Mass., have placed on the market an irregular curve attachment used in conjunction with their shaper. The illustration with this notice explains matters fully. This attachment is used to plane or shape curves, and ensures absolute duplication, on split dies, and other similar classes of work. Forming dies and blocks for a large variety of work are easily shaped and duplication possible any time when reqdired.

The larger class of work in which this attachment is found a necessity is, of course, die work, bending forms and formed tools, but many special jobs that are difficult of machining can be done with this attachment and cost reduced.

The illustrations indicate in a general way the possible range in curves and angles that can be reproduced. It will not only reproduce the curve of the templet once, but over and over again at one setting, or at any future time reproduce the identical shape of the original.

The templet carried in the cross-slide holder is made from about ½ in. x ¼ in. stock shaped to the required outline of surface to be duplicated. The cutting tool is directly beneath the follower and it is raised and lowered as the follower moves along on the surface on the templet and reproduces its curves and angles.

Attachment can be furnished with all sizes of Stockbridge shapers; it is interchangeable with the regular Stockbridge shaper head and can be furnished either on the shaper without regular head or as an addition to regular head.

Many of the formed tools used on automatics can be shaped to good advantage and at a large saving over the usual methods.

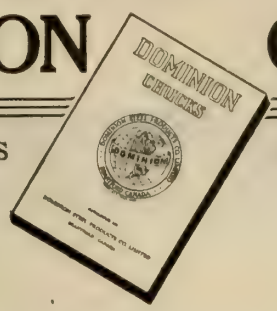
SUBSTITUTE DOOR KNOBS

The two knobs and the bar connecting them were lost from the back door of a room used as a storage room. Otherwise the lock was O.K. and was used as such. To also make it convenient to pass through I took a piece of ¼ inch (really 9-32) round iron rod and a piece from the end hammered about two inches of it flat so that when inserted in the lock and turned back and forth it would operate the bar; then I turned the ends downward at right angles, at the same time leaving plenty of room for one's fingers between the rod and the door. This served the purpose of the knobs and their square connecting bar. About 8 to 10 inches length of iron rod is required; depending some on how much one wants to have turning downward for a hand hold. The flattened portion is made near the centre of the piece.

J. E. M.

Send for this Book

DOMINION CHUCKS



DOMINION CHUCKS ARE GUARANTEED

Steel or Cast Iron Body — *Built for Heavy Duty*

You Want Dependable Chucks

INCREASED cost of production demands that every tool give satisfactory and continuous service and be free from the annoyance of frequent breakage. **Dominion Chucks** were perfected by us for our own use and to fill a specific need for a chuck that would stand up and give a satisfactory service under the strain of heavy and continuous work.

Chuck troubles in our own plant compelled us to design and manufacture for our own use the **Dominion Chuck.** It has proved satisfactory under the test of heavy duty service and the most exacting work. We are manufacturing this chuck either in all-steel or iron bodies—sizes 10 to 24 inches. *Write for our Chuck Book.*

DOMINION STEEL PRODUCTS CO.
LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

7

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Builders of Heavy Duty Machines for over 50 years
PLANERS, BORING AND TURNING MILLS, HORIZONTAL BORING & MILLING MACHINES, LATHES, SLOTTERS.
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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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PORTABLE PLANERS
DRAW CUT SHAPERS
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FINISHED MACHINE KEYS
STATIONARY & PORTABLE KEY WAY CUTTERS
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OFFICE AND WORKS, MUSKEGON HEIGHTS U.S.A.

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AGENTS WANTED THROUGHOUT DOMINion for Cowan Transveyors. Address R. B. Smiley, 120 Glenholme Ave., Toronto, Ont.

FIRST-CLASS MACHINIST WANTED

EXCEPTIONAL OPPORTUNITY FOR MAN OF ability and education to become demonstrating rate setter. Requirements are thorough knowledge of machine tools and skill in their operation, initiative, perseverance and tact. In reply, please state age, experience, salary expected and when available. Box 646, Canadian Machinery. (c4m)

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FOR SALE—ONE 16" BURKSTONE MILL: one Schutz O'Neil Disintegrator. The above machines are practically new and in good condition. Can be seen at our works. Dalton Spice Co., 11 Front St. East, Toronto, Ont. (c7m)

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	Stroke Inches	Width Bed	Approx. Cap. Tons
2—No. 666 Toledo Embossing Presses....	2	32	1,200
2—No. 27 Bliss Embossing Presses.....	2	32	1,000
2—No. 87 Bliss Crank Presses, double back geared	16	27	250
2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
9—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
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1—360 Brown & Boggs Press.

LATHES

7—11" Blount Speed Lathes, 5' bed.
4—No. 2 Warner & Swasey Speed Lathes.
2—20" Stoll Wood Turning Lathes.
35—Bullard Cartridge Case Lathes.

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1—12" x 72" No. 4 Cincinnati Universal Grinder.
1—No. 70 Heald Internal Grinder.
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1—No. 1 American Surface Grinder.
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1—Ford-Smith Double Head Grinder, 3" x 24" wheel.

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3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

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2— " " "	6" "	1.5 " "
1— " " "	6" Horizontal	1.5 " "
1—Boland Positive Blower	4" "	

3—Desk Fans.

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	Volt	Phase	R.P.M.	Cycle
1—Type Dumore	115 with buffiing spindle.			
1—Garage Pump and Motor	110	1	1400	25
1—10 H.P. Westinghouse	200	2	1245	60
1—20 H.P. Westinghouse	200	3	710	25
1—25 H.P. Westinghouse	200	3	710	25
5—50 H.P. Westinghouse	200	3	715	25
1—75 H.P. Westinghouse	200	3	720	25
1—1 K.W., 2 H.P., Can Gen. Generator Shunt Wound	125		1950	

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1—No. 3 Tinius Olsen Testing Machine, 10,000 lbs., capacity hand-operated.
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1—No. 2X Garvin Vertical Tapping Machine.
1—Whitton Centering Machine.
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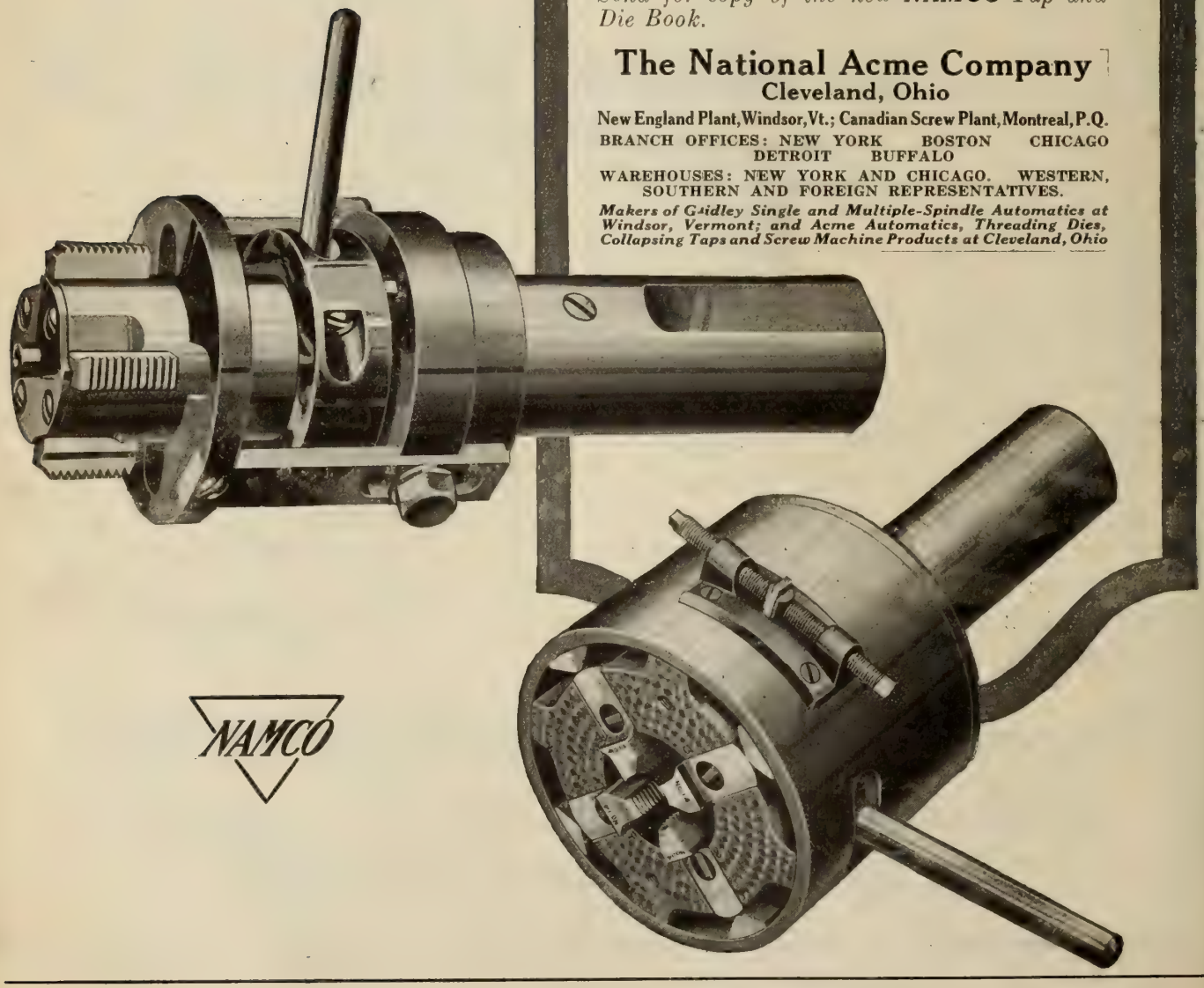
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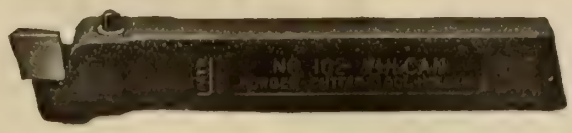
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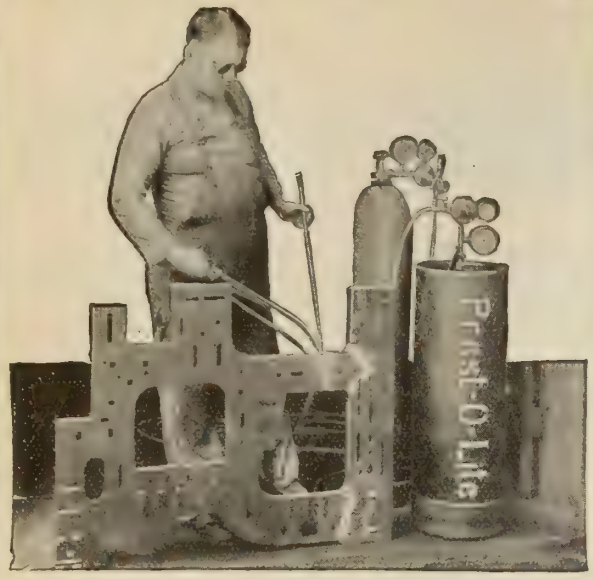
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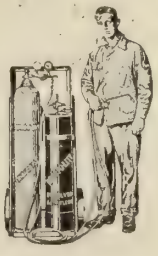
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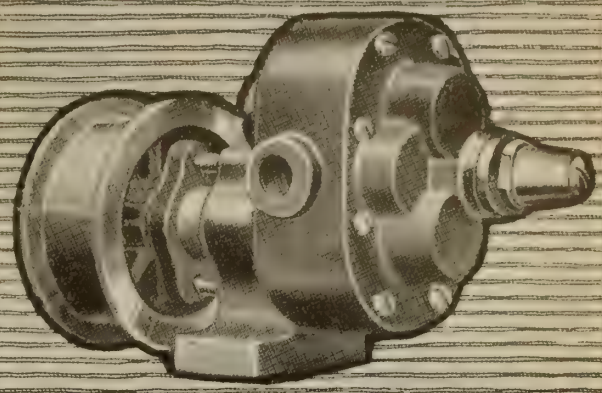
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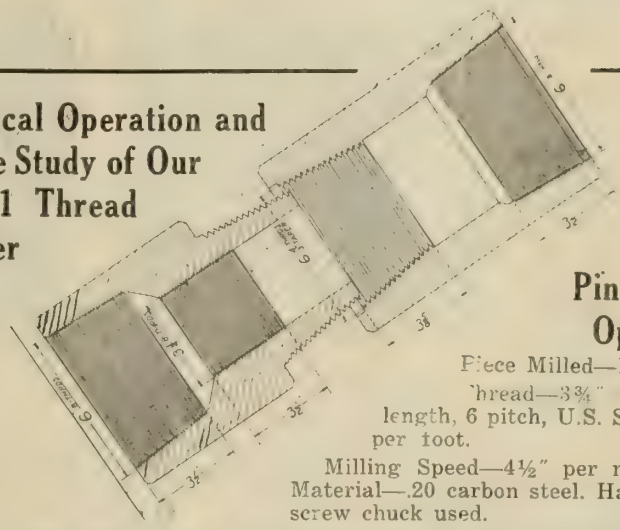
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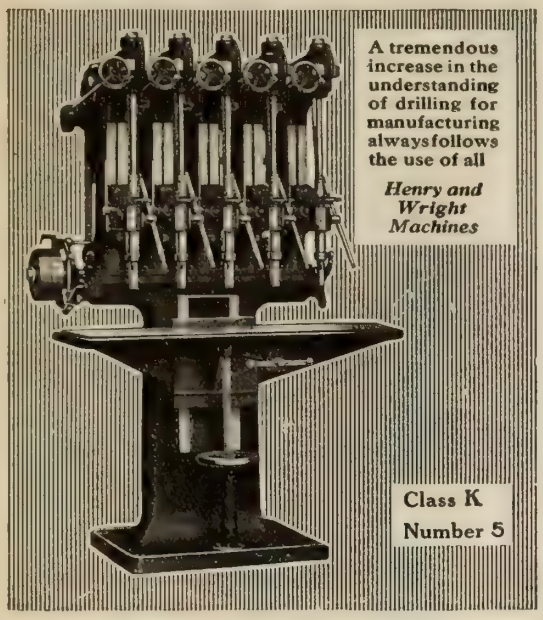
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H & G

Die Head Cuts

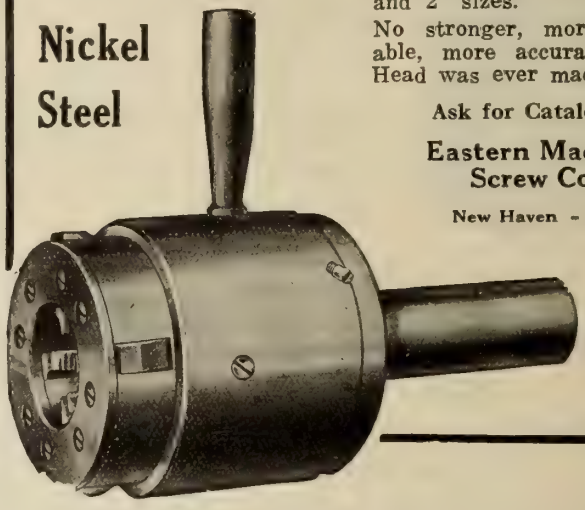
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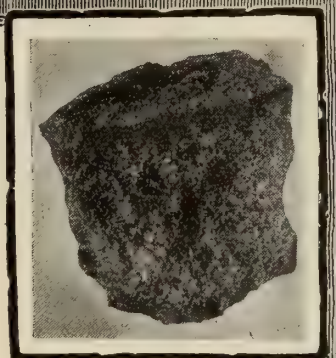


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Eastern Machine Screw Corp.

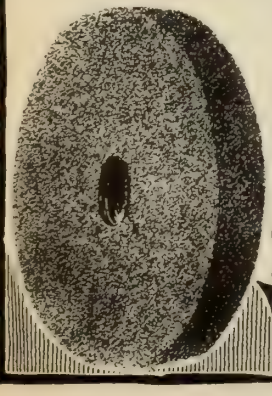
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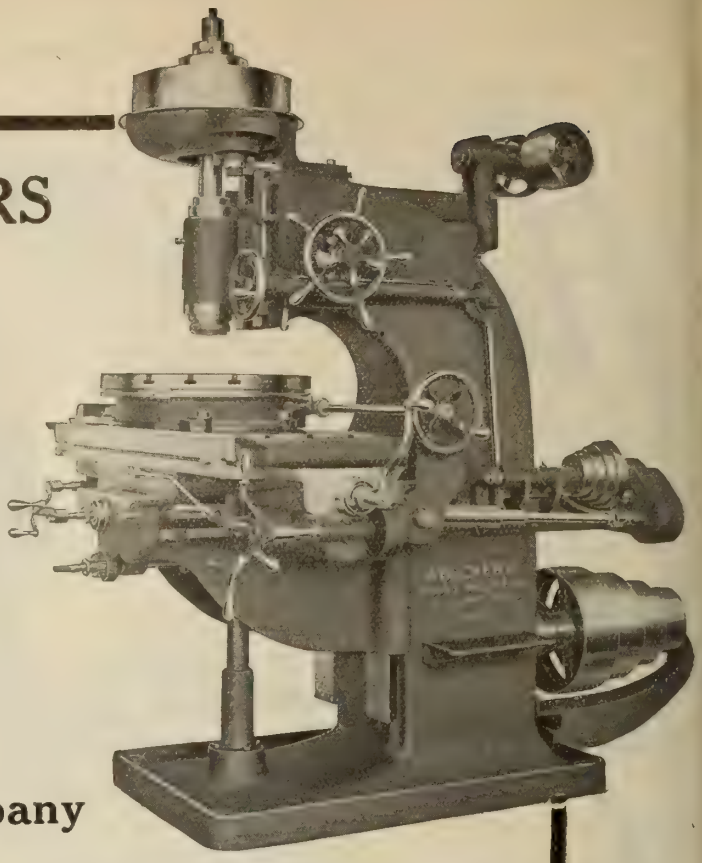
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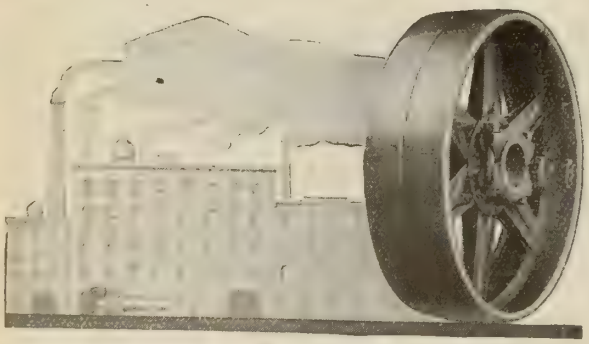
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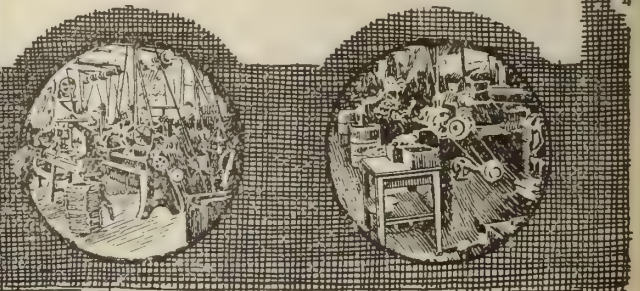
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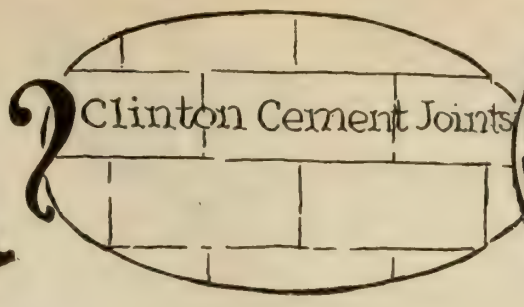
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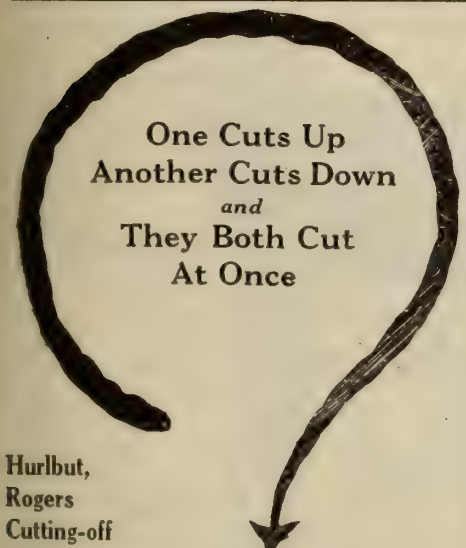
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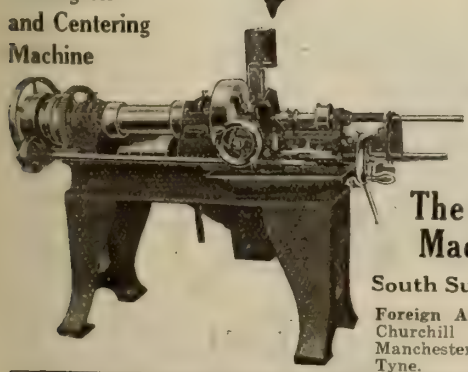
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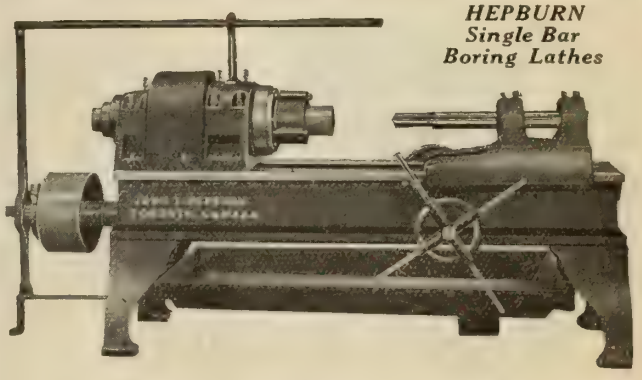
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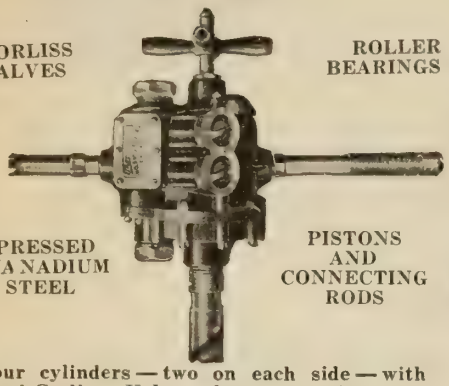
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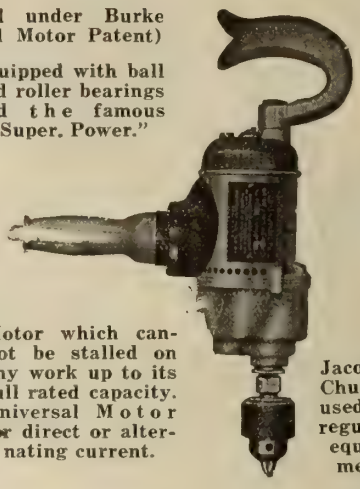


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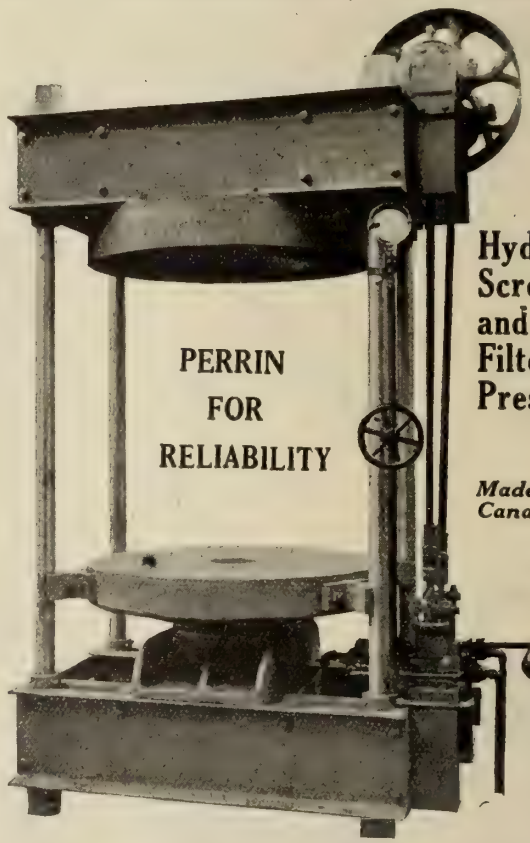
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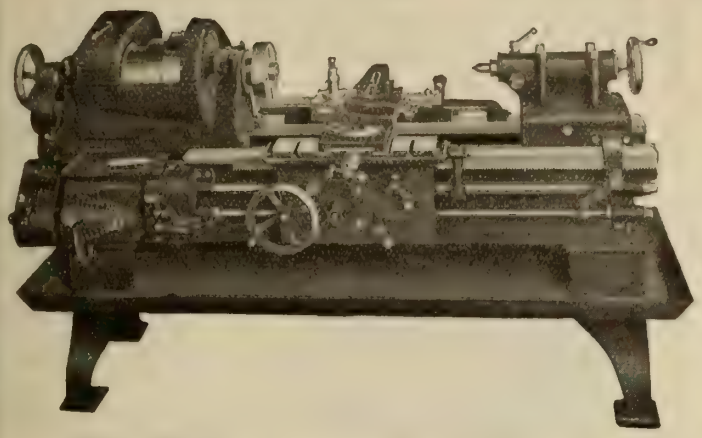
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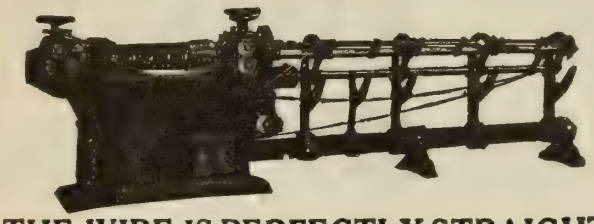
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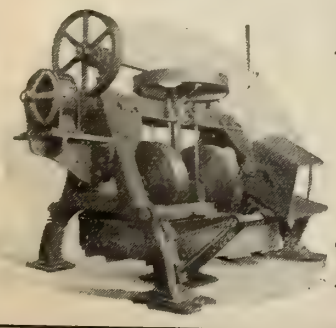
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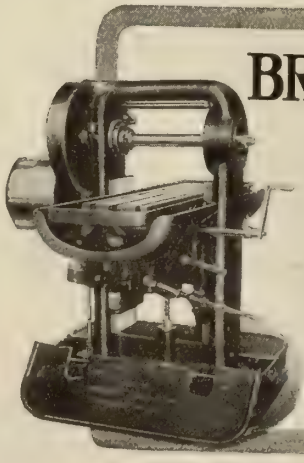
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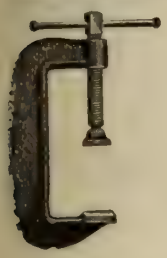
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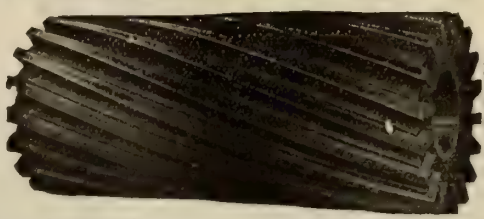
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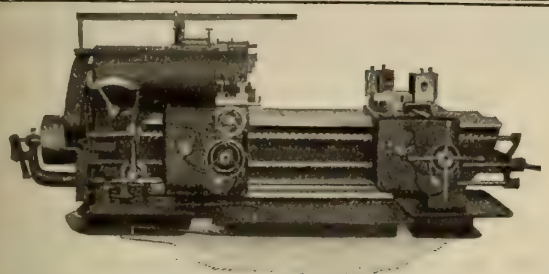


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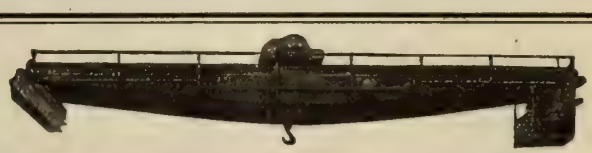
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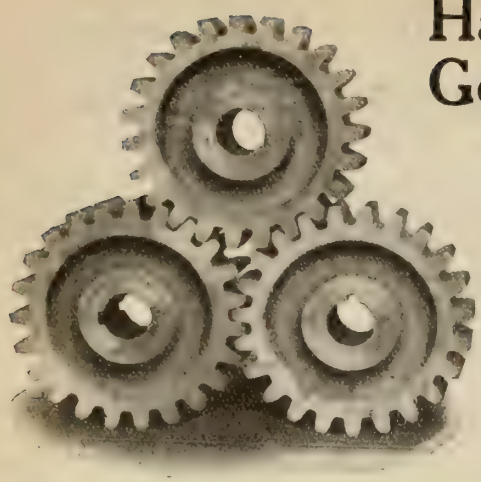

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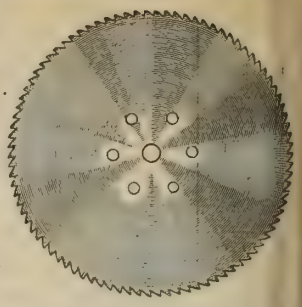
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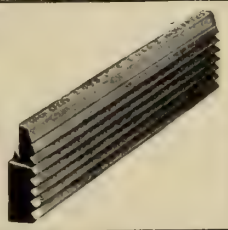
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J. C. McLAREN BELTING CO.
Limited
Montreal Toronto Winnipeg

Canadian Machinery BUYERS DIRECTORY

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Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

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Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Union Carbide Co., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACETYLENE GENERATORS
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACORN DIE AND HOLDERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

ACCUMULATORS, HYDRAULIC
Canadian Fairbanks-Morse Co., Montreal
Garlock-Walker Mach'y. Co., Toronto.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co., Ltd., A. R., Montreal

AIR COMPRESSORS
See Compressors.

AIR CONDITIONS, DEHUMIDIFYING—HUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

AIR CYLINDERS
Smalley-General Co., Bay City, Mich.

AIR RECEIVERS
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Williams & Wilson, Ltd., Montreal.
Welding & Supplies Co., Montreal, Que.

AIR WASHERS
Can. Blower & Forge Co., Kitchener.

ALUMINUM
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Tallman Brass & Metal Co., Hamilton.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

ALUMINUM SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.

ALLOY, STEEL
Armstrong, Whitworth of Can., Montreal.
Boker & Co., Inc., H., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Norton, Ralph B., Agent, Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Samuel Osborne (Canada) Ltd., Montreal.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ANCHORS
Fellows Bros., Ltd., Chadley Heath, Eng.

ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

AUTOMATIC METAL CUTTING-OFF MACHINES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Burniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BAND SAWS
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal, Que.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Baxter & Co., Ltd., J. R., Montreal.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal, Que.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd Montreal.
Main Belting Co. of Can., Ltd., Montreal.

BELTING, LEATHER
Can Graton & Knight Mfg Co., Montreal
Goodhue, J. L., Danville, P.Q.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams & Wilson, Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach Co. Toronto.
Giddings & Lewis Mfg. Co., Ford du Lac, Wis.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto
Rockford Drilling Mche. Co, Rockford, Ill
Williams & Wilson, Ltd., Montreal, Que

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKEBAND LINING CUTTERS
Peck, Stow & Wilcox Co., Southington, Conn.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER BARS, RODS BRAKES, CORNICES
Peck, Stow & Wilcox Co., Southington, Conn.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.
Peck, Stow & Wilcox Co., Southington, Conn.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Luftin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glasco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Jones & Glasco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca. New York.

CHAINS, AUTOMOBILE ENGINE
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS. SPROCKET WHEEL
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
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Bertram & Sons Co., John, Dundas.
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Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
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Jacobs Mfg. Co., Hartford, Conn.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.
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Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
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Niles-Bement-Pond Co., New York.
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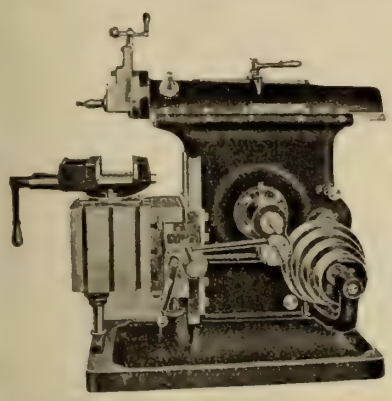
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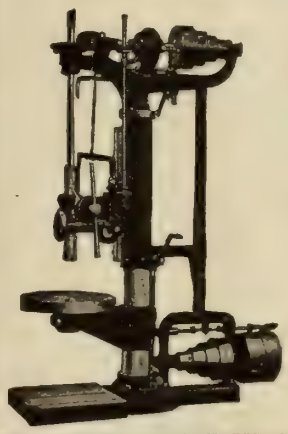


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Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
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Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd. A. R., Montreal

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Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
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Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

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Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
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Williams & Wilson, Ltd., Montreal.
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Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
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Taylor J. A. M., Stair Bldg., Toronto.
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Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
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Cleveland Pneumatic Tool Co., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal
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Greenfield Tap & Die Corp., Greenfield, Mass.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
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Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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Wilt Twist Drill Co. of Can., Walkerville.

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Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

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Williams Mchy Co, Ltd., A. R., Montreal

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Williams & Wilson, Ltd., Montreal.

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Canadian Fairbanks-Morse Co., Montreal.

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Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Strong, Kennard & Nutt Co., Cleveland.
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Sheldons, Ltd., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

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Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

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Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

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Can. Wire & Iron Goods, Hamilton, Ont

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Elk Fire Brick Co., Hamilton, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Illinois Tool Works, Chicago, Ill.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

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William Hamilton Co., Peterboro, Ont.

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.

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Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
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Williams & Co., J. H., Brooklyn, N.Y.

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Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
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Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Bellevue Industrial Furnace Co., Detroit
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Toronto Iron Works, Ltd., Toronto.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

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GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

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Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
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Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

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Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Can., Galt, Ont.

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C. E. Johanson, Inc., Toronto, Ont.

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Bristol Co., Waterbury, Conn.
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—for handling forging, castings and cut-off bar stock—

The P. & J. Automatics



Bulletin 41

The above words were spoken by the Foreman at the New Process Gear Corporation's Plant at Syracuse, N.Y. It is too bad space is limited as it is only possible to show a portion of their equipment and only a small variety of the class of work they are doing. Write to us and we will tell you some of the work these machines are doing. Better still, send your drawing or samples along and we will tell you how to produce.

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Roelofson Machine & Tool Co. Limited

Head Office: 1501 Royal Bank Building, Toronto, Canada
Warehouse: Galt, Ont., Canada

If interested tear out this page and place with letters to be answered.

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Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.

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Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
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Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co. Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co,, Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Illinois Tool Works, Chicago, Ill.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
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Northern Elec. Co., Ltd., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith, Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Wilkinson & Kompass, Hamilton, Ont.

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Universal Grinding Mach. Co., Fitchburg, Mass.

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Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

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Blanchard Mach. Co., Cambridge, Mass.

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Fitchburg Grinding Mach. Co., Fitchburg, Mass.

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Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

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Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
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Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Modern Tool Co., Erie, Pa.
Norton Co Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Norton Co., Worcester, Mass.

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Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

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Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

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Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
Strong, Kennard & Nutt Co., Cleveland.

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Marshall, Son & Bunney, Toronto.
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Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Victor Saw Works, Hamilton, Ont.
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Can. S K F Co., Toronto, Ont.
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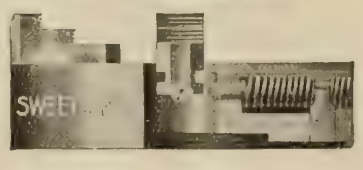
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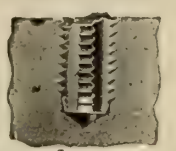




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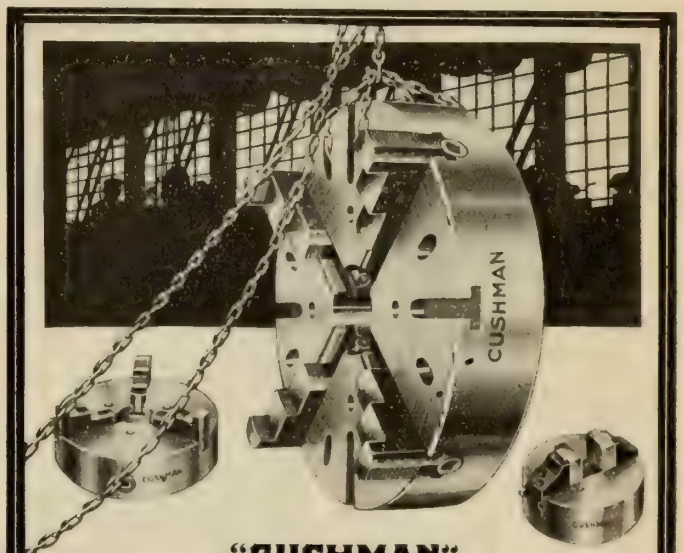
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Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.
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Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trabern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox Scurhington, Conn.

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven Conn.

MACHINISTS' TOOLS
Brown & Sharpe Mfg. Co., Providence, R.I

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa
Matthews & Co., Jas. H., Pittsburgh, Pa

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MASKS, WELDING, SMOKE, FUME GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.

MICROMETERS
Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
E. C. Atkins & Co., Inc., Indianapolis, Ind.

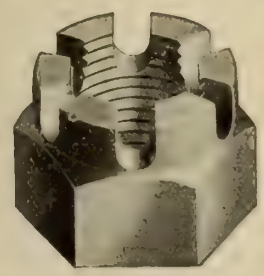
MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.

MILLING ATTACHMENTS
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLED FROM THE BAR-



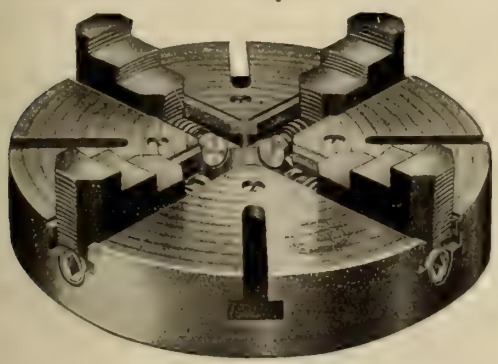
STANDARD
U.S.S. & S.A.E.
CAP SCREWS
U.S.S. SET SCREWS
S.A.E. NUTS

SPECIAL PARTS
TO YOUR SPECIFICATIONS

THE NATIONAL ACME CO.
De Courcelles and G.T.R. MONTREAL, P.Q.

ALL STEEL
INDEPENDENT CHUCKS

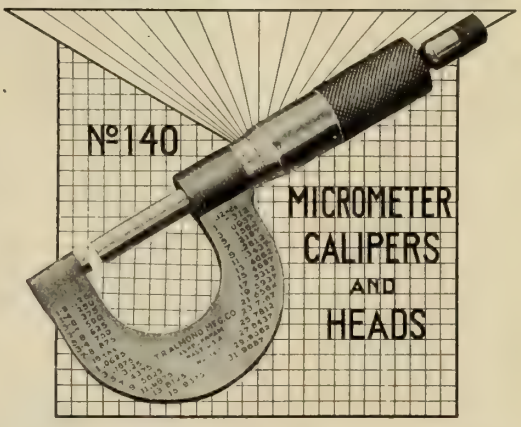
are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS
are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY
New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

ALMOND



All Almond Micrometers are inspected and adjusted to Johansson Gages and recognized comparison only with these gages.

Almond Service.—Should the Micrometer need readjusting at any time or defect in material or workmanship develop send to Ashburnham and readjustment or replacement will be made without expense.

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DRILL CHUCKS, RIGHT ANGLE TRANSMISSION LATHE CHUCKS, FLEXIBLE STEEL TUBING

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Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Runner, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Boker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co. Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Sudden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Bidout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
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PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson Ltd., Montreal.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PLANING AND SHAPING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Keriton, Ohio.
Perrin Ltd., William, Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PLANER-SHAPER COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

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MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.

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Peckovers, Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co. Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

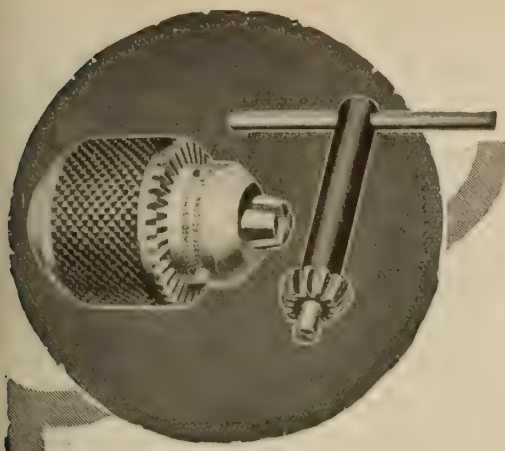
PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

The Mechanic Knows



The workman expects Jacobs as the drill chuck on his machine. He knows it does not break drills, that the toothed sleeve and key make adjusting easy and safe.

Are your machines Jacobs equipped?

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Toledo Machine & Tool Co, Toledo.
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Stoll Co., D. H., Buffalo, N.Y.
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Brown & Sharpe Mfg. Co., Providence.
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Kennedy & Sons, Ltd., W., Owen Sound.
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Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Bernard Industrial Co., A., Fortierville, Q.
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Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
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Williams Mchy Co, Ltd., A. R., Montreal
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Stoll Co., D. H., Buffalo, N.Y.
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Williams Mchy Co, Ltd., A. R., Montreal
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Niles-Bement-Pond Co., New York.
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Williams Mchy Co, Ltd., A. R., Montreal
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Shore Instrument & Mfg. Co., New York.
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Williams Mchy Co, Ltd., A. R., Montreal
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Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
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Illinois Tool Works, Chicago, Ill.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

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Illinois Tool Works, Chicago, Ill.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

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Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.

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Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
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Garvin Machine Co., New York.

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Garlock-Walker Machinery Co., Toronto.
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Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.
Williams Machinery Co., A. R., Montreal.
Williams & Wilson Ltd., Montreal.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
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ROTARY SHEARS
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ROOF COOLERS
Electric Steels & Metals, Ltd., Welland.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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RUBBER PRODUCTS, MECHANICAL
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Lufkin Rule Co. of Can., Windsor.

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Lufkin Rule Co. of Can., Windsor.

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Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

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Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)
SAWS, SILVER STEEL
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Hunter Saw & Machine Co., Pittsburgh
Wells Bros. of Can., Galt, Ont.

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E. C. Atkins & Co., Inc., Indianapolis
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Shore Instrument & Mfg. Co., New York.

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SCREW EXTRACTORS
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Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
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National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
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Williams Mchy Co. Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.
Wood Turret Mach. Co., Brazil, Ind.

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Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
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Galt Machine Screw Co., Ltd., Galt, Ont.
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Brown & Sharpe Mfg. Co., Providence, R.I.

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Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
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Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
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SCREW SLOTTERS
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Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

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Jacobs Mfg. Co., Hartford, Conn.

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John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton
Standard Equipment & Tool Wks., Montreal.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEET METAL ROLLING MACHINES
Peck, Stow & Wilcox Co., Southington.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

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The Quickwork Co., St. Mary's, Ohio.
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SHEARS, SQUARING
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Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Ralph B. Norton, Agent, Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Globe Engineering Co., Ltd., Hamilton.
Hogeson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia.

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hogeson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hogeson & Pettis Mfg. Co., New Haven, Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baker & Co., Inc., H., Montreal, Que.
Baines & David, Toronto.
Baron & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent Montreal.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Joilette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal.
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Baker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford.

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Norton, Ralph B., Agent, Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co,, Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt. Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Bicknell-Thomas Co., Greenfield, Mass.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Wells Bros. of Canada, Galt Ont
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BENDING
Peck, Stow & Wilcox Co., Southington.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.

TRUCKS, ELECTRIC
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Holyoke Truck Co., Holyoke, Mass.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal.
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio.
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield.
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., The, Cleveland, O.
Williams Mchy Co, Ltd., A. R., Montreal

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q.
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que.

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
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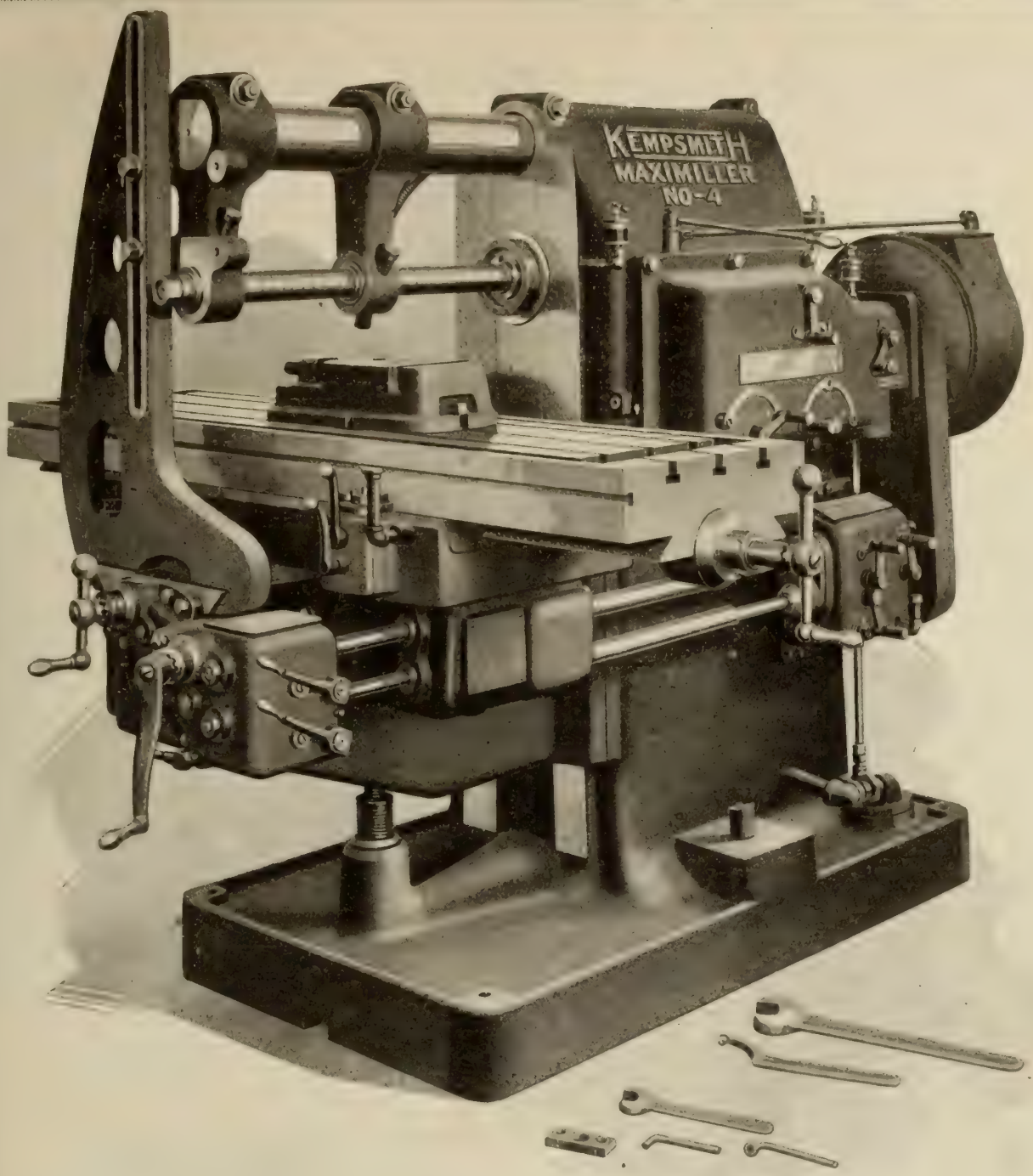
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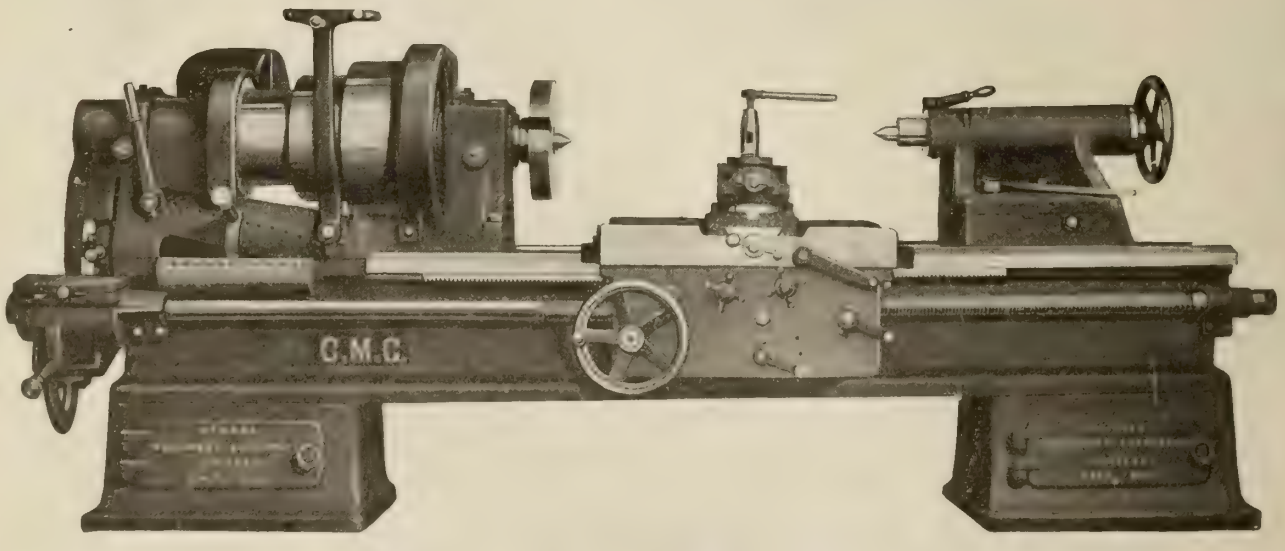
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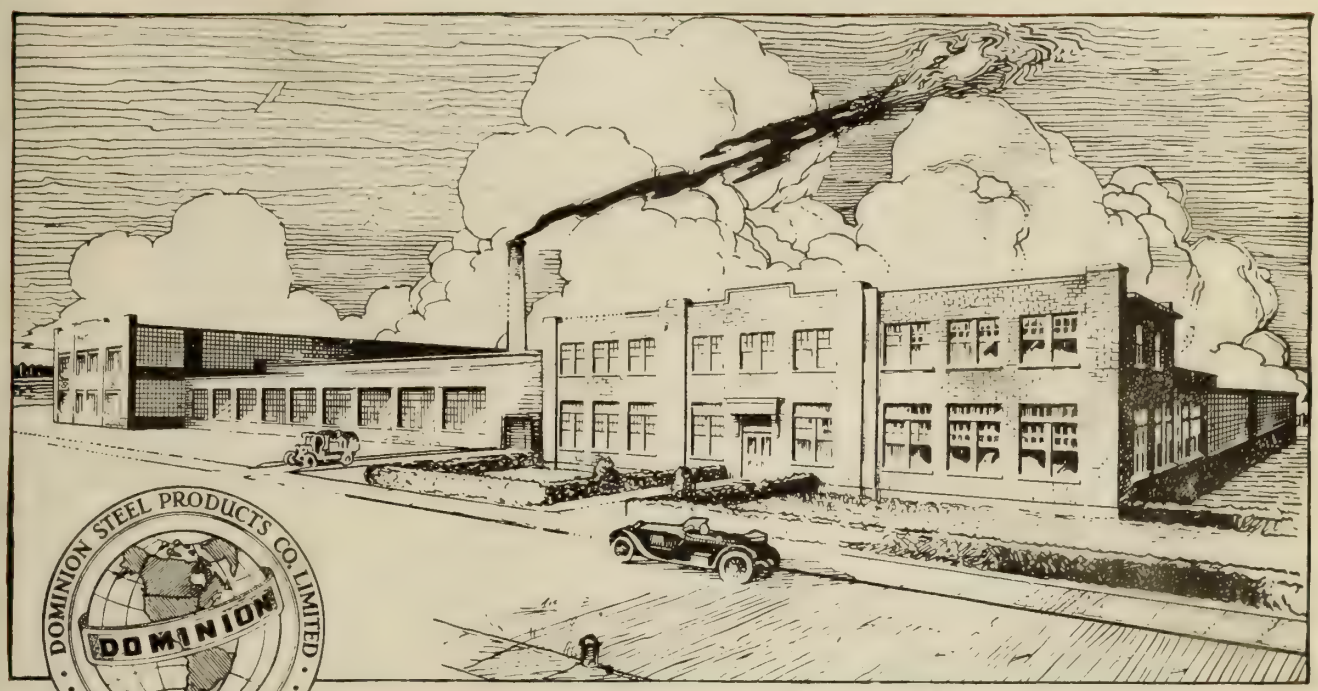


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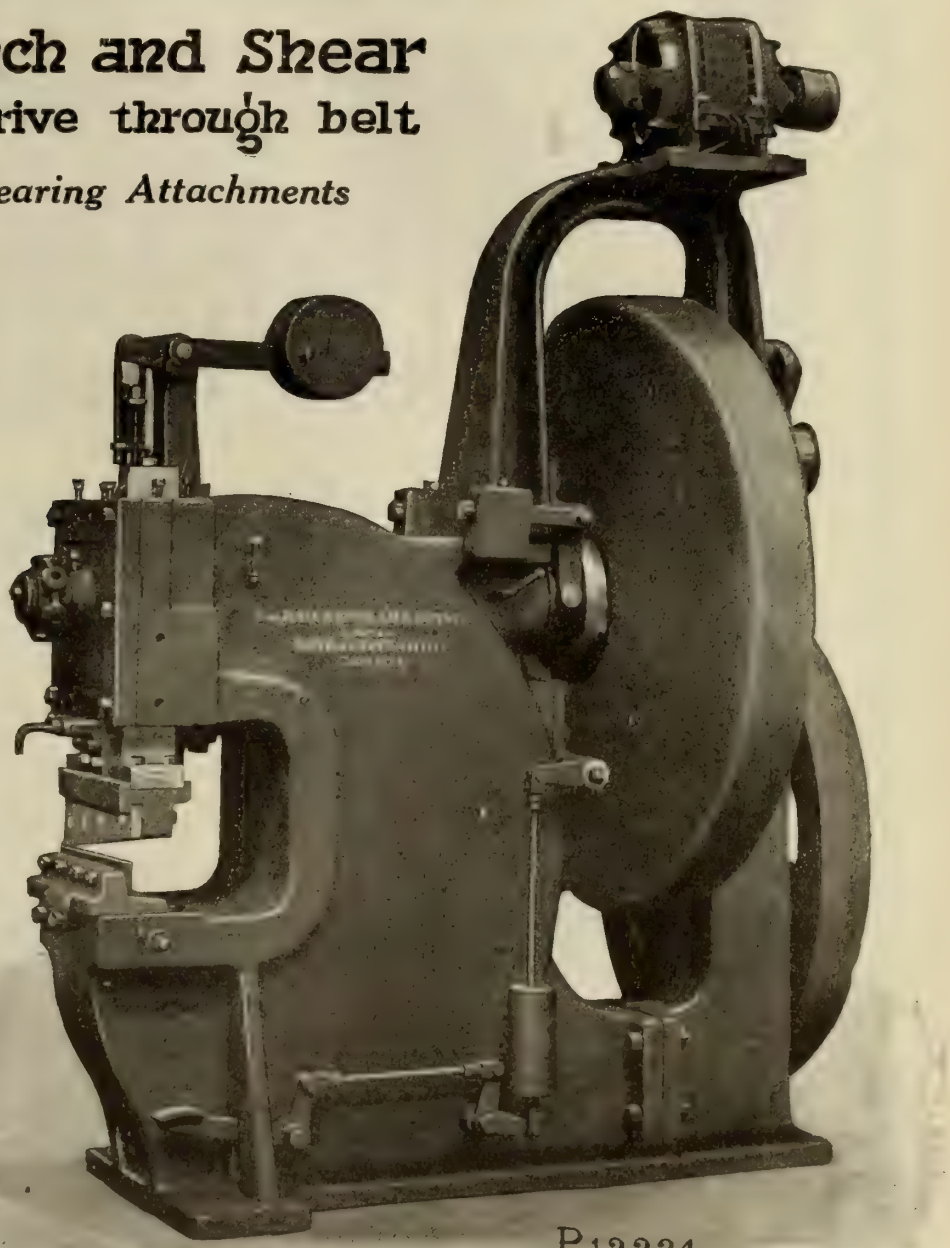
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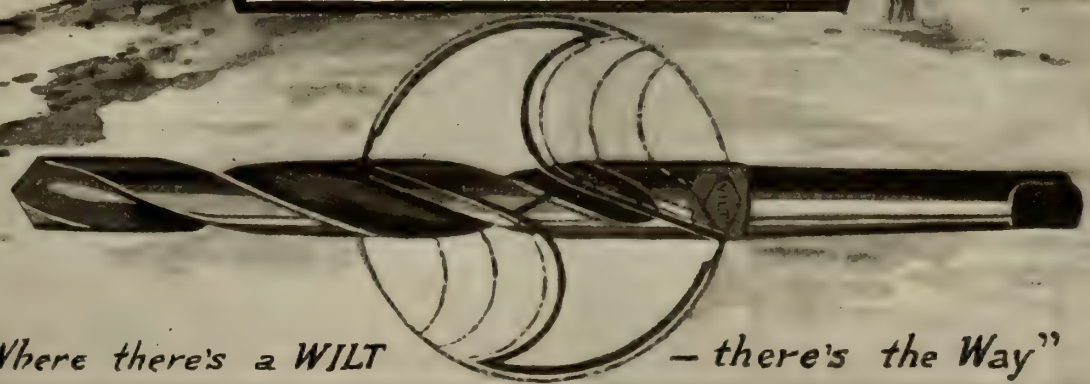
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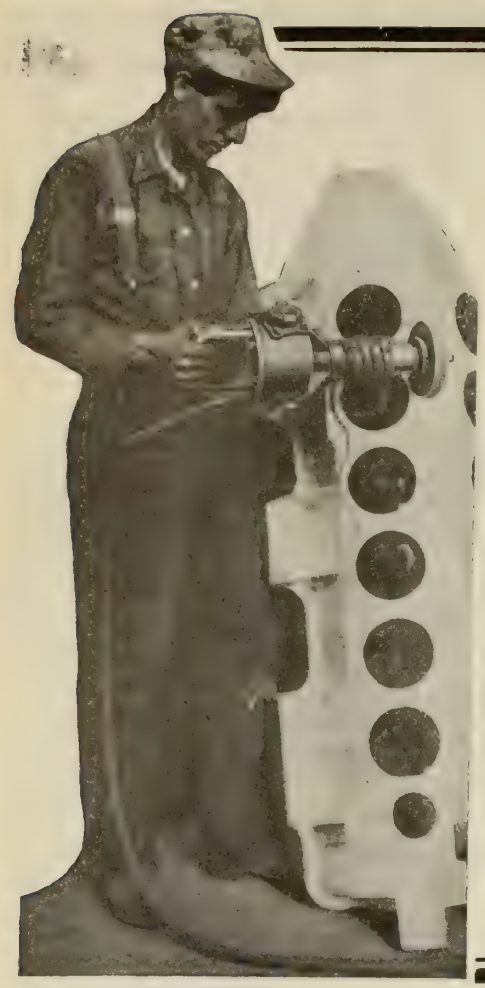
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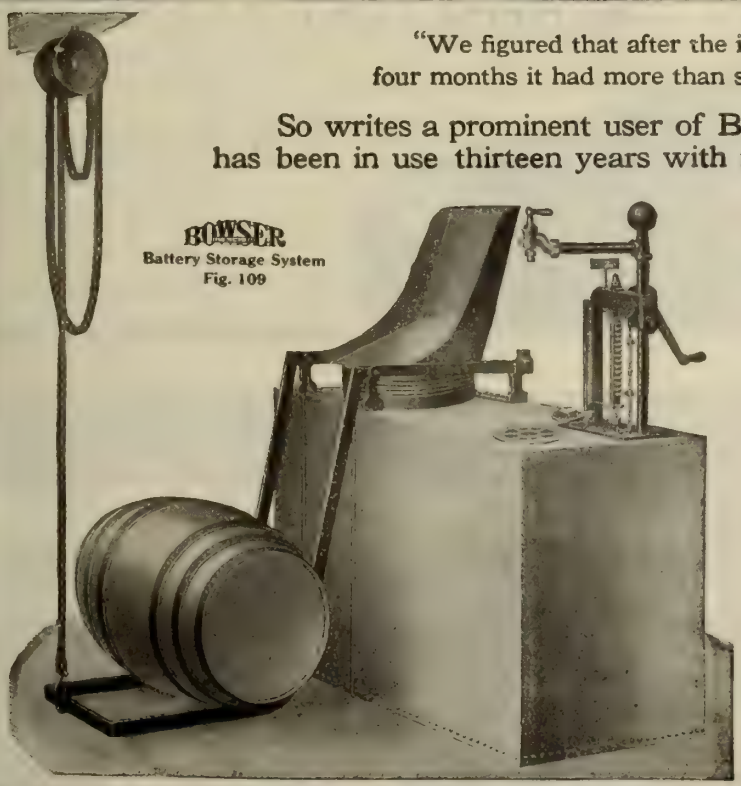


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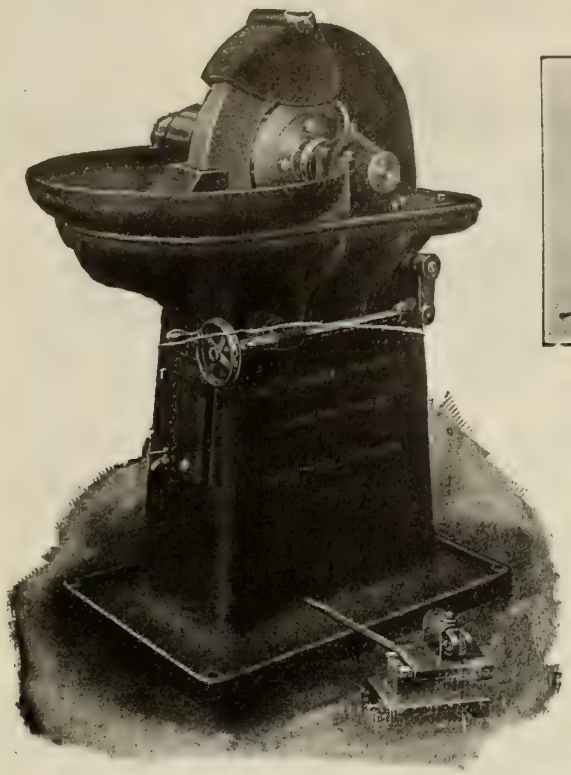
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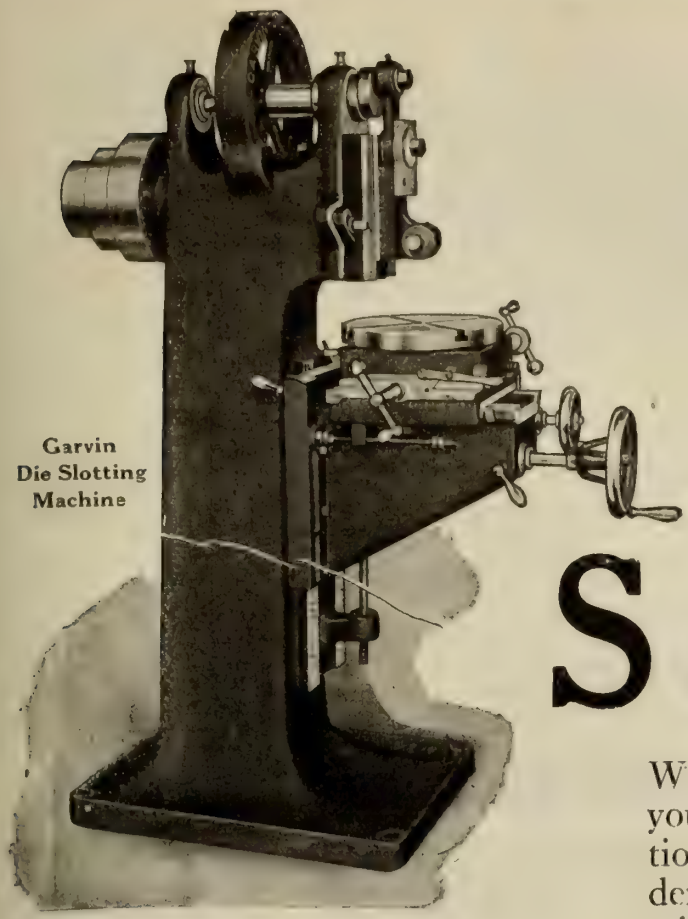
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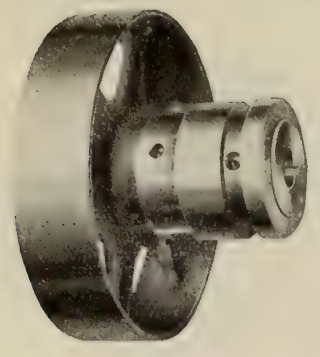
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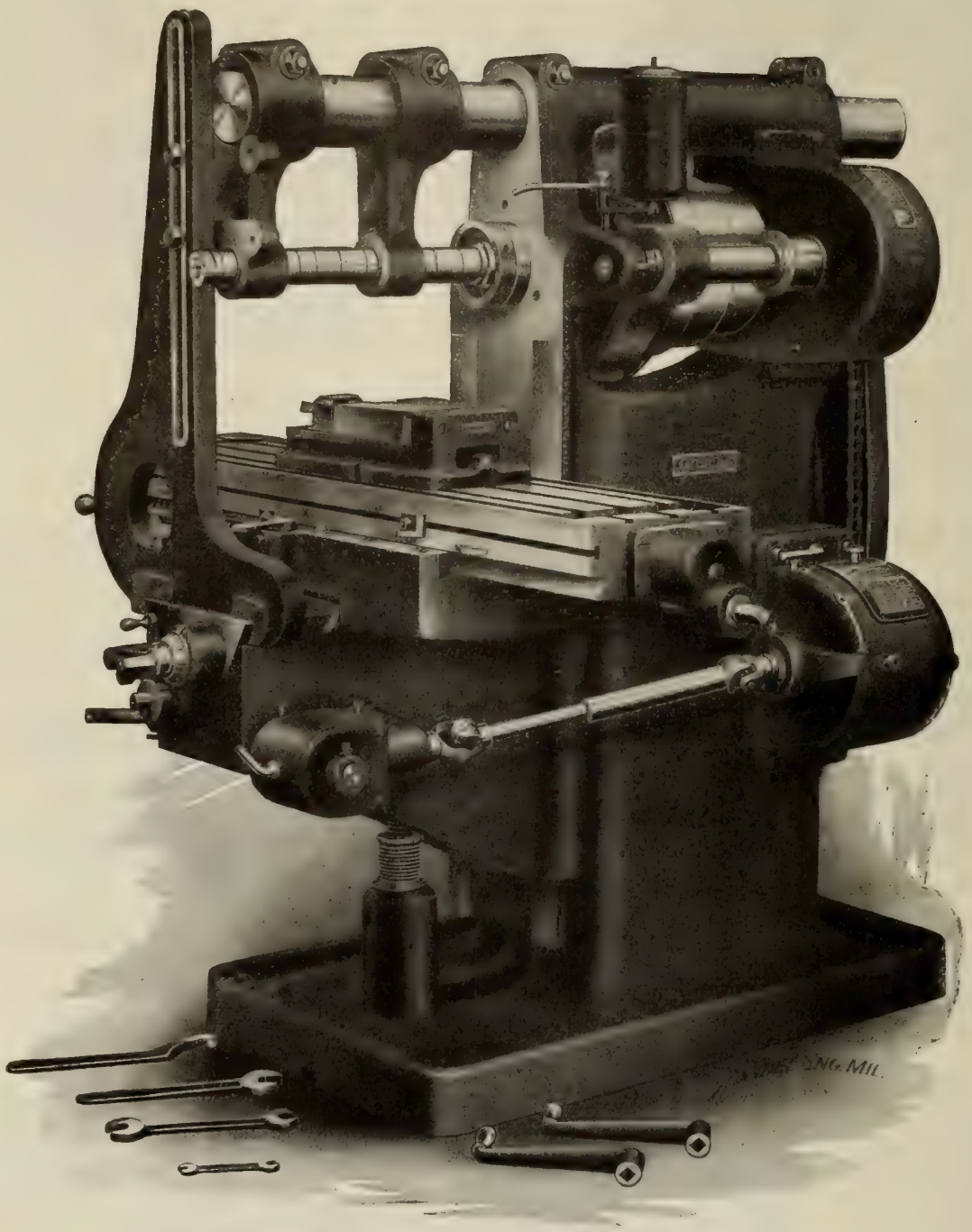
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A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

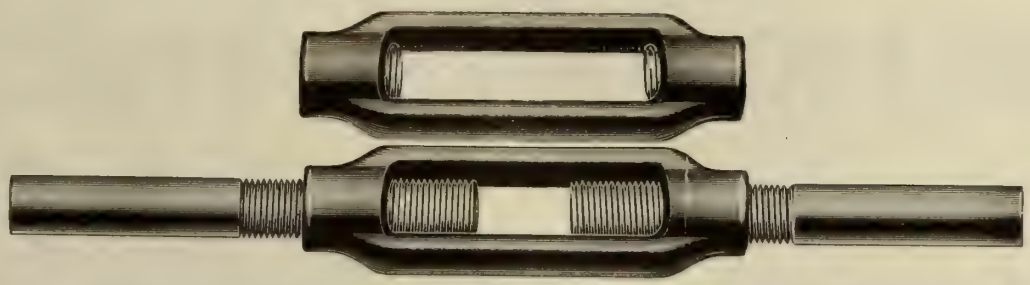
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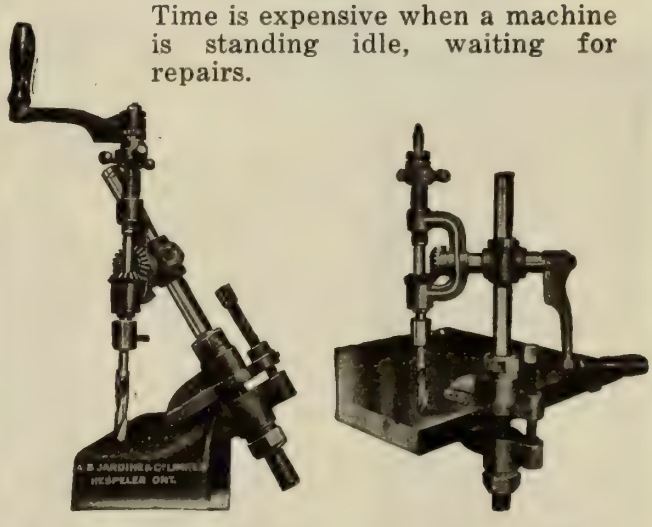
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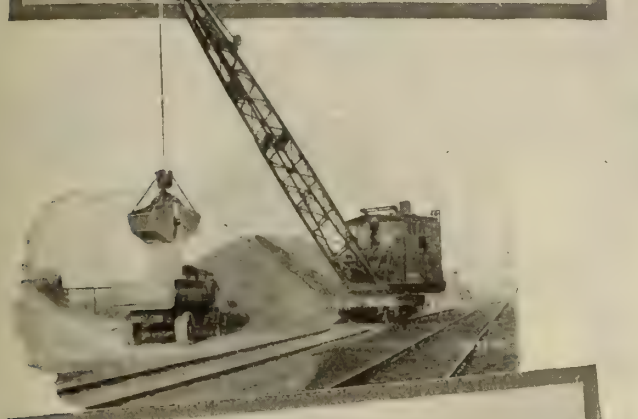
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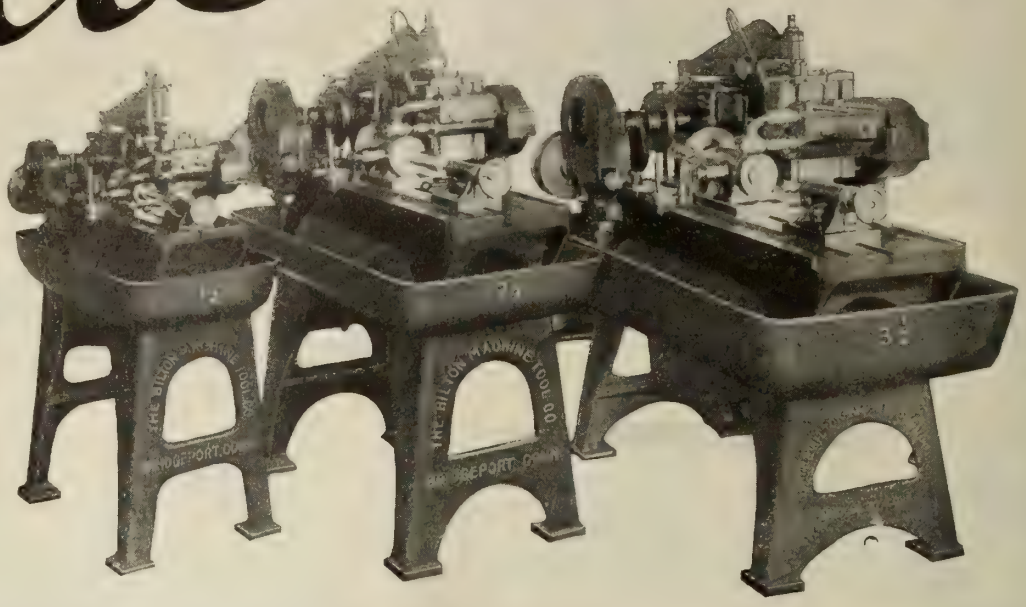
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Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

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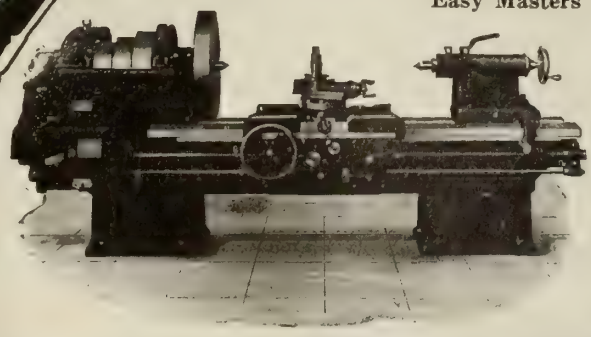
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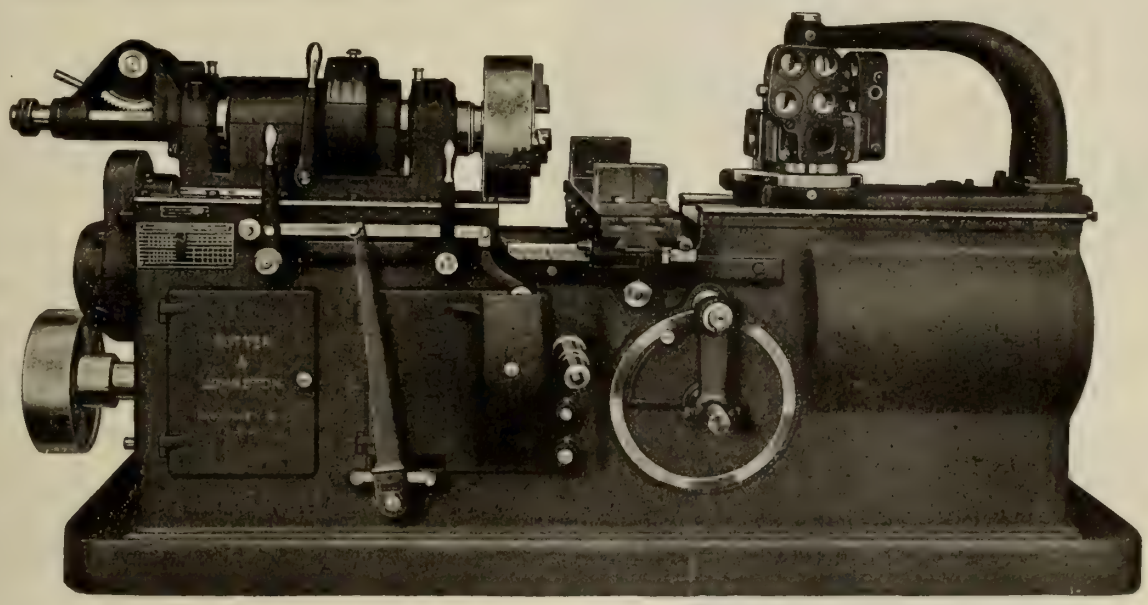
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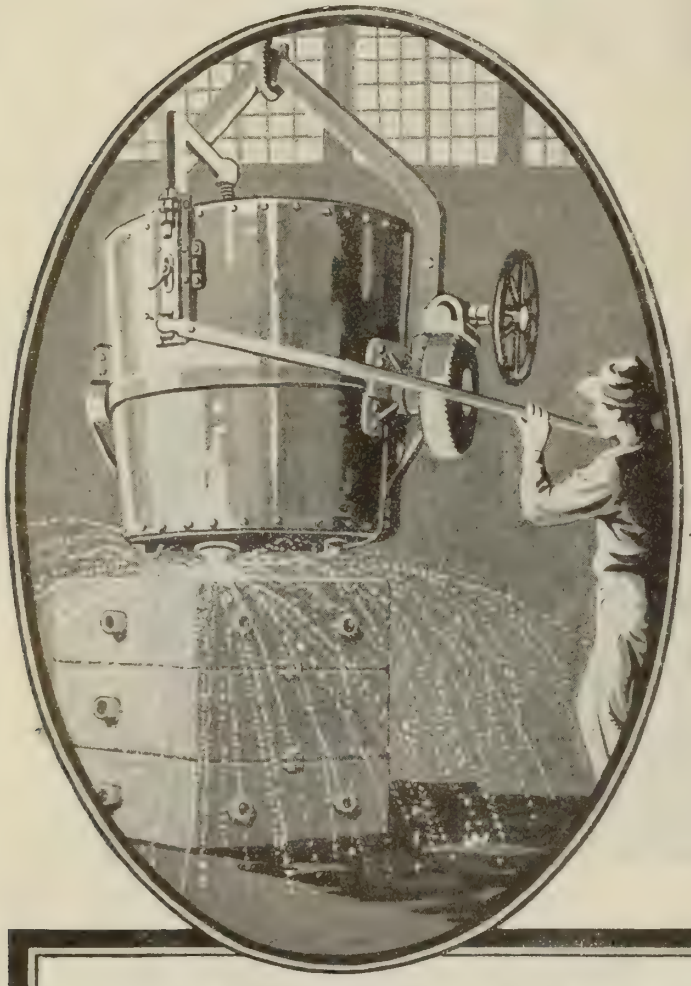
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Uniform Heat Treating Results at Lower Cost

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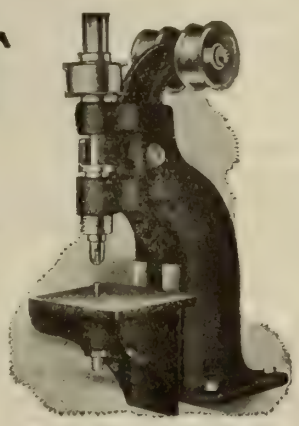
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And in tightest corners just as fast. Every head just as smooth. Not a bent shank; not a tool mark on either rivet head or casting.

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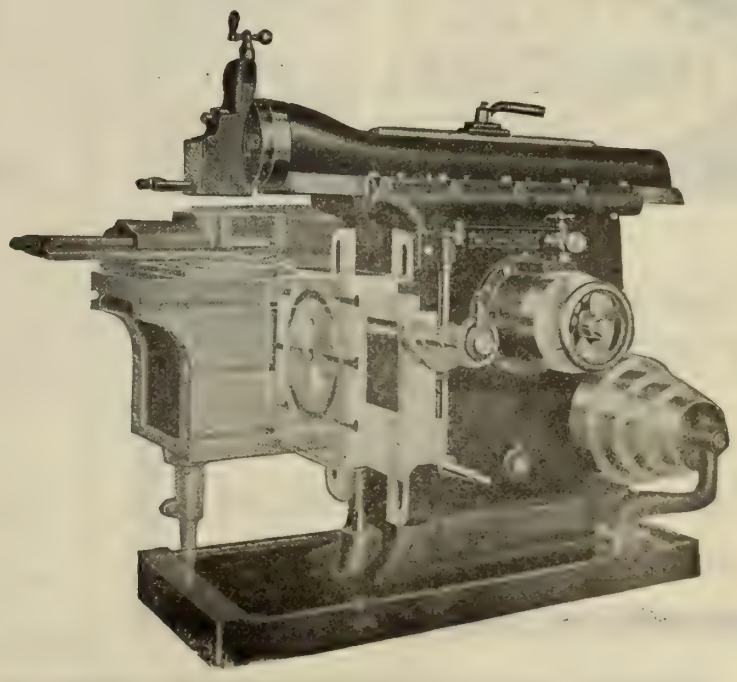
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Milwaukee Back Geared Crank Shapers are built in 16-inch, 20-inch and 24-inch sizes.

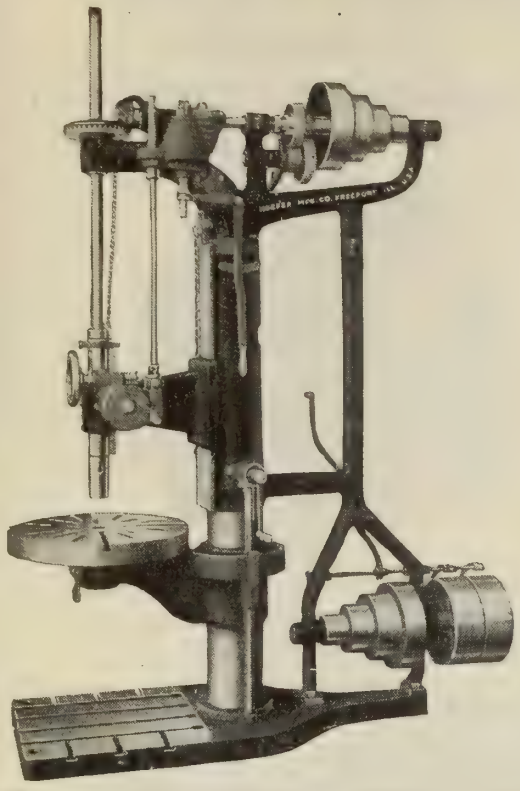


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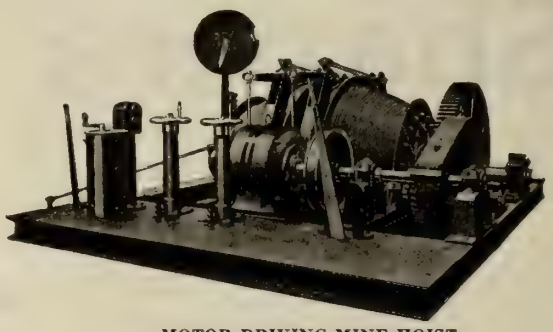
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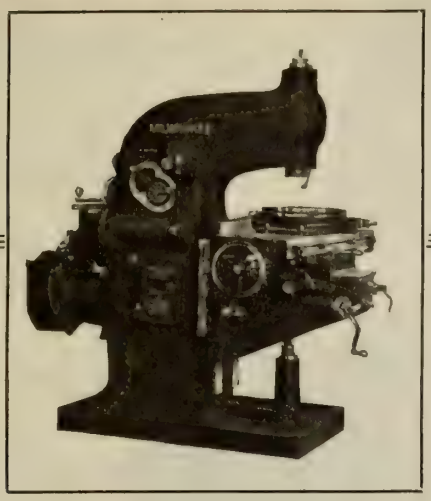
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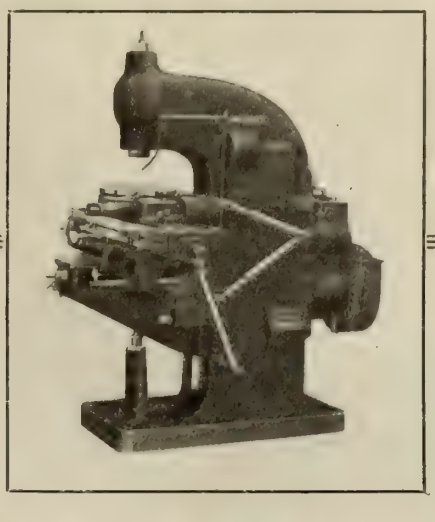
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Milwaukee Vertical Milling Machines





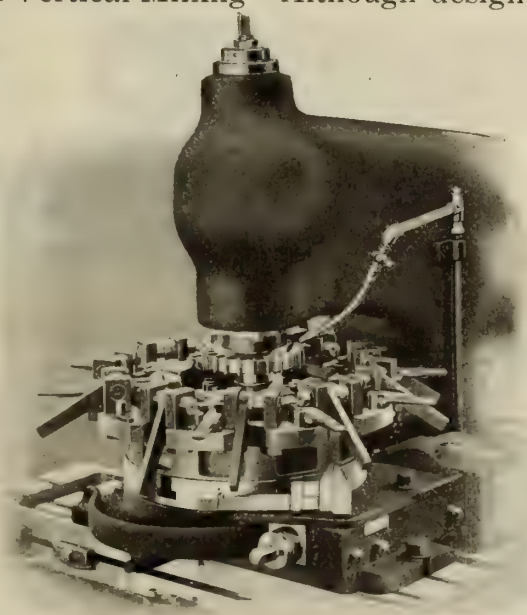
Capable of Doing Heavy Work Accurately

The Vertical Milling Machine Construction, in which both spindle and knee are adjustable, is a relic of the days when a milling cutter was regarded as scarcely more than a coarse file and when machines were light and delicate.

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The Milwaukee Vertical Milling Machine is built with adjustable knee and with spindle adjustable only to wear. This construction is decidedly rigid and can always be relied upon to maintain correct alignment.

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OUR POINT ILLUSTRATED

Continuous milling of 6l-inch adjustable wrenches on a Milwaukee Vertical Milling Machine. These parts are turned out at the rate of 3,000 a day and the finished surface bears a constant and accurate relation to other selected points on the part. The cutters are always in the cut. The table revolves and the operator simply keeps chucking new pieces, removing the finished ones.

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Although designed and built primarily for the regular line of work which is best adapted to the Vertical Milling Machine, because of the ease of chucking, the design of both the machine and the rotary table takes into account the large quantity of work that can be milled in connection with the rotary table by the continuous milling process, whereby the cutters are always in the cut and remarkable results accomplished. Write for catalogue and get the full facts concerning these machines and also Milwaukee Horizontal Milling Machines.

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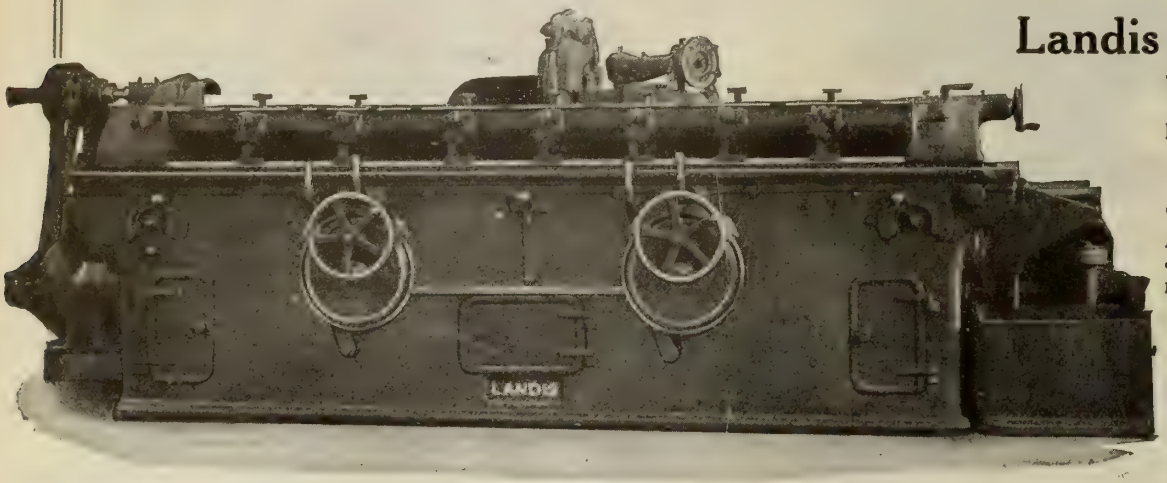
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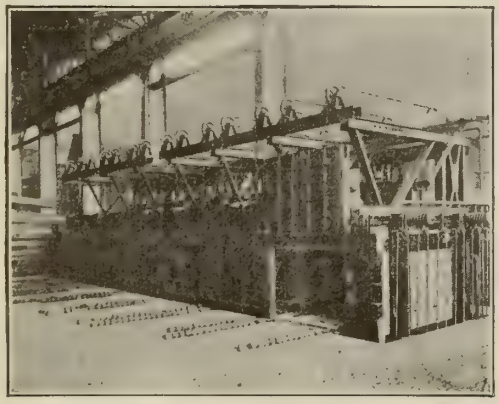
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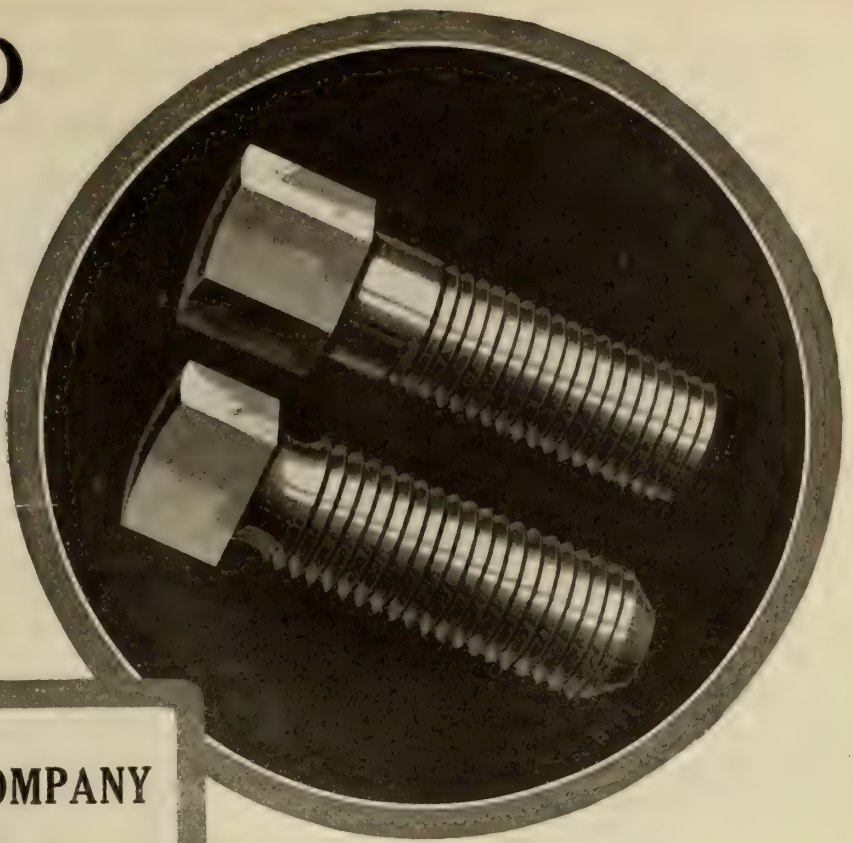
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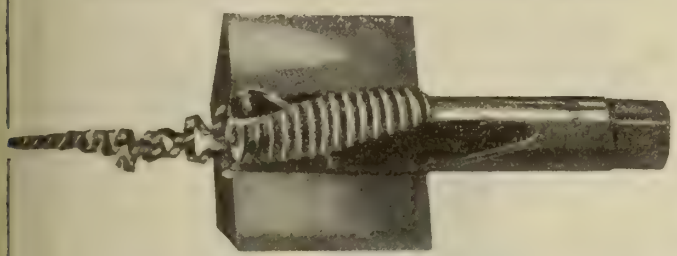
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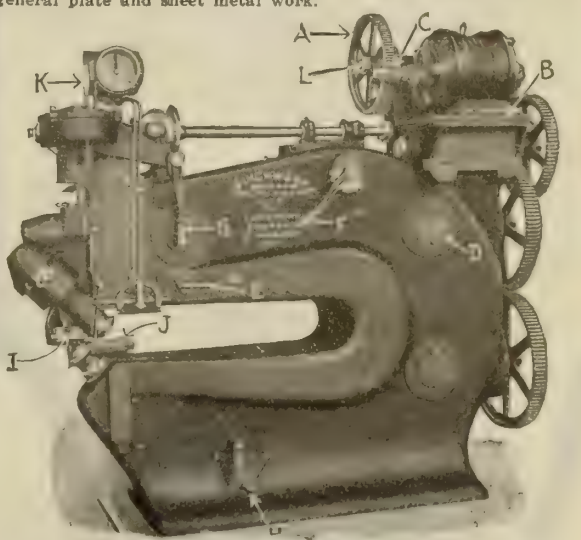
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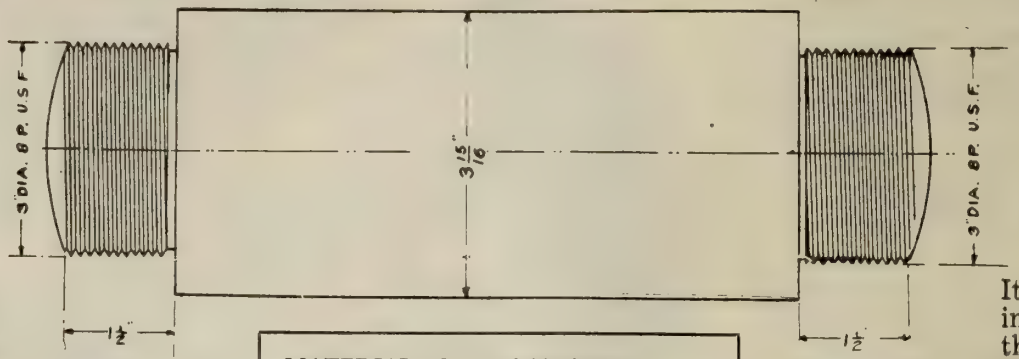


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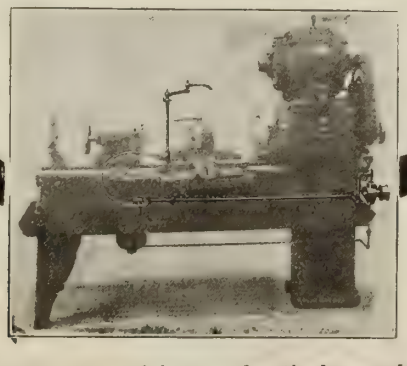
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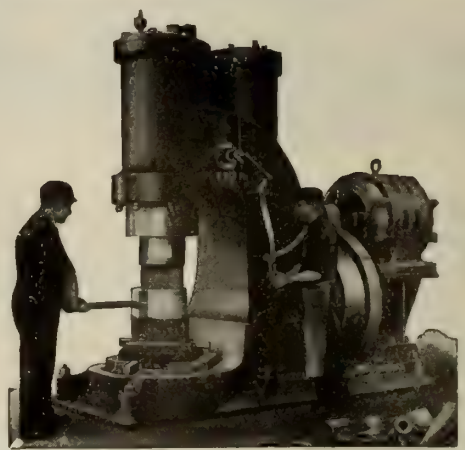
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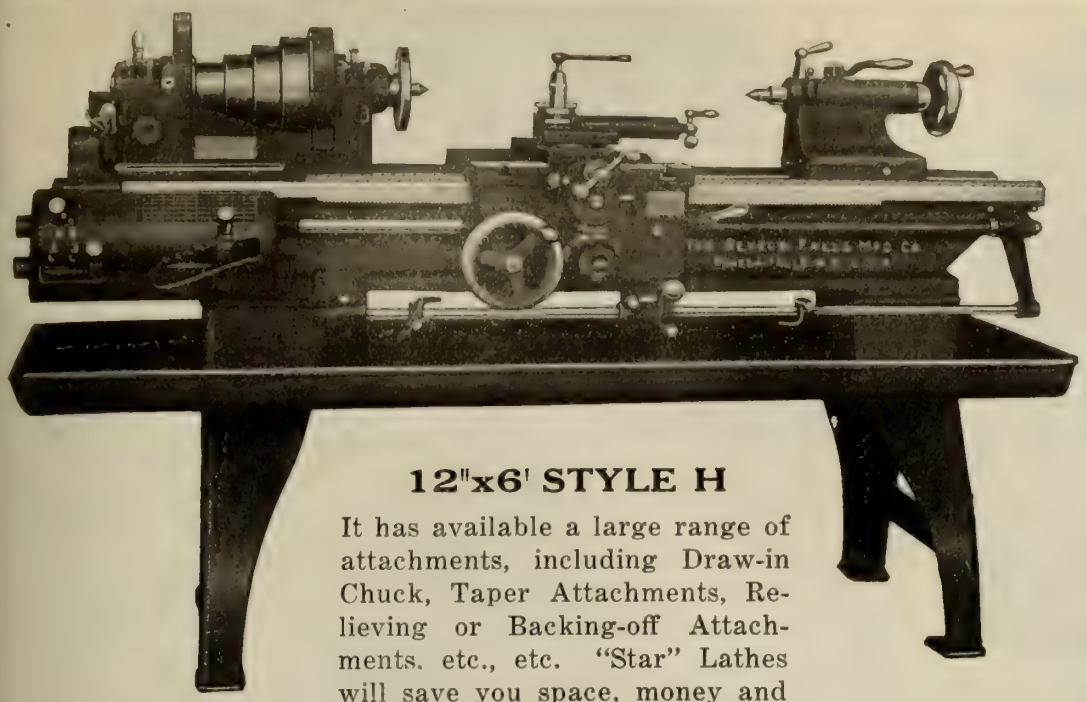
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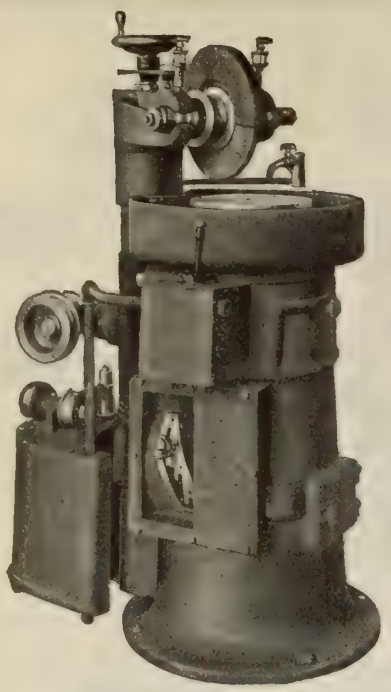
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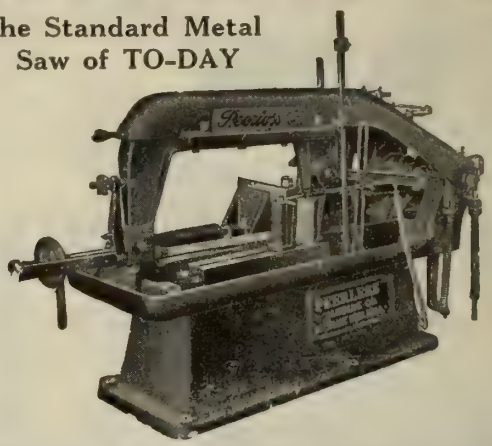
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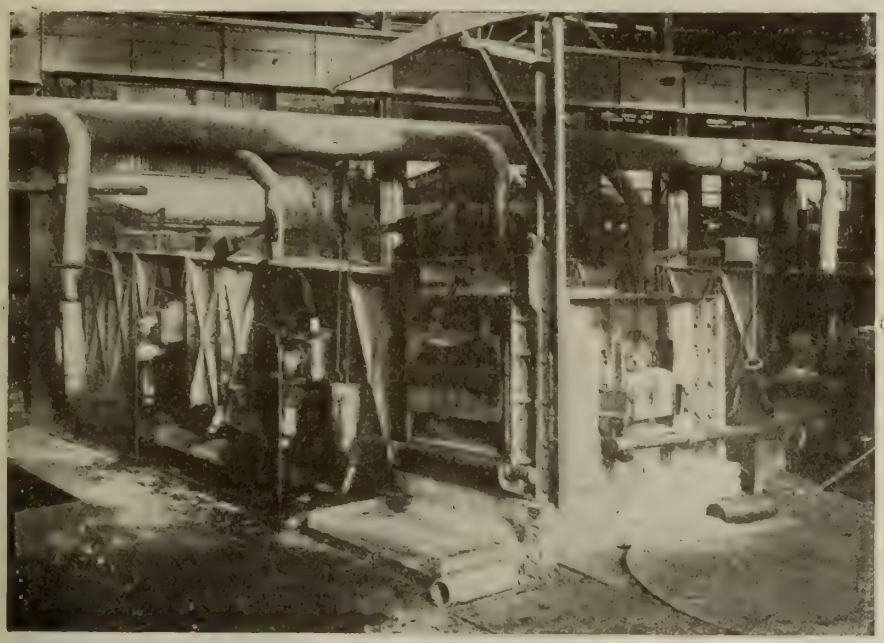
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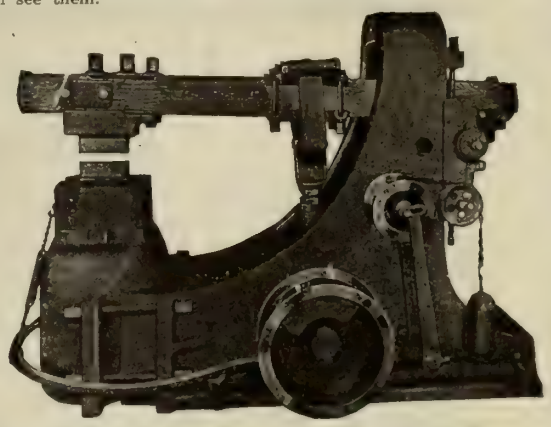
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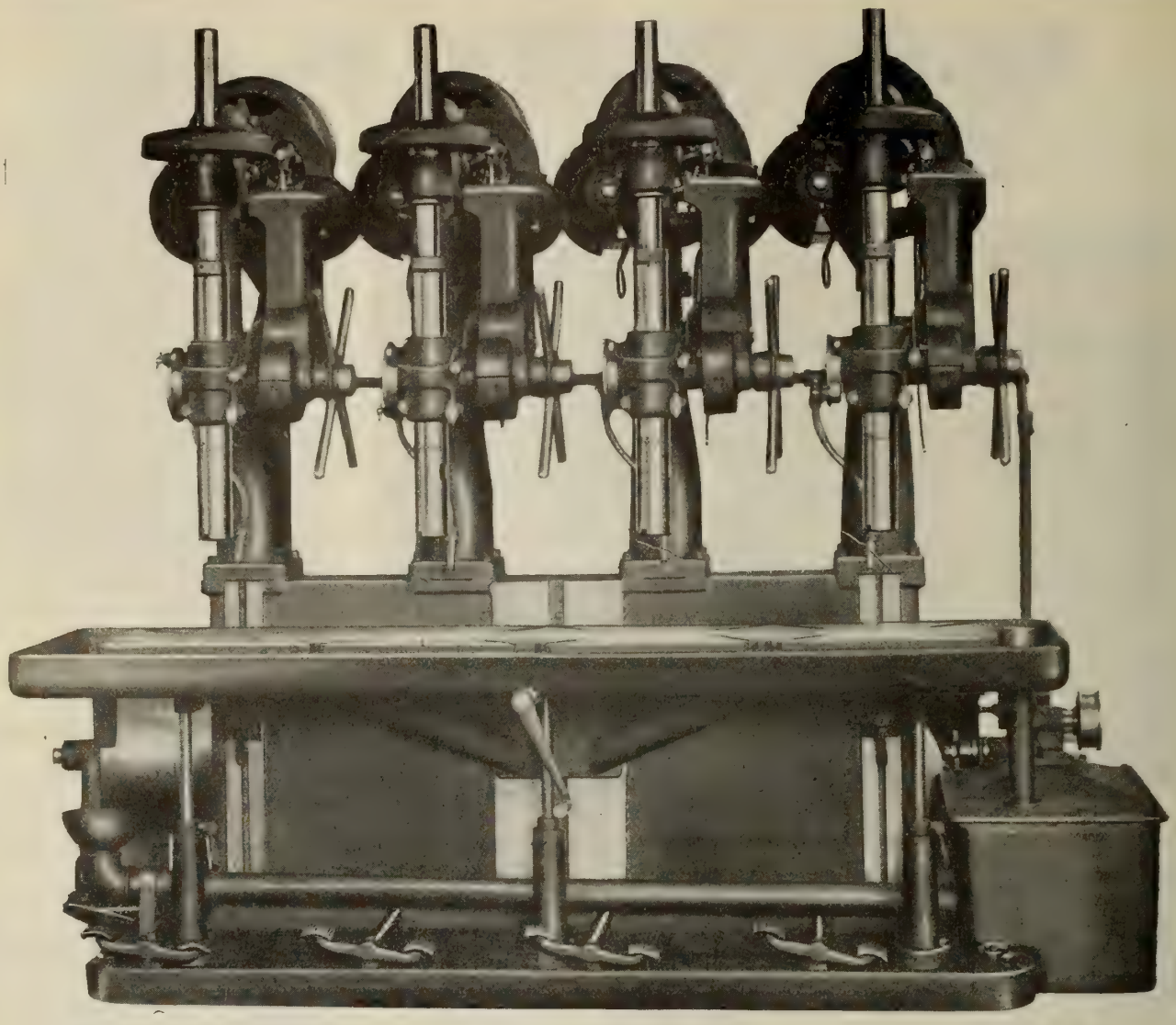
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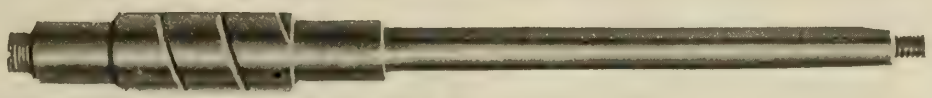
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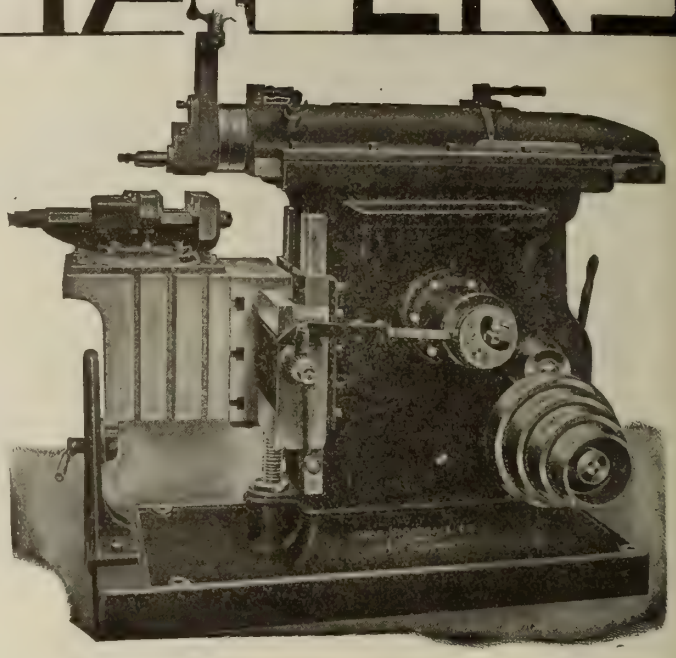
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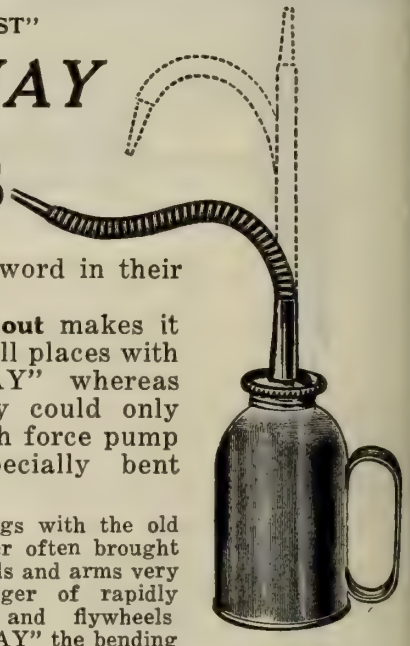
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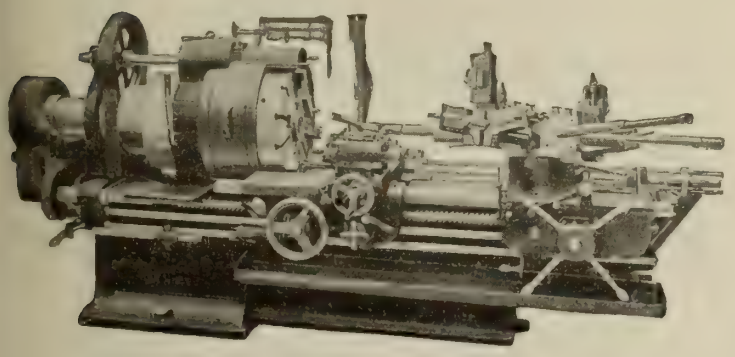


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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XXIII. No. 4. January 22, 1920

Further Examples of Jig and Fixture Work

The Concluding Portion of Article Describing Various Type Fixtures Used in Milling Machine Construction. We Find Herein That a Very Simple Fixture is Often the Solution to Our Interchangeable Problem

By J. H. MOORE, Associate Editor, Canadian Machinery

IN the first portion of this article we described and illustrated six simple jigs used in the manufacture of certain portions of a well-known milling machine. In this, the second and last portion of the article, we will consider other six fixtures used in the making of these machines.

The first to be considered is the worm box jig shown at Fig. 1. This is a fixture of the box type, as can be readily noticed. The worm box is also clearly seen resting on the top of jig. To load the work in the fixture, the plates A and B are first removed. The gear box is placed in jig bottom down until it hits the screw C. The plates are now placed in position. The work is next adjusted by set screws until it comes up to positive stop. The screw C is next tightened, which holds the work securely against the plates A and B, after which the work is drilled. Six holes are drilled in this operation, these being clearly noted on the photograph.

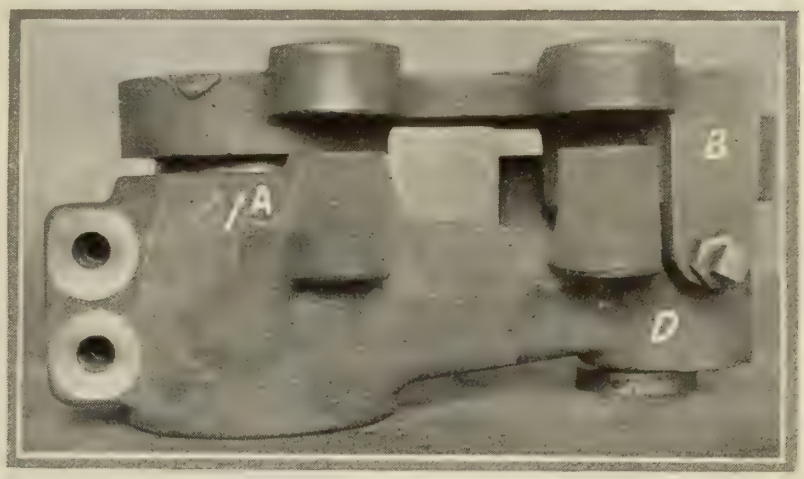


FIG. 3—JIG FOR DRILLING THE OVERARM.

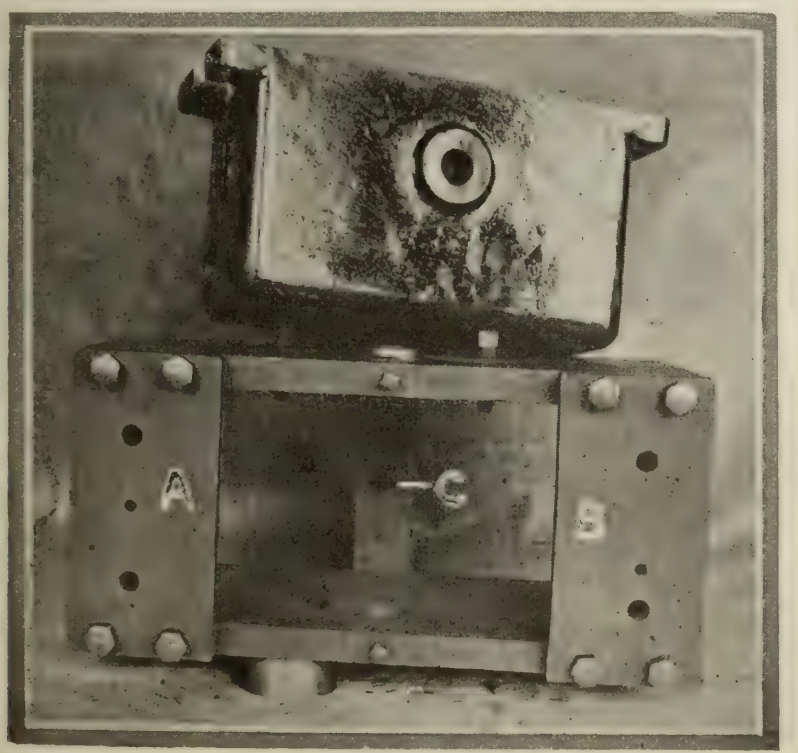


FIG. 1—BOX TYPE OF JIG FOR DRILLING THE WORM BOX.

Gear Lever Jig.

The next fixture is that shown at Fig. 2. The price illustrated at A represents the work which is known as the gear feed box change lever. This is a steel casting, for considerable strains are exerted on this piece while in actual use. Before being ready for this operation, the hole B is finished. The work is now placed in the jig in the following manner: The hole B goes over the stud C, while the portion D rests against the stop E, and is tightened up against the stop by the set screw F. First, a hole is drilled at G, then the jig is turned end for end, and a hole drilled at H. The fixture is now placed on its side, and the two holes drilled through the bushings J and K. In this way four holes are drilled at the one set up. An essential point to watch in a jig of this nature is the importance of having all resting surfaces planed perfectly true and at right angles to each other.

Overarm Jig.

At Fig. 3, we illustrate a jig for drill-

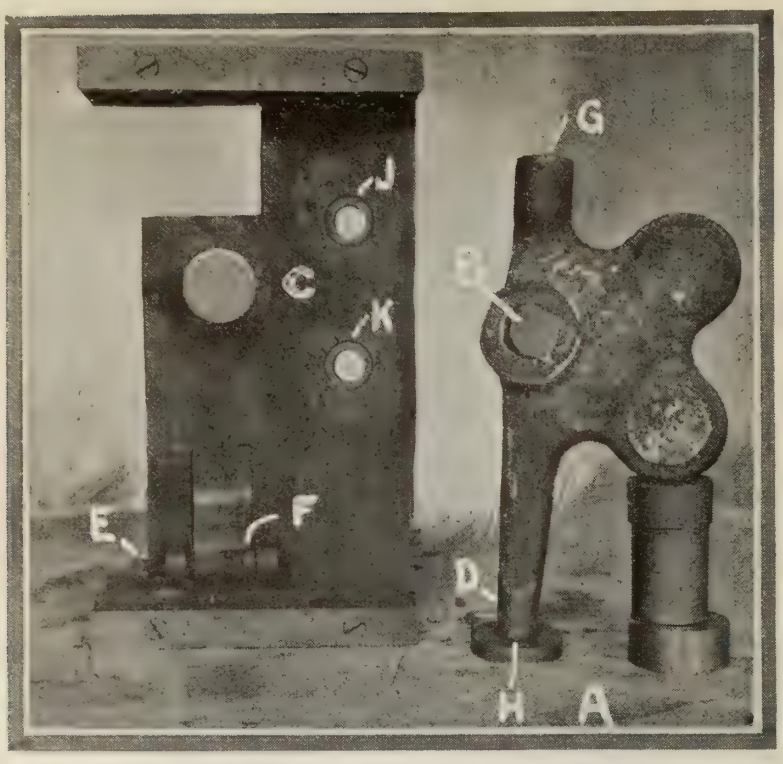


FIG. 2—A SIMPLE BUT EFFICIENT GEAR LEVER JIG.

ing five holes in the overarm steady rest. The idea is very simple. A plug of similar diameter to that of the overarm fits into the finished hole A, while the lug B, with its adjustable stop C, hits up against the boss D. A set screw on the other side tightens up the complete fixture. Five holes are now drilled, four to accommodate the brace, and one to suit the arbor. The remaining details of the fixture are so self-apparent that we leave the reader to study the photograph at his leisure.

Fig. 4 illustrates a double purpose fixture of almost ridiculous simplicity. So simple, in fact, that we hesitated illustrating it, yet it accomplishes its purpose —so why not?

First, it is used for drilling the spring pin hole in the face gear, as shown at A. A plunger of proper diameter fits the bore of the gear and in this way centering the jig, as the distance from the center of this plunger to the center of either bushing is the correct radius necessary.

The bore of the step cone pulley, B, is of similar size to that in the face gear, therefore the same jig is used. In the operation on the pulley the four holes are drilled; drilling two holes at a time. In both these cases, the jig is held securely by means of a long bolt with washer and nut.

Two Other Examples.

The next illustration, Fig. 5, depicts two other drilling jigs.

At A is shown the fixture for drilling the gear guard which goes at the end of miller table. At this operation, it is only desirable to drill the hole B. To accomplish this, a pin of proper diameter is placed into the already finished hole C, which, of course, centres the jig as far as this hole is concerned. The other end is centered by means of adjustable set screws, illustrated on photograph.

The other jig shown at D represents the fixture used to drill the change gear handle bracket. On this operation the piece is placed over the stud E and pulled up to place by means of the nut shown. Adjustment is also obtained from the set screw F. The remainder of the jig is so self-apparent that we make no further comment.

Dividing Head Jig.

A very important portion to any miller is that of the dividing head. For this reason, the drilling of the head must be watched with care. In the illustration shown the head has passed through the operation of drilling the three holes in its side A, B and C. The head is placed in a duplicate base D similar to that used on all dividing heads which passes through the plant. In this way they are assured of accurate results. The base in turn has a groove in it, which slides on the tongue E. This groove is also a duplicate of the size used on the miller table. The complete arrangement is slid into the jig proper, until it hits up against the stop F. The bolt G, and another similar bolt at the other end (but not seen on the photo) is tightened into place, holding everything securely. The jig is now turned up and rests on the faces H and J, which are, of course, machined at right angles to the other face. The one bushing is interchangeable for all the holes drilled.

While none of the fixtures illustrated have been of the complex variety, they have delivered the goods, which is what counts when all is said and done. Of course, in some cases, work, owing to its complex nature, demands a more complicated jig, but where the piece is of a simple type similar to the example shown, there is no necessity of expending more money than is absolutely necessary

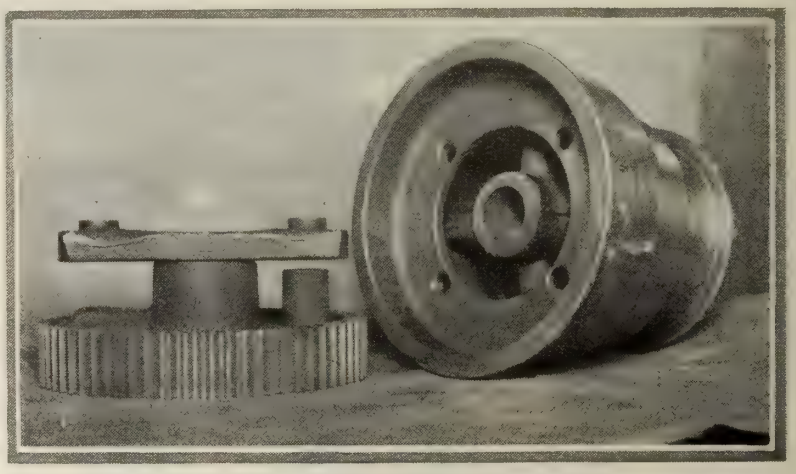


FIG. 4—A DOUBLE PURPOSE SIMPLE JIG.

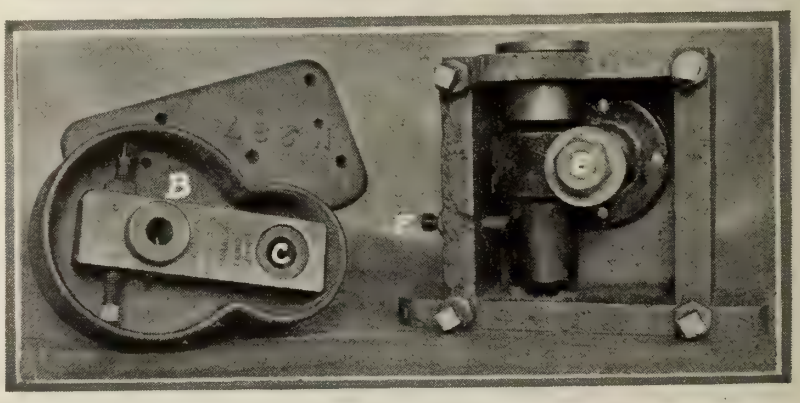


FIG. 5—TWO DIFFERENT JIGS OF SIMPLE DESIGN.

on the fixture. In a later article we shall illustrate some other jigs of a more complex nature.

CHANGES AT CHAPMAN CO.

A DEVELOPMENT and change of considerable importance has taken place at the Chapman Double Ball Bearing Co., Ltd., Toronto, Canada. As readers of CANADIAN MACHINERY are no doubt already acquainted with the well-known line of ball bearing equipment turned out by this firm, we will make no comment on their existing lines, but will first discuss the new position attained by Frank H. Lennox, who formerly had charge of the sales department of this concern.

Mr. Lennox has now been appointed assistant manager, with special duties, which will be explained in detail later on in the announcement.

Previous to coming to Toronto as sales manager for the parent company, Mr. Lennox was assistant sales manager at the United States company, whose plant is situated at Buffalo. He first entered their employ as mechanical engineer, afterwards becoming road engineer, and then sales engineer. He also attended Michigan University, studying engineering in its various phases. He spent a few years with some of the largest manufacturers of ball bearings in the United States. His one source of information and conversation, which never fails, is that of ball bearings, with their proper application.



FRANK H. LENNOX.

Service That Will Be Service

Speaking of the proper application and installation of ball bearings brings us to the second position of our story. It is the intention of this company to create a service in attending to customers' requirements that will have no equal.

In speaking of this service, Mr. Lennox mentioned that what they were particularly anxious to accomplish was this: "To let every manufacturer know of the service, and to have them realize that it was open to them without any obligation on their part."

"In what manner do you propose to supply this information?" we asked.

"By answering any enquiry pertaining to ball bearing installation. You know," continued Mr. Lennox, "in all respect to the average draftsman or designer, they know very little about the proper installation of ball bearing equipment. The subject is a very difficult one, combining various formulae with which only ball bearing manufacturers are conversant. For this reason the proper size of bearing is not actually figured out, but guessed at. Such a condition does not produce maximum efficiency, but far from it.

"Then, again, the subject of proper protection against dust is seldom considered as it should be, and as anyone can understand, this is a most important point, for without the proper protection, the bearing cannot deliver the best results.

"We have often found the following condition to exist: A manufacturer decides to install a ball bearing installation in some portion of his product. His designer goes to work, drafts up his idea of what the installation should be, and sends us the result, with a request to state cost of such an installation.

"As a general rule, we are forced to reply that the design, as shown, is not what it should be, submitting to the firm a new layout at a reduced cost to the manufacturer.

"The unfortunate part, however, is this, that the firm concerned may have, in the meantime, proceeded with their pattern changes, thus necessitating a further change to our corrected design. This condition holds good in practically all the proposed layouts sent in for our approval.

"It is such a state of affairs that we hope and intend to overcome. Our trained staff of expert designers allow us to feel assured that such a condition can be stamped out, if, in turn, we receive co-operation from the various manufacturers."

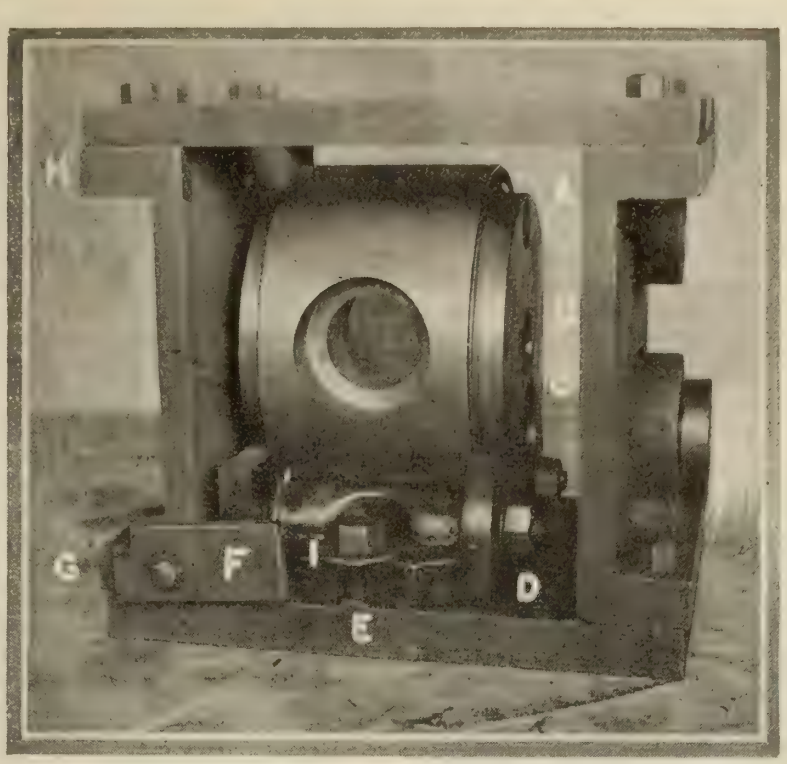


FIG. 6—THE DRILLING JIG FOR DIVIDING HEAD.

A New Line

In addition to this service, the firm spoken of are now handling two new lines of annular ball bearings. These new types are known respectively as the Schatz Universal, and the Schatz Commercial.

The former bearing has as its feature a three-area contact, which absolutely ensures against any binding strain. This type of bearing is supplied in light, medium and heavy series, and in millimeter sizes.

The second style handled is that of the commercial design. Two types, A and B, are made, the style A not being ground, while the type B is ground in the bore, outside diameter, and ball tracks. These two commercial types are supplied in English sizes only.

Each type has its own particular use, and to those interested we can only add that catalogues can be secured by request, which illustrate these lines fully, going into the mechanical details.

Taken in its entirety, this announcement of new appointment, new lines, and added service is one that should interest every manufacturer contemplating the use of ball bearing equipment.

The Generating Process of Producing Gears*

It is Questionable if the Average Mechanic Understands Thoroughly the Fellows Principle of Gear Cutting. This Article Covers the Subject in an Able Manner, Discussing Different Styles of Work Accomplished

ALL surfaces produced mechanically are either formed or generated. The simplest generating operating operation is that of a planer, which produces a plane or flat surface by means of the point of the planing tool. Another simple generating operation is the production of a cylinder by traversing the

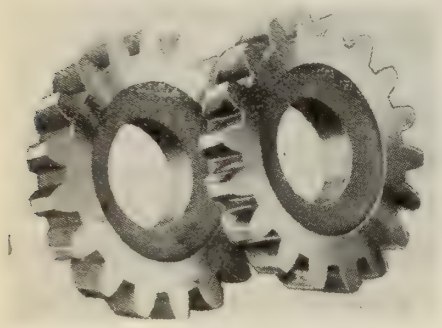


FIG. 1 -TWO CUTTERS AS DESCRIBED IN TEXT.

point of a lathe tool in a straight line while the surface being produced is rotated on its axis.

The simplest forming operation is the production of a plane or flat surface by using a broad milling cutter. It is obvious that any errors in either the form or the setting of a formed milling cutter will result in similar errors in the surface produced.

The generating process of producing a true surface of any definite kind offers fewer chances for error than the forming process. In gear cutting both the forming and generating processes are used.

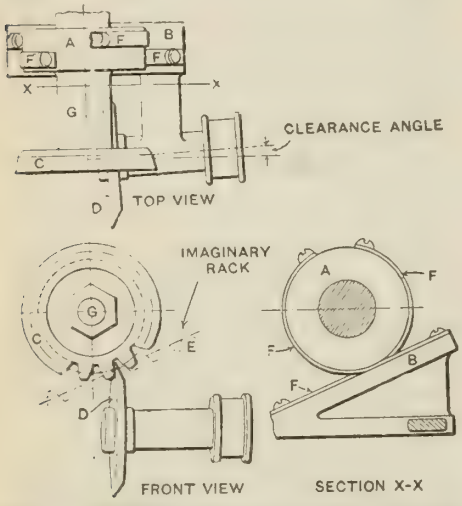
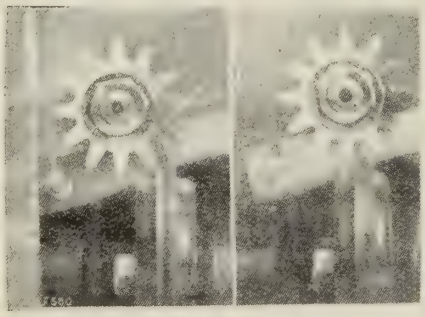


FIG. 2.—SHOWING THE PRINCIPLE OF THE CUTTER GRINDERS.

Since the cutters used in cutting gears can only reproduce in the finished work their own accuracy, it may be of interest to note how the cutters for each process are made.

The shape of the formed milling cutter is dependent upon the methods employed in making the template. These are generally hand and eye methods, requiring superlative skill even to approach accuracy. Then again errors due to hardening cannot be avoided, no matter how carefully that operation is performed. In the end the formed milling cutter when ready for use must naturally be inaccurate.

On the other hand the cutter as used on the Fellows gear shaper is itself a generated gear. It is first roughed out and then hardened. In Fig. 1 the left hand cutter has been hardened, but the tooth outlines are only roughed out while the right hand cutter has been finished. The involute tooth outlines are generated on the cutter by grinding after hardening. Thus any errors can be rectified, producing a very accurate cutter.



FIGS. 3 AND 4.—SHOWING EITHER GRINDING IN ROLLING CONTACT WITH WHEEL.

In grinding the tooth outlines advantage is taken of the fact that the flanks of an involute rack tooth are straight. As every gear will mesh correctly with a rack of the same pitch, it follows that every gear that meshes with its rack correctly will run correctly with each other. It is therefore possible to replace one of the flat faces of the imaginary rack with the flat face of the grinding wheel (D). This, in conjunction with the rolling motion of the blank, will cause the wheel to grind a true involute curve on the face of the teeth.

The principle of the cutter grinder is shown in Fig. 2. The grinder (A) is of the same diameter as the pitch of the cutter, and rolls on the plane surface (B). It is constrained to roll on that surface without slipping by the action of tapes (F), which control this rolling motion. The cutter (C) is mounted on the end of the spindle (G), which is solid with cylinder (A). As the cylinder is rolled up and down the plane the cutter, by means of the tapes on the cylinder, is caused to roll in exactly the same way as

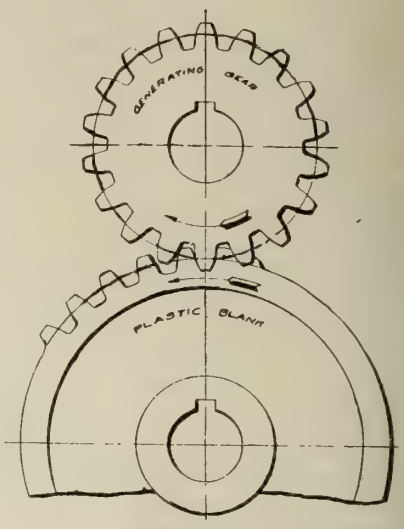


FIG. 5.

a gear in mesh with an imaginary rack (E) shown by dotted line.

Fig. 3 shows the cutter just rolling into contact with the wheel. At Fig. 4 it is nearly at the end of its rolling motion ready to return. By means of special instruments the gear shaper cutter is measured for tooth thickness and tooth space at the pitch line of every tooth and space on every cutter made. The measurements are indicated by a 10 to 1 multiplying lever bearing on the contact point of a dial micrometer gauge, which gives readings directly to .0001 of an inch; the error from one tooth to another must be well within .0004 before it is passed.

The principle of operation of the Fellows gear shaper is similar to the action of two gears in mesh; one gear, the cutter, is provided with teeth, which are relieved to facilitate cutting and to provide for sharpening without change of

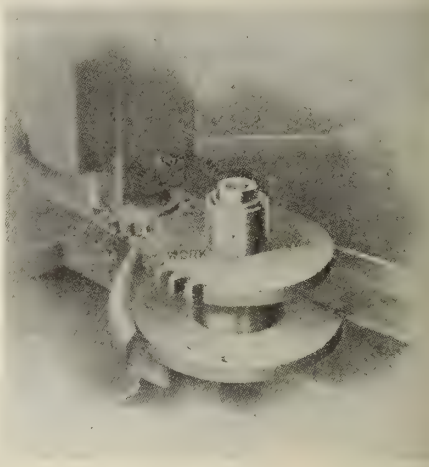


FIG. 6.

*From "Machine Tool Review."

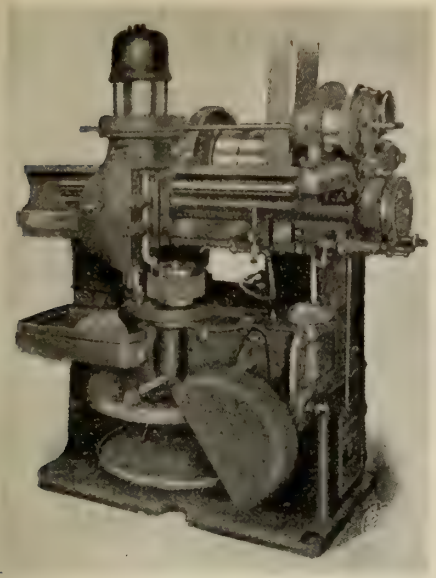


FIG. 7.

form, and the other is the gear blank to be cut.

Fig. 5 shows a metal gear rolling with a blank made of some plastic material, such as wax. When rolled together, as if they were a pair of gears in mesh, the generating gear will mould teeth on the plastic blank of proper shape to engage it. If the teeth of the metal gear are properly designed they will generate correct tooth outlines for a 12-tooth blank, for rack or for any number of teeth upwards, all of which will run properly with the generating gear or with each other.

Fig. 6 shows the scheme applied to the cutting of metal gears. The generating gear is made of hardened steel sharpened to a cutting edge all round its profile. The cutter is held on the cutter spindle mounted in the ram, and is given a reciprocating motion similar to that of a crank shaper.

At the same time the work and cutter are connected by gearing so that they slowly rotate together. The work blanks are mounted on an arbor held in the table or apron of the machine which is fitted with a relieving arrangement for withdrawing the work from the cutter at the return stroke of the latter.

Fig. 7 shows an illustration of the No. 6 Fellows gear shaper. The apron on which the work is mounted can be swung clear of the machine in order to facilitate

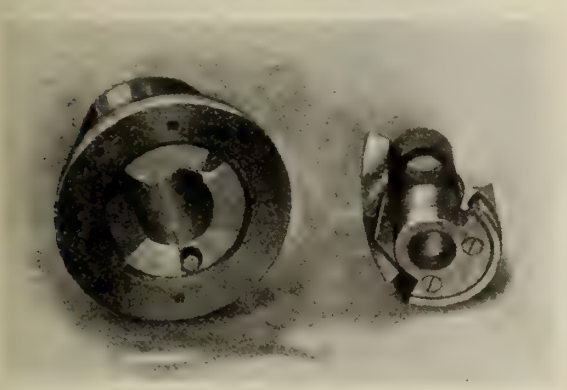


FIG. 10.

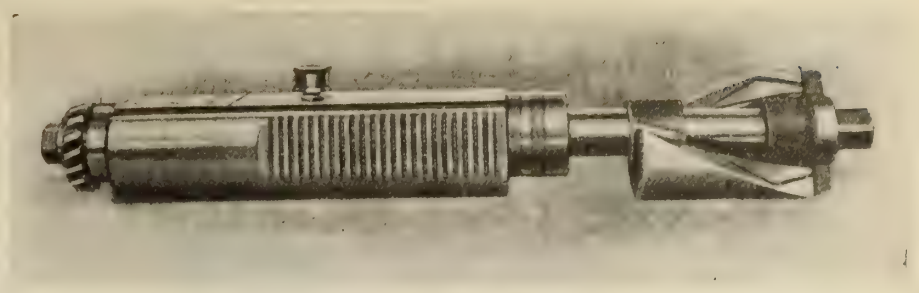


FIG. 9.

setting up. Two independent motions are provided for the feed of the cutter, the depth feed by which the saddle carrying the cutter is fed into the blank, and the rotary feed by which the cutter and blank are slowly rotated in unison. The rotary feed of the cutter is effected through change gears to preserve the correct relation between the number of teeth in the cutter and the number of teeth in the gear to be cut. A special chart gives the correct change of wheels to use.

In commencing to cut a gear it is usual to engage the depth feed first, the cutter being allowed to feed in three-quarters of the depth before the rotary feed is engaged. When specially accurate gears are being produced in large quantities it is more economical to use one or more gear shapers for roughing and another battery for finishing. In this way the cutter is not called upon to take roughing and finishing cuts, and so the finishing cutter which takes only a light cut will last much longer and produce better work.

Helical Gears

Spur gears with helical teeth are gradually superseding straight tooth gears where quietness of action is important. The reason for this is that in helical gears the tooth contact is progressive. It is made first at one end of a pair of teeth, then a little further from the end, and so on progressively until the end of the tooth is reached. By this time another pair of teeth will be in contact at the front end.

The Fellows Company have designed a machine for cutting the teeth of helical

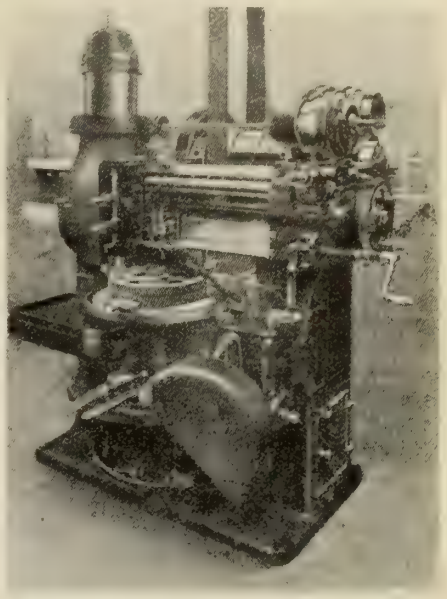


FIG. 12.

spur gears, both internal and external. It is similar in principle to the straight spur machine, with the exception that the cutter and cutter slide are given a spiral motion to correspond to the helix angle of the cutter. The substitution of

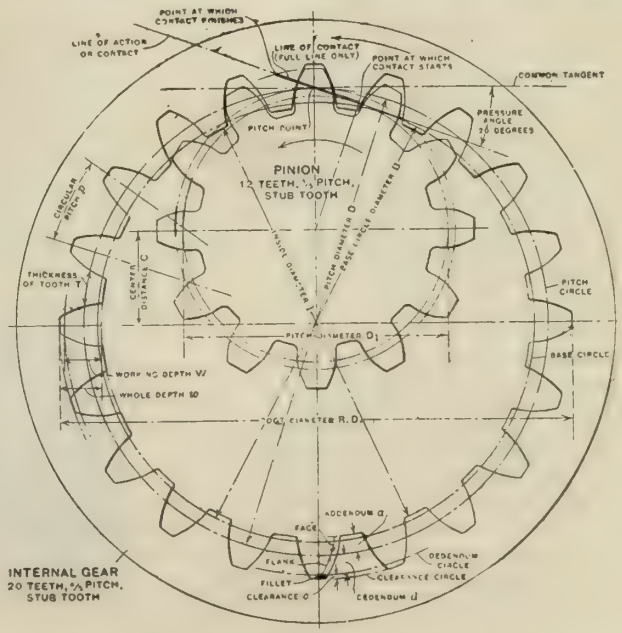


FIG. 13.

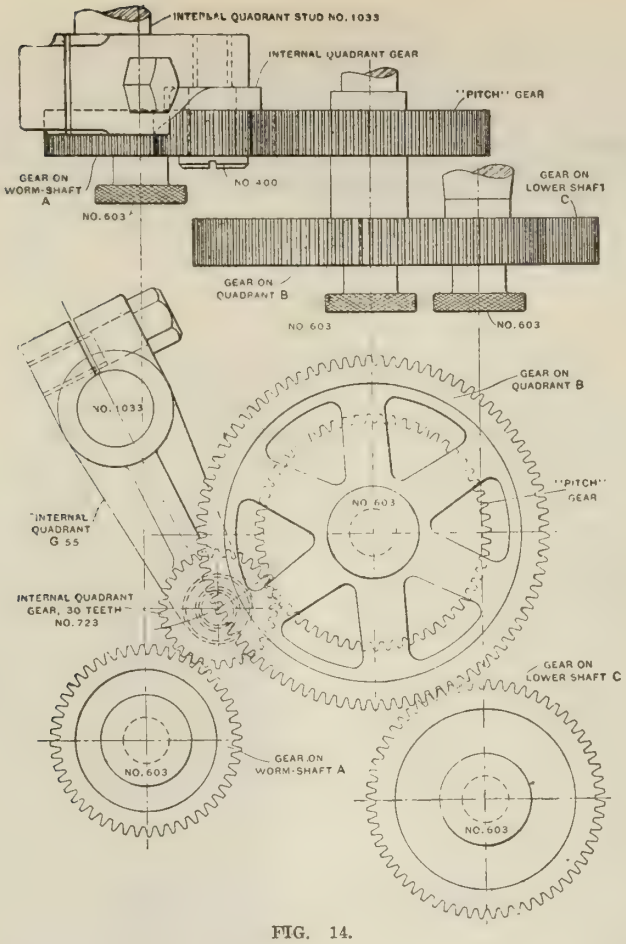


FIG. 14.

a helical in place of the straight guide to the cutter spindle, as shown in Fig. 9, produces this motion.

The guide shown in Fig. 10 is a block of cast iron, and is generated by means of special machinery to exactly the same angle as the lead angle of the gears to be cut. The mating guide, also shown in Fig. 10, is fixed in a large hub, which forms part of the upper index wheel. The guide in the hub is split and provided with endwise adjustment to take up any wear.

By means of the special machinery used any number of guides can be generated, enabling gears of exact interchangeability to be produced in large quantities.

The guides are quickly changed; ten to fifteen minutes only being necessary to change from one helix angle to another or from left to right hand gears.

Fig. 12 shows a helical machine cutting the driving gear of a British electric truck.

Internal Gears.

The cutting of an internal gear prior to the advent of the Fellows machine, presented a difficult proposition and was, as a rule, accomplished by make-shift means. The cutting of an internal gear on the Fellows gear shaper does not differ materially from that of cutting an external gear, the only difference being that an intermediate gear must be inserted in the train of change gears so as to keep the cutter and work rotating as two gears in mesh.

It will be realized that when cutting external gears the work and cutter rotate in opposite direction to each other, whereas on internal gears the work and cutter must rotate in the same direction. Fig. 13 illustrates this. An intermediate gear is therefore put between the gear on the worm shaft and the pitch gear (see Fig. 14). Otherwise the selecting and setting of the change gears is accomplished in the same manner as for external gears.

In cutting internal gears it is necessary to provide a groove at least 3-32 in. wide for the cutter to run into at the end of its stroke. This is to provide for the excess stroke of the cutter and for chip room.

Compactness of design and efficient tooth action represent two of the most important advantages that the internal gear possesses over the external gear. These two advantages make the internal gear particularly applicable to speed-reducing mechanisms. Within the past few years the internal gear drive has been applied with success to trucks and other heavy commercial vehicles, tractors, etc. This form of drive is highly efficient, and forms a very convenient and satisfactory means of transmitting power. Fig. 15 shows a phantom view of a popular type of internal gear drive axle as applied to trucks.

Internal gears give a highly efficient result when applied to reduction mechanism. An example of this type of gear is shown in Fig. 16, which illustrates what is known as the Turbo reduction gear. These reduction gears are made in various capacities, and are capable of transmitting power under different conditions. The particular ratio shown is for a 500 h.p. Turbo gear turbine drive, having a reduction of 7 to 1. The internal gear, as shown in Fig. 17, is applied to a disc clutch. The external member of this clutch is an internal gear, and sliding in this is a series of discs. These discs are kept in contact by means of a stiff spring, and as their faces are provided with a form of brake lining a very satisfactory drive is secured. As soon as the tension of the spring is overcome the discs are separated and the clutch disengages. When used in this connection the internal gear is simply used as a multiple spline. This is clearly illustrated in Fig. 18 where a detail view is shown of the internal gear member of a disc clutch.

Irregular Shapes.

At first sight the production of irregular shapes, such as gas engine and

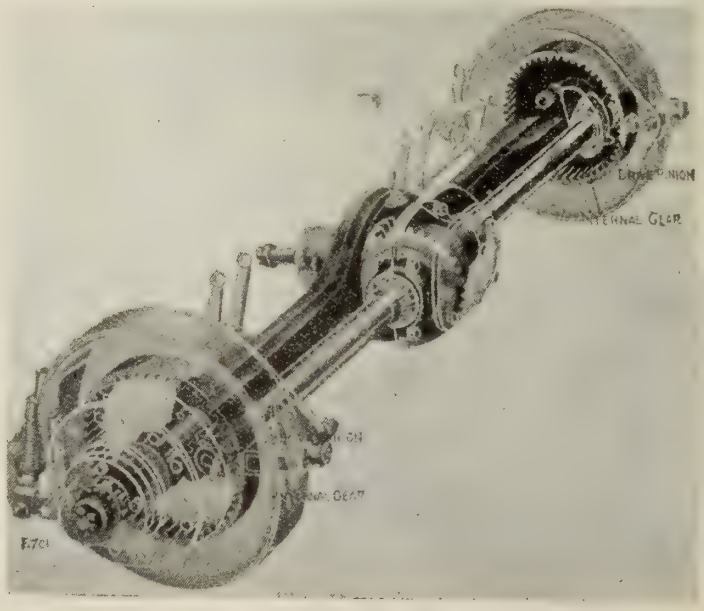


FIG. 15.

other cams, would appear to be beyond the scope of the Fellows gear shaper.

As a matter of fact, however, the machine will produce a more accurate cam than can be obtained by any other known method. The cutters have to be specially made to the required shape depending upon the cam.

The foregoing description of the gear shaper and the character of the work it is adapted to handle will illustrate the almost universal application of this machine. New uses are being found for the gear shaper every day, and for the information of the designer and manufacturer a list of some of the work the gear shaper is now handling on a commercial basis is appended.

Spur Gears, external and internal, within the capacity of the machine. External, pitch dia. 35 in., face width 51 in., pitch 4 D.P. Internal, pitch dia. 26 in., face width 3 in., pitch 4 D.P. Spur, cluster and shoulder gears.

Helical Gears, external and internal within the capacity of the machine. External, pitch dia. 26 in., face width 5 in., pitch 5/7 stub. Internal, pitch dia. 26 in., face width 3 in., pitch 5/7 stub. Helical, cluster, shoulder and double helical gears.

Herring-bone Gears. Chain sprockets. Ratchets, internal and external. Cams of all shapes both internal and external within the capacity of the machine. Geneva stop cams. Splined shafts and keys not exceeding 5 in. long. Graduating, and dividing.

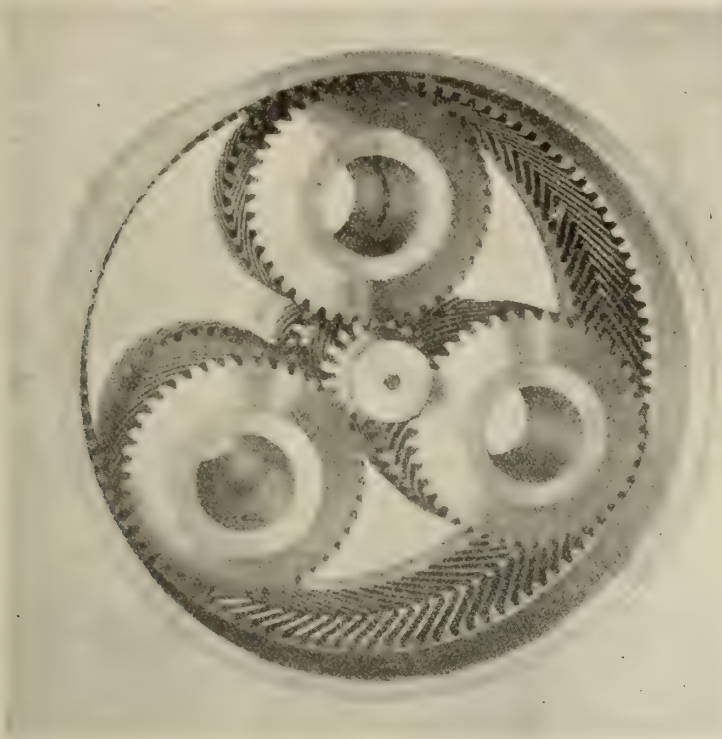


FIG. 16.

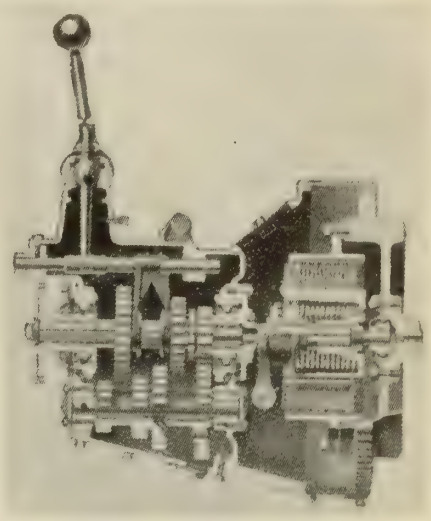


FIG. 17.

PYROPHORIC IGNITION

One of the minor changes brought about by the war is the increased use made of pyrophoric ignition devices, which are, after all, merely a modern form of the old flint and steel and tinder box. Where flint was used the sparks obtained were weak and uncertain and a good deal of practice was required before the tinder could be ignited with certainty. It was not long before it was found that various forms of pyrites, struck by steel, gave off sparks of greater heat and larger size, and had it not been for the discovery of the mineral cerite, there is no doubt that the use of pyrites would have been still further developed.

The spark-giving properties of cerite, when first discovered, seemed likely to prove of little commercial value, as there was a difficulty in producing the substance in sufficient quantities. A German scientist, Muthmann, gave a good deal of attention to the subject and devised, with the aid of his students, a method by which cerite could be produced by the aid of fusion and electrolysis. Another German, Auer, whose name is chiefly known in connection with the gas mantle, availed himself of the discoveries of his predecessor, but even he did not realize the commercial importance of the discovery. He took out a patent covering the use of alloys of cerite with heavier metals, and this had the effect of checking the investigation of others in the mineral and its properties. An Austrian, in Vienna, disregarded the Auer patent, and having become possessed in some way of a specimen of the Auer alloy, devised a pocket kindling apparatus, in cartridge form, in which a piece of steel, suitably notched, was made to rub against a piece of cerite alloy, by pressure, and give off sparks which were caught on a piece of charred rag which could be used for lighting pipes or cigarettes. Hearing of this, Auer took steps to safeguard and develop his discovery and ultimately sold his German patent to a Cologne company, who paid a sum equivalent to £30,000. The Austrian inventor also began the development of his cartridge lighter in a commercial form, and there was subsequently a keen competition between the German and Austrian houses, and the ultimate outcome was an attack on the validity of the Auer patents. At that date it was known that Auer had made several errors in connection with his gas mantle patents, and whether this influenced the decision or not, the Patent Office annulled the second Auer patent. Auer had stated that the pure metal, cerite, did not possess pyrophoric properties and although he subsequently altered his opinion on the matter, it was decided that his patent only related to alloys which contained 30 per cent. and over of heavy metals. According to Dr. Bohm, another German scientist, the use of light metals as alloys suitable for use with cerite was not mentioned in the Auer patents, although a manufacturing firm, Kunheim & Co., had specified these. As a result of several objections their patent was also annulled, and as a result there is to-day no monopoly in pyrophoric materials. According to him there is a third possibility of producing pyrophoric substances, illustrated in the so-called Lucium patent. The efforts of Krieger to produce pyrophoric alloys containing no cerite have so far only led to the discovery and use of materials which only give out satisfactory sparks under certain restricted conditions.

ERRATUM

A regrettable typographical error occurred in the Dec. 4th issue of CANADIAN MACHINERY in connection with the leading article on the Greaves-Etchells electric furnace. On page 547, third column, the statement is made that "During this time 220 heats were run off. This statement is erroneous, and should read: "During this time 2,200 heats were run off."

The Use of Vee Blocks in the Machine Shop*

While Vee Blocks Are Used in Many Ways in the Machine Tool Industry, it is an Open Question if Their Value as an Accurate Means of Lining Up Work is Appreciated and Understood.

By JOSEPH HORNER

GENERALLY all cylindrical articles that are not held in special fixtures are attached to machine tables while supported in vee-blocks. They are seldom put in semi-circular seatings, because these will only take one exact diameter, while a vee will accommodate diameters that vary by from half-inch to an inch, dependent on the depth of the vees. These sustain the cylindrical articles centrally, they prevent them from rolling about, and they also maintain them at a uniform height from the table. The vees provide the support; the clamping is done in various ways, differing with circumstances. The cylindrical pieces held are mostly shafts and spindles that have key-grooves cut in them or facets tooled. But a considerable volume of work of a different character is held for tooling of other kinds, for which the shaft located in the vees is not the part operated on, but an intermediary, to carry the work to be planed, milled, etc. Brackets and articles of many kinds

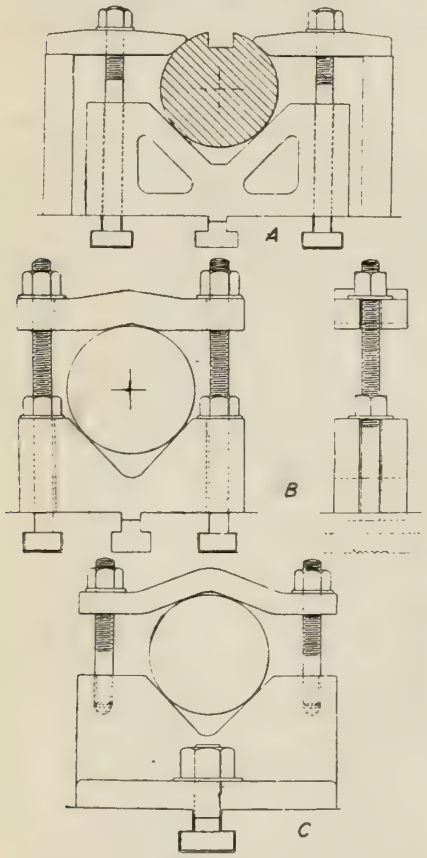


FIG. 1.

that have bored bosses have shafts thrust through their bored holes, and the shafts are laid in the vees and, being clamped down and the bracket also being suitably secured, its foot or the other portion to be faced is dealt with. The advantage gained is that the machined face occupies its correct relation to the bored hole, and it is more likely to be accurate than if it were faced first and the hole bored subsequently.

These very essential blocks occur in a good many varieties. The plainest kinds are represented by the typical form in Fig. 1, A. The block is made in forged iron or steel in the smallest sizes, in cast iron in the larger, and lightened out as shown in the largest. It is simply laid upon the table, in many cases without any tongue to guide it in the tee-groove. The work is very commonly clamped in the manner shown, but only necessarily so when a key groove or a facet has to be tooled along the whole length of the shaft, to permit of which the clamping plates must be kept clear of the tool. The abutting ends of the clamps are made convex, and if the shaft is polished it is well to insert a bit of packing, of card or soft metal sheet, to prevent it from becoming marked by the clamps. These clamps and their packings are those used for general service on machine tables. The bolts that secure the clamps also hold the vee-blocks down.

When the tooling to be done is not continuous, but only occurs along a portion of the lengths as, say, near the ends, the clamp plates may be bridged right across. (Fig. 1, B.) In this instance the clamps are portions of the vee-block, which economizes time spent in fixing up. There is the further greater advantage that the bolts can be brought very close to the work, instead of standing a considerable distance away from it, as at A. The grip will be better. The bolts are a permanent fitting in the vee-block. The lower nut holds the block down on the table, the upper nut tightens the clamp plate on the work. The bolts are slid into place endwise in the block through open slot holes with clearance. The alignment of the blocks is secured by a shallow tongue on the base that fits the tee-grove. A slight self-centring of the clamp plate is provided for by cutting a shallow vee of large angle to fit on the work.

Fig. 1, C, shows another design, in which the block has a tongue fitting in the tee-slot. The bolts are permanent fittings, being stud bolts in this instance. A separate clamping bolt is therefore necessary to hold the block down It goes through the flange seen. The clamp plate is a slightly better form than that shown at B, because, being cranked downwards, it affords a larger area to grip the work, and the bolt length is correspondingly lessened, giving a steadier grip.

There are several designs of vee-blocks which are used to accommodate different diameters on a single piece of work. This is very often done by selecting a couple of blocks that stand at different heights. But the difficulty often then is to get the precise differences in heights required, which renders the use of thin packings necessary. There are of angular section laid in the vees, or they are plain packings under the foot. These adjustments are avoided by employing

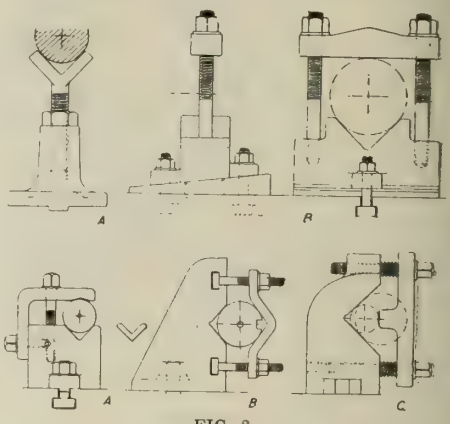


FIG. 2.

vee-blocks of either of the shapes shown in Fig. 2.

At A the vee has a screwed stem entering a boss with a tongued base. The screw has a locking nut. The height adjustment required is obtained by rotating the vee, setting its height by measurement and locking its screw with the nut, after which the work is laid in and clamped by the method most suitable for the job. In the example shown, as in all tall blocks, the height is unfavorable to stability, but this is unavoidable in many cases. A common illustration of this kind is that of a dip crank, where the shaft must be raised high enough to permit the crank to clear the machine table. At B another design is shown, which is rather better than at A. Here the vee-block is made separately from its base, fitting to it with an inclined plane, which affords a fair range of height adjustment. In this feature it resembles a good many adjustable packing blocks. The stud bolts in B fit into the vee-block and the clamp plate is a permanent fitting. It is stiffer than those previously shown, being thickened where the bending stresses consequent on the tightening of the bolts come.

The group in Fig. 3 shows blocks suitable for holding articles that have to be milled with a horizontal cutter. In A the block is bolted to the table through a tee groove, to which it fits by a

*From "Hardware Trade Journal."

tongue. The clamp plate, of right-angular shape, is attached permanently to the block. It is adjustable in the vertical direction to accommodate varying diameters through a slotted hole moving over the set-screw that is tapped into the

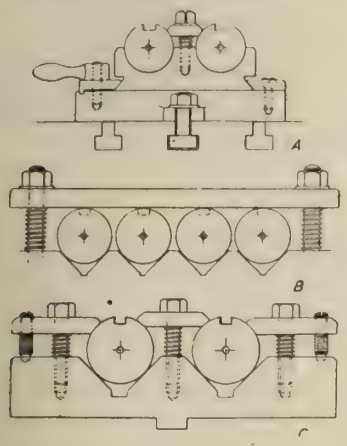


FIG. 3.

block. A set-screw above grips the piece of work through the clamp, which is veed to embrace it. Packings can be inserted, one of which is seen to the right.

The objection to this form is that, although it admits a fair range in diameters, each different diameter stands at a height which varies with diameter. If the centre for one coincides with the horizontal axis of a cutter the centres for all other sizes will not, but will stand higher, or lower, with increase or lessening of size. This in the case of a machine where the cutter cannot be adjusted for height renders the form objectionable. A better design therefore is that at B, where the vee is cut in a vertical face, so that all diameters will lie in the same horizontal axis. The clamp plates, if fitting permanently as shown, would interfere with the cutting of a groove along the entire length, but not with tooling in lesser lengths. If a whole-length cut must be taken plates and packings like those in Fig. 1, A, can be substitnted.

A variation in this form is shown by Fig. 3, C. The principal difference lies in the larger range of capacity provided in C. The vee is very deep, so that it will centre a small shaft like that shown, or one much larger, indicated by the dotted circle. The clamp plate is designed to accommodate this range, having a projection on one side for small shafts and being left flat on the other for large sizes. Another detail of value is the fitting of coiled springs to throw the clamp off the work on the release of the nuts.

In all the previous examples only a single article is gripped at one time, which is not economical when quantities are called for. For these requirements special blocks are made, which may be grouped with the fixtures. In Fig. 4, at A, a block is shown which carries two shafts lying in semi-circular recesses with means for rapid gripping. The block is made in two portions with a base bolted to the machine table, through a bolt in a lug at each end with open slot holes and the work-holding block, which lies on this and is held between bevelled edges, one of which is screwed fast by the strip to the right, while the other, to the left, is tightened with a lever nut. This strip has an abundant tongue fitting in a groove. Its face stands off the base, so that the tightening of the nut causes the bevelled edge to take a grip on the block. The latter will only receive shafts of one exact size, so that it is only suitable for repetitive work. Two shafts are shown, held with central clamp plates with set screws and spring to throw them off when the nuts are loosened.

The vee-block shown in Fig. 4, B, has provision for holding four shafts to be tooled only over portions of their length, since one clamp plate covers the whole series. Springs throw the plate off. The block at C has separate clamp plates, to permit the cutting along the whole lengths of the shafts. The flanking clamps are tightened finally after having been set horizontally by the grub screws. Springs throw the plates off the work.

There is no particular advantage possessed by the form at A, so far as the semi-circular recesses are concerned, over the vees in B and C. Possibly some may think the support would be steadier

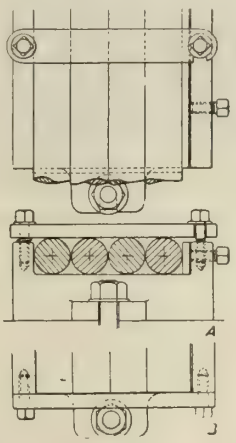


FIG. 4.

than that afforded by vees, but the claim could hardly be insisted on. The real advantage lies in the method of gripping the block, since it permits of the use of duplicate blocks, one of which can be loading on a bench or machine table while the tooling is proceeding on the other. The machine is thus kept fully occupied, instead of being held up during loading.

In Fig. 5 a method is shown of holding several shafts without inserting them in vees. From the plan and end view, A, it will be seen that the shafts are disposed side by side in a recess in the block, and are tightened laterally with set screws, pressing a loose strip against one of the outer shafts so pushing them all against the resistance offered by the abutment on the side opposite. A single hinged clamp plate bridges and secures them all. The plate, or plates if the block is long, are hinged on one bolt, to be swung aside, instead of lifted off, and the pivot bolt has a coiled spring. The clamp prevents cutting along the whole length of a shaft. An alternative then is to clamp laterally, as at A, but to exercise end pressure also, as at B.

A WRINKLE IN BRASS CASTING

In casting brass and some of the bronzes on the flat there is often a very great tendency for the castings to become "smoky,"as it is termed, this, in reality, being caused by a series of cold sheets in more or less developed stages. Assuming that the metal poured is clean and in a good fluid state, this points to the fact that too slow pouring has been used and waves of air have passed in with the metal, the remedy being obvious. As an additional precaution, however, it is well to adopt an uphill method of pouring, as shown in the illustration, the flasks being placed at an angle of roughly 20 deg. from the horizontal, with the ingate to the mould at the lower end. By this method the ingate is kept choked with molten metal, with the result that air cannot pass, and in combination with fast pouring, smooth castings should be produced. In most cases it will be found necessary to put in risers on projections as shown, so that not only shall air and gases escape freely, but also that any dirt carried to the higher points and there trapped may rise out of the way in the readiest manner.

This article was taken from "The Practical Engineer," and we will not attempt to throw a hint about where they got it, but by a strange coincidence we had it in CANADIAN MACHINERY in the issue of old 1918. Of course, there is nothing particularly new about the idea, but it is not generally followed, although it is the proper way to get a sound casting, either in brass or iron.

For an iron casting of this description, it would be best to cover the risor until the pouring was done, but with brass the risor should be left open for the escape of air.

GETTING OVER THE THUMB TACK TROUBLE

By Harrison Jenkins

It often happens that the usual system of placing your thumb tacks on the drawing-board becomes quite a nuisance, but if readers interested will employ the scheme shown in the accompanying illustration this difficulty may be easily overcome.

Of course such an idea as this is only applicable where standard size drawings are made.

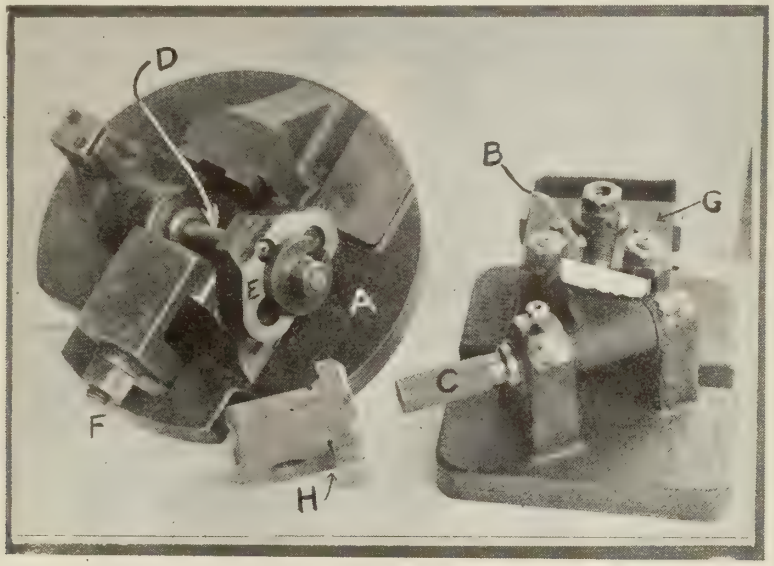
Merely counterbore a slight distance down in the drawing board, small holes. Bore these holes where the tacks come on these standard sheets, which naturally will be just clear of the trimming line. In this way you will have no further difficulty with raised tacks hitting your T-square, and even should the holding holes for tacks get pretty well used up in time you can easily insert wooden plugs or cork inserts, so that this fact should not deter readers from adopting the idea.

Two Interesting Fixtures Used on Automobiles

By J. H. MOORE

TWO very interesting fixtures are shown in the accompanying illustration. First, we will refer to the jig marked A. This is known as a turning fixture for the support spring bracket on the Overland car. The operation consists of turning, facing and threading the portion marked B. While looking at B, let us closely consider the peculiar form of this spring bracket. It is easy to realize that this is a difficult piece to hold in proper position, so in order to ensure rapid handling, the first operation consists in drilling and reaming the hole through which the pin C is placed in the photograph.

This hole being drilled and the bosses faced, makes the task a simpler one. The bracket is placed over the stud D and held in position by the clamp E. The complete fixture is bored and threaded at the back to suit the spindle of the lathe. The clamp F is also utilized in the holding of the work. Thus a difficult piece to handle is so arranged on a fool-proof jig to ensure both speed and accuracy.



TWO INTERESTING FIXTURES, BOTH OF WHICH HAVE PROVED VERY EFFICIENT.

The other fixture illustrated is used on a bevel milling operation on the same piece. It is necessary to mill a 45-degree bevel on this part, which must be absolutely accurate, owing to the fact that all the strain is taken on this face, also that this piece fits into the rear axle housing. Even a slight variation would mean that undue strain would come on the portion B, with possibilities of damage resulting, so that this operation is conceded to be a very important one. The pin C goes through the hole already described, while the portion G is slid in until it comes to a definite stop. The bracket rests on this slide, after which it is clamped securely in position.

To test the accuracy of work turned out on this milling jig, the gauge H is used. Workers are held to very close limits, being allowed plus one thousandth, with no minimum whatever. The nature of the gauge is such that the work can be passed on very rapidly. Placing the portion B through the hole in the gauge H, the lugs J and K at once determine the accuracy of the product turned out. Readers will, no doubt, be surprised to learn that such close limits are the rule rather than the exception in automobile manufacture.

Gear Gauges of Special Interest

By J. H. M.

THE testing or gauging of gear teeth is at any time a very interesting study, so that we feel sure our readers will be interested in the following description of various test gauges used at the plant of the Willys-Overland Ltd., of West Toronto.

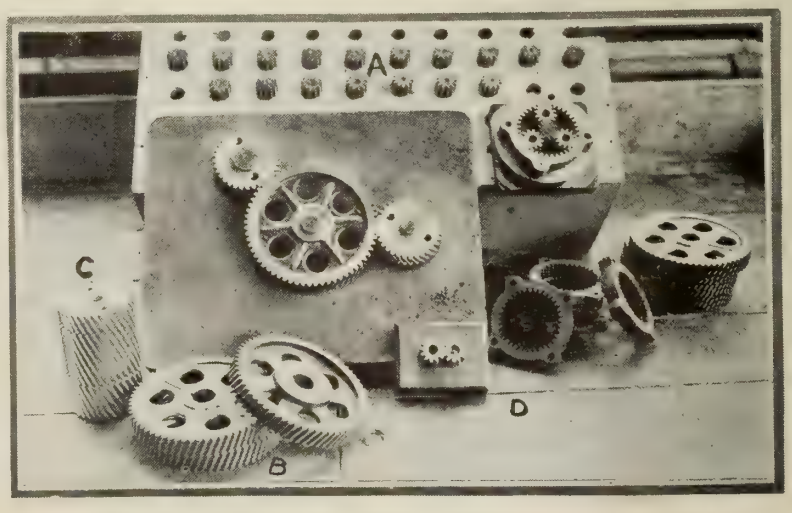
Perhaps, as good a plan as any would be to point out the technical names of the various gears shown in the illustration. The small gears shown on board at A are known as the steering shaft pinions, while the cam shaft gears are shown at B. The generator gears for crank shaft are shown at C, and the steering pinions at D.

The first gauge which we will consider is the one shown at D. Two differential steering pinions are placed on special studs on this gauge, and the pinions revolved to ascertain their smooth running.

The second gauge used is shown at E, and is used to test the timing gears. In this case, three gears mesh into each other, being placed on studs as before.

The last gauge illustrated is arranged to test the steering pinions, the three differential pinions, and the internal gear. The same principle holds good in this case also, the complete arrangement being mounted on a plate as shown.

This method of testing the accuracy of gear teeth has proved very successful, and ensures that nothing but the best of work passes the inspectors' hands. The majority of the gears cut at this plant are cut on gear shapers, which further aid in the high quality of the product turned out.



A GROUP OF GEARS WITH THEIR ACCOMPANYING TEST BLOCKS.



WELDING AND CUTTING



HINTS TO WELDERS

To readers not familiar with A. W. P. products, we might say that these electrodes, outfits, etc., for electric arc welding are manufactured by the Alloy Welding Process, Ltd., 14-16 Cockspur St., S.W.1, London, England.

The "A.W.P." electrode has only recently been placed on the market, but it has been used privately for some years, and has proved its value by reason of the excellent results obtained. In changing over from another type the operator will probably not feel "at home" with the first two or three electrodes used. He would, therefore, be wise not to condemn the electrode after one trial run, but pass judgment after he has welded with "A.W.P." electrodes for some little time.

Our electrodes are just as good on alternating as on direct current. The operator will, of course, be controlled by existing conditions as to plant, but if on D.C. from a separate generator adjust the voltage by the shunt regulator to as near 60 volts as possible. This lower voltage may make welding a little more difficult for the first two or three hours, but it will soon be noticed that there is a considerable improvement in the weld. With this low voltage it is necessary to keep a shorter arc, and that means better welding.

If welding with A.C., do not use a non-inductive grid resistance in your circuit to adjust the current. Try and get an adjustable choking coil, which provides the same variation in current in addition to steadying the arc and saving power.

Be guided more by personal judgment as to the current than by any set table; a higher current means quicker welding and a better weld.

The temperature of the electric arc is constant, and is not affected by the amount of current passing whilst temperature of the work depends on the length of time the arc is played on the work. The current only affects the quantity of heat generated in a given time, so if welding is carried on faster with a higher current the work will not get any hotter with a lower current for a longer time.

Use, therefore, as high a current as can easily be manipulated without burning through the metal.

When on work which comes under the regulations of any classification society (shipbuilding) you must be guided by their rules as to preparing plates, etc. On other work vee all close butt joints, and where welding can only be done from one side the vee should extend to the bottom of the plate. When welds are to be made on both sides of the plating the veeing need not be carried right through if the edges are left slightly open.

On plates of ½ inch or less, excellent butt joints can be made without veeing by leaving the plates 3-16 inch to ¼ inch apart, and making a light run down the back, or by using a light butt strap at the back if welding from one side only.

Except when working under society or local regulations, it will be found that with our electrodes there is no need to chip off the slag when making a second run of metal. Just brush away the loose pellets with a brush and chip a clean place to start upon. The slag will then flow well away from the fresh metal and come up to the surface.

In using the "A.W.P." electrode do not worry about the slag, which will be found to run so freely that it sometimes comes back behind the electrode. Moreover, the slag keeps running away from the metal, thus preventing the formation of slag-holes in the weld.

A NEW WRINKLE IN CARBIDE ECONOMY

By E. D. Bullard*

It is well known that calcium carbide will waste considerably when exposed to the air for an extended length of time. This slacking will vary, of course, with the duration of the exposure and the amount of moisture in the air. In some industries where huge quantities of carbide are used this loss is noticeable, especially in remote regions where transportation cost must be added to the purchase price of the carbide.

This is particularly true in tropical operations, due in part to the high humidity, and in part to the low intelligence of workmen who cannot be made to understand the need for careful handling of their daily allotment of carbide. This very serious waste has led to some interesting experiments in the large mining operations conducted in the Island of Sumatra. These enterprises are operated on a very large scale and employ many thousands of native miners, and tremendous quantities of carbide are shipped to them constantly from the United States.

Some time ago the writer was informed that the wastage from air-slacking at the Sumatra mines has been practically eliminated by the simple expedient of anointing all carbide with kerosene oil; each drum is opened and filled up with kerosene, which is immediately thoroughly drained off and used in the next drum. In this way an astonishingly small quantity of oil is expended, and yet each lump of the carbide is coated with it and completely insulated from the atmospheric moisture. In this state the carbide will not slack at all unless brought into contact with water. It can be carried in sacks to distant points, by prospectors, for instance, or for the use of construction gangs with flarelights, etc. There is no loss from slacking unless the carrier gets caught in the rain, drops his load in a stream, or, in a word, allows water to reach the carbide. In such a case the carbide will become a total loss, of course.

The point is that atmospheric moisture affects the carbide thus treated not at all. In the lamp or generator, however, there is no loss of acetylene through the presence of the kerosene envelope. Indeed, there is, presumably, some added heat in the flame due to the kerosene vapor generated by the heat of slacking when the water reaches the carbide.

Of course there is the expense of the kerosene that adheres to the carbide, but this is said to be quite insignificant compared to the great saving in carbide.

This method has been very well tested out at the Sumatra mines and in generally adopted there. The atmosphere of that country is exceptionally humid and the loss of carbide in the old days was proportionately great. The writer has tried it out very thoroughly, also. He carefully cleaned and dusted two pounds of ⅜ inch (mine-lamp size) carbide, coated it well with kerosene, which took approximately one fluid ounce, and set it out spread thin to a day of hot sunshine and strong ocean wind, and a night of heavy San Francisco fog. There was no loss of weight and no slacking dust after this exposure. Not even the slightest odor of carbide could be detected when the pan was finally brought in from the window-sill; only the slight smell of the kerosene was present. The treated carbide was then subjected to a burning test along with untreated carbide in every type of mine lamp. It gave off gas freely and burned as long, or longer, than the untreated carbide, and gave a perfectly clear flame. On cleaning the lamps the sludge was in no way different from that of the untreated carbide.

*From Acetylene Journal.



WHAT OUR READERS THINK AND DO



EQUALIZING GEARS FOR BUCKET CONVEYORS

By John S. Watts

Any engineer who has operated a bucket conveyor driven by plain gears, knows from painful experience the heavy strain put on such mechanism by the uneven velocity of the conveyor. The reason for this unevenness is that the links of a bucket conveyor are relatively long between centres of pins, and therefore the driving sprockets, to be of a reasonable diameter, are generally made with only six teeth. This, with plain circular gears, gives the buckets a maximum velocity equal to $\pi \times D \times$ R.P.M., and a mean velocity of $3 \times D \times$ R.P.M., D being the diameter of the sprocket from centre to centre of link pins, or in a six-tooth sprocket, twice the length of the link centres.

This can be proved from a perusal of Fig. 1 by noting that the centres of the link pins in one revolution of the sprocket travel a distance equal to the circumference of a circle whose diameter is D; i.e., a distance of $\pi \times D$, while the actual travel of the bucket chain in the same time is only the length of six links, or $3 \times D$.

To overcome this effect, it is necessary to have the driving sprockets revolve at a speed which will vary the amount necessary to give a uniform velocity to the buckets. While this causes the driving sprockets to have an unequal speed, the mass of the sprockets is so small relatively to the mass of the buckets and chain that this uneven velocity is of no importance.

In all that follows, we assume that a six-tooth sprocket is being used, but no difficulty would be found in working out the problem for a sprocket with more or less teeth by using the same reasoning.

As the peripheral velocity of the sprocket must vary from the minimum to the maximum and back to the minimum six times per revolution, it is essential that the ratio of gear to pinion be some factor or multiple of six, and will generally be six. Now, this ratio of six is the mean ratio, and a pair of gears can be decided on which will transmit the required horsepower, using the usual formula and neglecting for the moment the equalizing effect required. The general dimensions of the pair of gears being decided, we have the distance centre to centre of gear and pinion, which distance we lay off as shown at C in Fig. 2; on this line describe a circle whose radius is $\frac{6 \times C}{7}$, which represents the mean pitch circle of the gear, which is the same as it would be if we intended using a plain circular gear.

From the above it follows that the maximum peripheral velocity of the sprocket should be $\frac{\pi}{3} = 1.0472$ times the mean velocity, and should occur six times per revolution. Now the mean gear ratio being six, the maximum gear ratio will be $6 \times 1.0472 = 6.2832$, and the short radius, a, of the pinion will be

$$a = \frac{C}{1 + 6.2832}$$

From centre line of pinion shaft lay off this length a, and from this new point measure back the radius of the pinion pitch circle as already decided and describe pinion pitch circle as in Fig. 2. Note that the pinion is truly circular but bored eccentric by an amount equal to $\frac{C}{7} - \frac{C}{7.2832}$; the centre of pinion shaft being exactly where it would be for a pair of plain circular gears.

Next lay off centres of teeth on the pitch circle of both pinion and gear, projecting the latter out to the circle drawn through the centre of the pinion shaft.

Now measure lengths from centre of pinion shaft to centres of teeth on pinion pitch circle, as at a, b, c, etc., Fig. 2, and lay off these distances inwardly from circle through centre of pinion shaft on lines projected through tooth centres on mean pitch circle of gears as shown. Through the points so found draw a curve which will be the required pitch line for the gear. In other words the pitch line of the gear is described by graphically rolling the pinion pitch circle around the gear.

Only one 60° segment has been worked out in Fig. 2, as the other segments are all duplicates of this one.

The teeth of the gear can be now laid out by the usual methods, using the curved line for the pitch line.

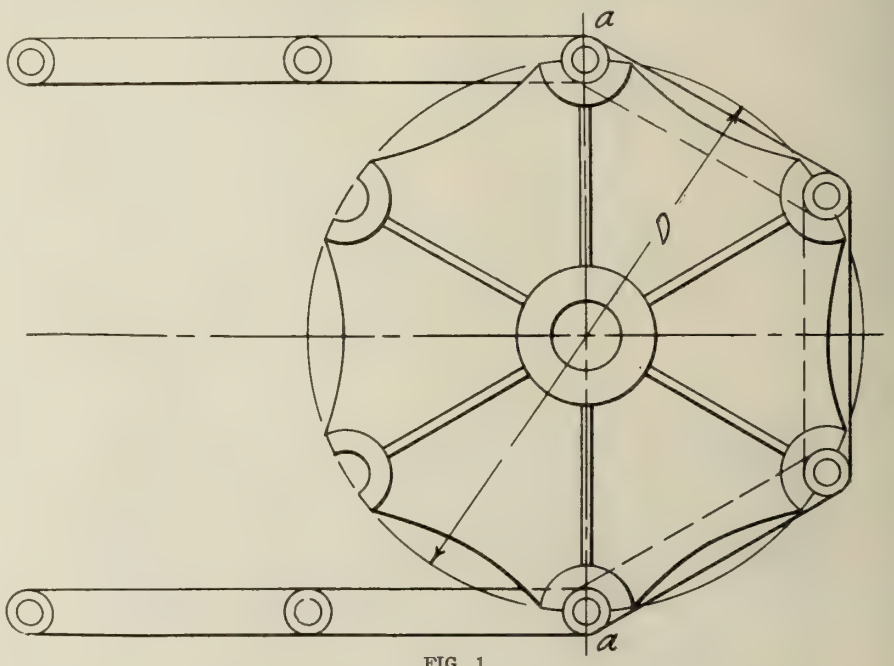


FIG. 1.

It will be found that where the gear ratio is half the number of teeth of the sprocket, the pinion pitch line will be elliptical in shape, as then one revolution of the pinion will take two points of maximum velocity and two points of minimum velocity.

In erecting these gears, care must be

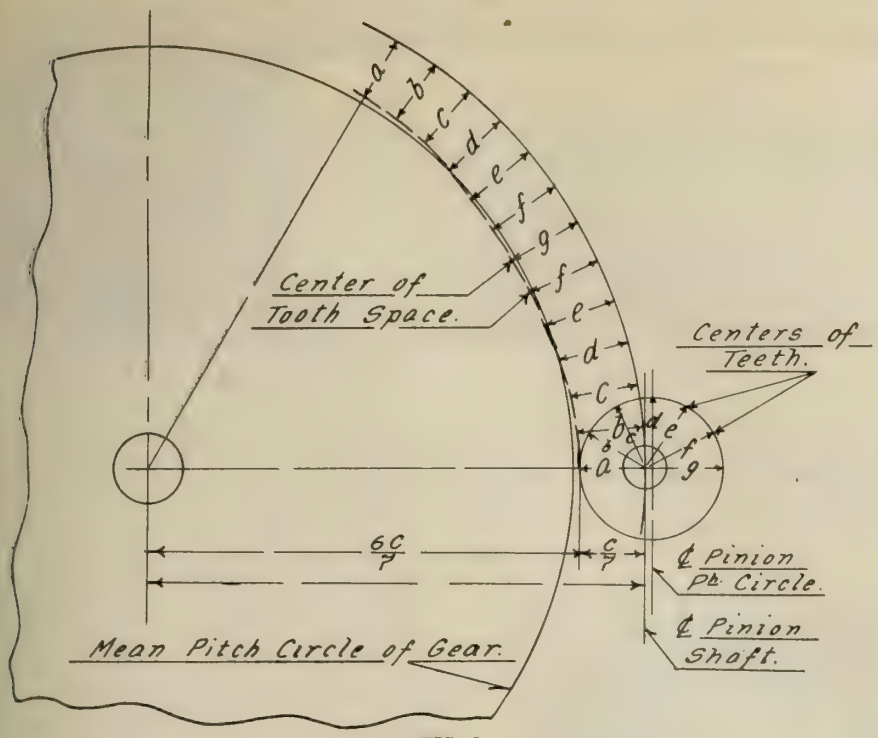


FIG. 2.

taken to get the gear and pinion set so that tooth "a" on pinion meshes with one of the teeth spaces marked "a" on the gear.

Also, in keyseating the gear and sprockets, the work must be done so that the centre lines through the points of maximum pitch diameter of the gear, i.e., at "a" in Fig. 2, are in the same plane as the centre lines through the sprocket teeth marked "a" in Fig. 1.

GRINDING CHUCK FOR GEARS

By J. H. Moore

A very interesting grinding chuck is shown in the accompanying sketch. This chuck is used at the plant of the Machine and Stamping Co. for the grinding of some of the gears on the differential for the Overland Four car.

As will be noted, the chuck really grips on the pitch line of the gear teeth in this way, ensuring absolute accuracy. The chuck is of the collet construction, pulling up in the regulation manner. When very accurate work is desirable one cannot do better than follow out the principle shown in the illustration.

After the gear is chucked in the method described, the centre hole is ground out on a regular style machine.

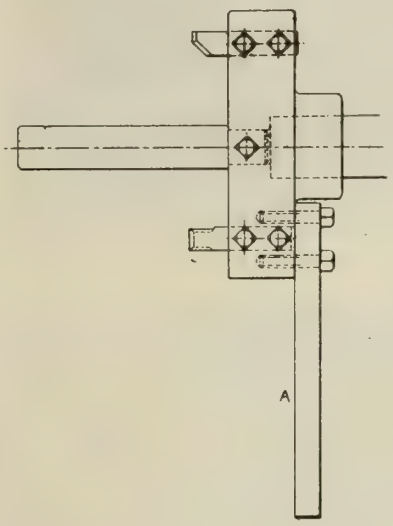
PERSONAL

E. L. Cousins, the energetic manager of the Toronto Harbor Commission, will leave Toronto at the end of January for a trip to England. He will, while over there, endeavor to secure new industries for the city, particularly for the sites which have been developed by the Harbor Commission.

Death occurred very suddenly to Mr. William Ross, general superintendent of the Phoenix Bridge and Iron Works, Montreal. He was stricken on Windsor street while on his way home, and died immediately. Death was due to heart disease. Mr. Ross was born in Ontario about seventy years ago. He held the position of general superintendent for the last twenty-three years. He is survived by a widow.

The death is announced from Montreal of David Robertson Stewart, deputy port warden of the port. Mr. Stewart was a native of Liverpool, England, and was 39 years of age. Until about 15 years ago he followed the sea, sailing in the Beaver, Elder Dempster and Canadian Pacific Lines. He then joined the shore staff of the C.P.O.S. and was appointed deputy port warden of Montreal in 1914. He was a member of the Waverley Lodge, A.F. & A.M., and of the St. Lawrence Curling Club. He is survived by his widow.

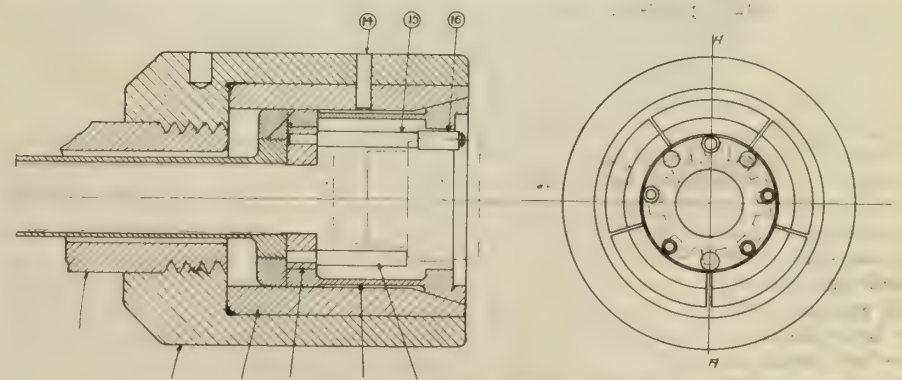
The Taylor Instrument Companies, Rochester, N.Y., have issued the 1919 edition of their General Industries Catalogue of Tycos instruments. This catalogue lists the temperature instruments manufactured for the requirements of manufacturing and industrial operations. Thermometers of all types, hydrometers, viscometers, pyrometers, both indicating and recording, temperature control apparatus are listed, and a valuable feature of the catalogue which will commend itself to the engineer is thirty-two pages of ready reference tables applicable to industrial uses.



USING TOOL HEAD ON POPPET BARREL

By J. HARDY

The plan view illustrates an arrangement that was devised to do a part of the machining of a casting on an engine lathe, the pair of tools, for recessing and chamfering, being fed up from a casting fitted over the nose of the poppet barrel. A pilot bar centred the head. As a means of taking the torsional effort without imposing any strain upon the barrel spline or its key, the dodge of tacking on a piece of bar, A, was adopted, this bar lying on the top of the lathe bed, a practice that answered successfully.



SECTIONAL VIEW THROUGH THE CHUCK.

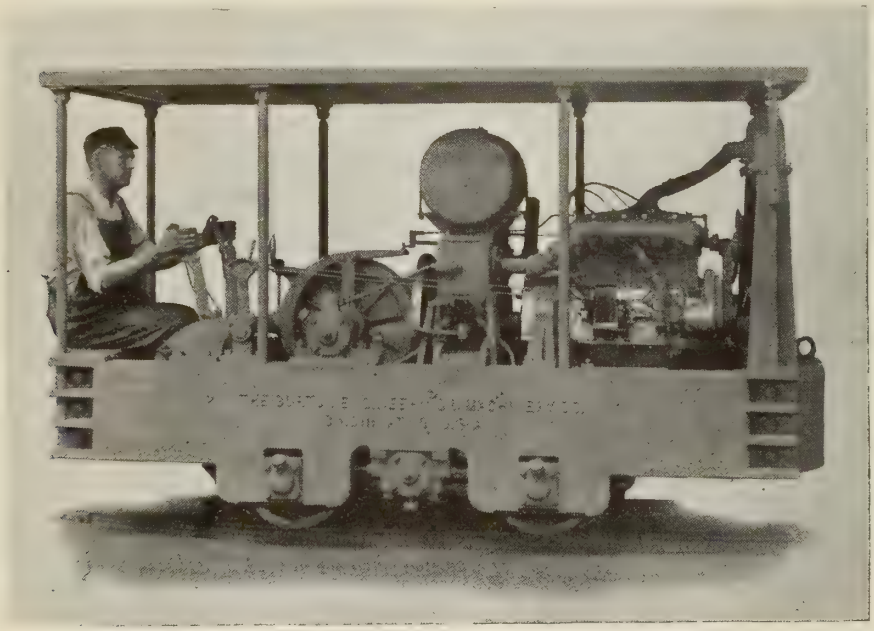


DEVELOPMENTS IN SHOP EQUIPMENT



BURTON LOCOMOTIVES

The Burton Engineering and Machinery Co., Cincinnati, Ohio, have placed on the market a line of gasoline and kerosene locomotives suitable and adaptable for any gauge track.



GENERAL VIEW OF THE LOCOMOTIVE IN ACTION.

These locomotives are designed to operate with either gasoline or kerosene, and are built in sizes ranging from 3½ tons to 12 tons. Simplicity of construction and operation are the essential features as the power is transmitted through a spur friction, 22 inches in diameter, on a large shaft carried on Hyatt heavy duty bearings.

The jack shaft is on heavy duty Hvatt bearings driven by steel roller chains having ¾-inch rollers, 1¼-inch pitch, and the final drive to semi-steel wheels with chilled flange and rim ground to a true running surface. These wheels are pressed and keyed on special axles which are mounted on extra large Hyatt standard bearings in journal box, carried on coiled springs of the proper size to insure smooth running, with ample provision for lubrication. Steel roller chains and cast steel sprockets are used throughout, eliminating all gears.

The friction control is operated by hand lever, brake by hand lever, speed chains by special locking device, and engine controls are all within easy reach.

The cab is of wood and metal construction, extending the entire length of the locomotive, providing ample room for the operator, and giving free access to all parts of the locomotive. The motor is the latest type of Herschell-Spillman, four-cylinder cast in block, equipped with Bosch high tension magneto, zenith automatic carburetor, Pierce mechanical-driven governor, and radiator with cast iron shell, honeycomb core, spring hangers, which absorb all shocks, which a machine of this type is subject to. There is also a guard in front of the radiator to protect it from damage by articles protruding from cars in actual work. All complicated parts such as gears, differentials, clutches, licensed engineers, are eliminated. It has any speed forward or backward with equal power in both directions. All parts are accessible for cleaning and adjusting.

Brakes on all wheels have a special equalizing device with large cast-iron brake shoes. This device has a powerful leverage, capable of locking all four wheels by means of hand lever conveniently located for operator. Another very important feature of the braking system is the sand device. The sand box is so located that the exhaust from the motor passes through the same, keeping the sand hot at all times, and in a condition to run freely. The control of sanders is by foot pedal, conveniently located for the operator.

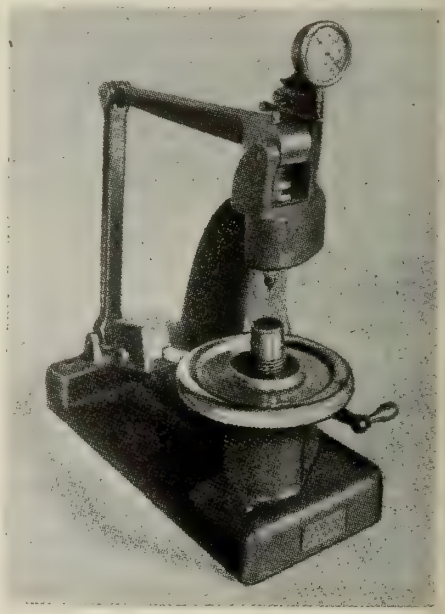
Another important feature is the cooling system, which is thermo-syphon, with radiator located in front of motor. The radiator is of a large capacity with cost iron shell hung on a special shock-absorbing device. One of the special features of the cooling system is the reversible fan blades which automatically reverse when the locomotive is run backward or forward. This insures cooling at all times.

The control by friction drive is conveniently located and the friction disc is protected from grease and dirt by a cast iron shield.

HARDNESS TESTER

S. P. Rockwell, 122 Dickerson St., Syracuse, N.Y., has placed on the market a hardness tester for use in testing the hardness of all kinds of metals by the Brinell method.

It is claimed that this machine gives very accurate results and that it is adapted for testing both curved or flat surfaces and either thin or thick sections. It operates rapidly, and may be carried around without trouble. Another important feature is that it does not excessively mark or destroy the



ROCKWELL HARDNESS TESTER.

work on which a test is made, and that the machine is adapted for testing the hardness of all metals ranging from lead to hardened steel. The machine consists of a sturdy hollow cast frame and a plunger, which holds the testing point at one end and abuts against a delicate measuring device at the other end. A series of levers with knife-edges connects this plunger with a weight, and by shifting the position of the weight, more or less force may be applied to the testing point to suit conditions.

A vertical movable chuck holds the piece on which a hardness test is to be made, this chuck being actuated by a handwheel. The piece to be tested is placed in this chuck and raised by the handwheel until it comes into contact with the testing point. At this moment, the initial pressure is applied through the point to the work, in order to cause the point to break through the light scale, decarbonization, etc., so that it may more clearly test the condition of the true metal beneath. Upward movement of the work is continued until the plunger has actuated the measuring device to a degree sufficient for testing; then the final weight is applied by a hand-lever, and the hardness is read direct by the difference of the testing point's position as indicated by a measuring device. The elasticity of the metal may also be determined by the test point's difference of position from final pressure to initial pressure.

With an equipment of this kind, an average operator can readily make six tests per minute. The greatest value of this machine for shop use is as a comparative tester. For such work, hardness limits are established by the Brinell, scleroscope, file, or working tests, and the Rockwell hardness tester is then set for the particular class of work on which it is to be used, and its limits are established. If so desired, the indicating dial can be calibrated in Brinell, scleroscope, or percentage hardness numbers, using electrolytic iron as zero per cent. soft. Such dials are available as a special equipment. All work has allowable variations in hardness, and for fast operation of this instrument an extra pointer may be provided. The angular difference in the position of the two pointers represents the allowable hardness variation; and if in operation the two pointers straddle the graduation indicating mean hardness, the work comes within the specified limits. Failure to straddle the mean graduation indicates that the work is too hard if the pointers are on one side, or too soft if they are at the opposite side.

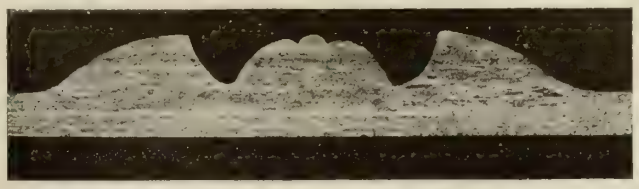
In view of the increasing need for readily applicable means for hardness testing, convenient and simple to operate, the machine described constitutes an interesting development which will, in addition to other means already available, make it possible to control the quality of manufactured articles, especially those subjected to various heat-treatments.

SHAPER ATTACHMENT

The Stockbridge Machine Co., Worcester, Mass., have placed on the market an irregular curve attachment used in conjunction with their shaper. The illustration with this notice explains matters fully. This attachment is used to plane or shape curves, and ensures absolute duplication, on split dies, and other similar classes of work. Forming dies and blocks for a large variety of work are easily shaped and duplication possible any time when required.



ONE STYLE OF CURVE.



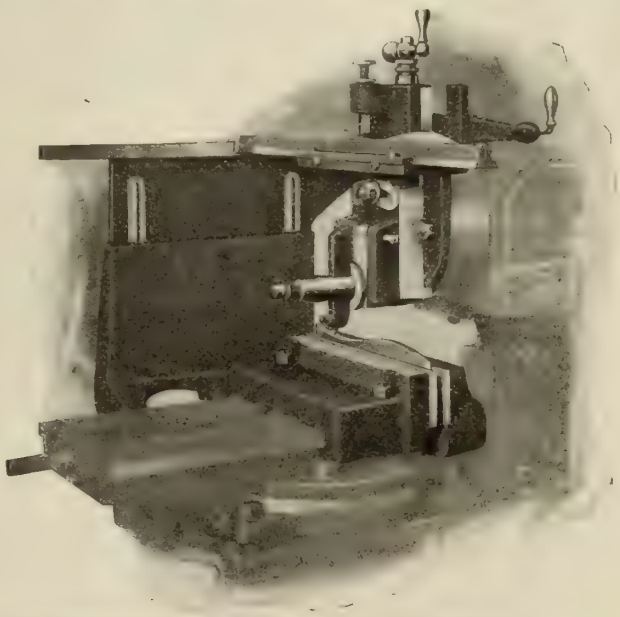
A PECULIAR SHAPED PIECE PRODUCED BY THE ATTACHMENT.

The larger class of work in which this attachment is found a necessity is, of course, die work, bending forms and formed tools, but many special jobs that are difficult of machining can be done with this attachment and cost reduced. The illustrations indicate in a general way the possible range in curves and angles that can be reproduced. It will not only reproduce the curve of the templet once, but over and over again at one setting, or at any future time reproduce the identical shape of the original.

The templet carried in the cross-slide holder is made from about ½ in. x ¼ in. stock shaped to the required outline of surface to be duplicated. The cutting tool is directly beneath the follower and it is raised and lowered as the follower moves along on the surface on the templet and reproduces its curves and angles.

Attachment can be furnished with all sizes of Stockbridge shapers; it is interchangeable with the regular Stockbridge shaper head and can be furnished either on the shaper without regular head or as an addition to regular head.

Many of the formed tools used on automatics can be shaped to good advantage and at a large saving over the usual methods.



VIEW SHOWING THE ATTACHMENT IN OPERATION.

As the result of a series of experiments on twist drills, recently undertaken at the engineering experiment station of the Illinois University, the following lubricants are recommended:—For tool steel—lard oil, machine oil, turpentine, soda-water, kerosene; for soft steel—lard oil, machine oil, soda-water; for cast iron—dry or compressed air; for brass—dry or paraffin oil; for aluminium—kerosene, soda-water, and aqualine and soda-water. Various compounds are also suggested, such as:—For steel—boil together lard oil one-third and soda-water two-thirds; for steel—heat together borax 7 lb., and water 40 gallons. When cool add 7 gallons of lard oil; for steel—a thin drilling compound, almost water—enough compound to make smooth and to prevent rust; for aluminium—half kerosene and half lard oil.

A Peep Into the Future; Ford Is Outdone

Mechanical Inventive Genius Will Undoubtedly be Equal to the Tasks Imposed in Future Years as Witness the Following Article. We Are Indebted to "The Engineer" for This Flight of Pure Imagination

A Christmas Story of 1930

WHEN Mr. James Mass asserted little more than a year ago that he was prepared to flood Europe with a £50 motor car, he was regarded rather as a madman than a knave, but when he began actually to find capital by the simple expedient of accepting fully-paid orders for cars which he had not even begun to build and for the construction of which neither the works nor the machinery existed, opinion veered round to the opposite point, and there were not wanting those who dubbed him a rogue and a charlatan practising on the gullibility of the public through a remarkable personality. So strongly at length did feeling run when it was obvious that more than the twenty million pounds would undoubtedly be subscribed, that deputations waited upon Cabinet Ministers to implore them to take steps to stop this wholesale robbery of the public and to prevent the kingdom being made the laughing-stock of the world. But the Government took no action, possibly because the members themselves had ordered their Mass cars, or possibly because they recognized that whether the people were fools or not, they were carried away by the daring Mr. Mass, convinced of his honesty and determined at all costs to support an enterprise which, if it were successful, would put the kingdom in the forefront of industrial pioneers, and which, if it failed, would cost them no more than the price of a few suits of clothes.

Within a month of issuing his prospectus Mr. Mass was sure of his capital; before three months had elapsed the vast factory at Aston began to rise from the ground, and nine months later the announcement was made that the first batch of cars had been completed, had run their tests on the private track of the company, and had been placed in the bonded store where they are to remain until the day when ten thousand are ready for simultaneous delivery. That day is now rapidly approaching, and it is confidently expected that before the month is out Mr. Mass will have replied effectively to all his critics, and that those who were daring enough to set the example to others by investing their money will be the happy possessors of cars as remarkable for their design as for their method of production.

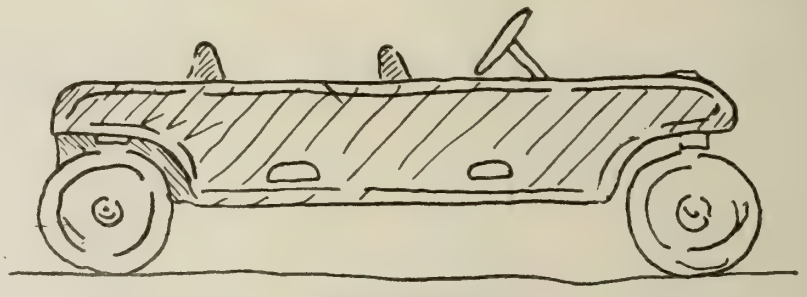
It is well known that Mr. Mass has insisted on the preservation of the closest secrecy about both the factory and its product, and that every member of his staff and every one of his workmen have entered with as much zest into this condition as they have into the endeavor to realize the aspirations of the great inventor. We believe we may say with precise truth that up till a few days ago not a single soul outside the Aston factory knew how the £50 car was made or what it was like. That Mr. Mass has consented to allow us to lift the corner of the veil, we must ascribe as much to the fact that in a few days' time ten thousand Mass cars will be on the road, as to the flattering reasons Mr. Mass gave us. Even now we should betray his confidence did we give more than the broadest description of the works and of the car, and to tell the truth we are not, in any case, in a position to do much more, for causes which will appear in their proper places.

The Mass Car

First, as regards the car. Chatting about it to Mr. Mass before our all-too-hurried inspection of the factory, he sketched its outline on a scrap of paper, and as that rough sketch may some day have historical interest, we give herewith a facsimile reproduction.

The reader will be at once struck by the extreme severity of its line; he will observe that there are no doors, no splash guards and no visible springs, and if a back view were presented he would be astonished to see no back axle and no differential, whilst in the front view he would see no steering gear. As a matter of fact, the body is a box without any of the projections from the bottom or sides to which we are habituated. The traveller enters it by stepping in over the side, indented footsteps being provided to assist him. The omission of doors has a two-fold effect; in the first place, it reduces cost materially, and, in the second, it admits the characteristic feature of the Mass car, which is the employment of the body itself as the chassis framework.

The body is built of two deeply pressed steel sides held together by the bottom and ends, and by four hollow transoms, one at the back of each seat and one just under the knees of the travelers. It forms, thus, a very stiff framework. The four wheels are quite independent, and each is carried on a stub axle, from which, by the way, it cannot be separated. Each stub axle is provided with a vertically projecting rod or plunger on which a helical spring of special design is threaded. The spring and plungers enter tubes welded into the body. To the summits of the front plungers the steering levers are attached, and they are thus entirely enclosed and out of all danger of shock or dirt. The plungers of the driving wheels are coupled by a pair of hinged transoms, thus forming a jointed frame. Between these two transoms is placed the engine, which drives straight on to external helical gear on the wheels. One word must be said about the wheels. They are of the pressed disc pattern, and the tires are a permanent attachment to them. It is only a few years since the pneumatic tire went finally out of use, but it is hardly necessary to say that the tires on the Mass car are not pneumatic.



THE MASS MOTOR CAR.

The Engine

The engine baffles us—though we have our suspicions—and the best course in dealing with it will be, perhaps, to reproduce as nearly as we can recall it, our conversation with the inventor.

"Placed as it is, Mr. Mass, your engine must be of very remarkable design?"

"Yes, it departs altogether from normal motor car practice. All that is visible from the outside are three somewhat similar steel casings. The first we call the generator, the second the motor, and the third the condenser."

"It is not an internal combustion engine, then?"

"Certainly not what is generally meant by an internal combustion engine."

"Might it be described as a steam engine—or steam turbine, perhaps?"

"It would be wrong to do so, for steam is not used in it."

"You excite our curiosity. May we make one guess? A mercury vapor engine?"

"What, with mercury at its present figure! Half the price of the car would go in mercury."

"Can't you give us just a little hint?"

"Did you ever hear of Arnostedium?"

"The liquid metallic alloy? Of course, but—

"Now, no more questions on that route. Switch off. You want to know why there is no differential. I will tell you. Because there are virtually two engines, one to each wheel, although the harmony between the two is automatic and perfect."

"But you make the engine harder than ever to understand. It can't be a turbine—

"You will have to amuse yourself thinking it out."

"I shall buy a car and see!"

"I'm afraid not. When the parts of the motor are in place the casing is electrically welded up."

"But what about repairs?"

"There are no repairs on a Mass car. If you want a new engine, send us back the old one and seven pounds ten. If you want a new front wheel, drop the old one out and return it to us with thirty shillings. We replace parts en bloc, not details, and we set our face against repairs, both because they are absurdly costly and because they are dangerous. When you are using the remarkable materials we employ, to entrust the heat treatment to a wayside smith is just looking for disaster."

"Do tell us one more thing about this fascinating motor. The fuel?"

"A solid fuel. Endothermite."

"Endothermite! You are joking. It is far too dangerous."

"It is far less dangerous than petrol. I agree that ignition once started is irresistible, but consider how difficult it is to start it."

"How do you start it."

"Now, now," said Mr. Mass playfully. "Break away there and come and see how we put our cars together."

The Works

We descended in a lift, and crossing a yard that was a model of tidiness, entered a doorway on the ground floor of a five-storey building. There are at present twenty of these buildings, all exactly the same, both internally and externally, and there is space for the accommodation of at least as many more. A branch railway runs across the front, and brings the raw material to the very doors. At the other end ramps run down to the charging and dispatching houses and to the great store. Around the works extends a trial course, now completely enclosed by hedges and hoardings, so that none of the cars are visible to the public.

In front of the building we entered stood a train of railway wagons full of steel plates. A bundle of these plates was picked up by a magnetic crane and carried right into the shop, where it at once entered a machine which automatically cut the ties and separated the plates. Leaving this machine on a conveyor, the plates were carried in rapid succession to a series of gigantic presses, from the last of which they emerged in the form of one half of a body, with half ends and half floors included. A series of presses lying parallel to the first and working in absolute unison with them was producing similar sides. Two parts left the last presses at the same moment, were brought together by the convergence of the conveyors, and entered the assembling and welding machine. Here nothing was to be seen, but on leaving the casing in which the operation was conducted, the two parts were completely welded into a single part. The car body was then transported to another machine which was connected to the floor above by four trunks. Down these trunks, Mr. Mass informed us, descended the four transoms already referred to. They were guided automatically into their correct positions, and were welded on with the ease and regularity of soldering cans in a tinning factory. The bodies then entered a final welding machine, in which the tubes for the springs were attached, and as they emerged from the end we caught a glance of them in their rapid passage to the painting enclosure. Here they were painted all over, inside and out, by spraying. They then entered a drying chamber of great extent, into which we peeped through glass windows.

Fifteen minutes is sufficient in this room to harden the special paint used. The last operation on the body is lining out, which is performed by paint wheels carried on long arms. The body leaves the final drying room bottom upwards.

The Erecting Towers

We are all familiar with erecting platforms of the Ford type. They travel horizontally. At the Mass works the movement is vertical; and for this reason: The various parts are made on separate floors; to bring all the parts to one floor would cause waste of time. The crescent car passes through the floors and picks up its parts as it goes. Each floor has its own moving platforms which lead to the erecting towers. The journey of the car through the towers is not continuous, but intermittent. There are eight floors in all, four up and four down, and it stops at each floor for about five minutes. In other words erection is completed in forty minutes. The same men, four in all, travel with it the whole way in each tower. At the first floor the wheels with springs are put in position; at the second the engine is dropped into place; at the third, the generator and condenser are fixed; at the fourth, the brakes are fitted and the final adjustments under the car are made.

Up to this point the car has been upside down—a very convenient position for the work to be done. The up-gang of erectors now leave it, and the conveyor carries it round a bend at the top of the building to the down-tower, which it enters in the upright position, standing on its own wheels. In its passage down it receives its upholstery—all made as separate items and attached by clips to the body—steering gear, lighting units and lamps, brake lever, fuel container, etc., and all the connections to the dash—which, by the way, is attached as a single unit—are also made. When it reaches the bottom again it is a complete car and runs on its own wheels to the filling shed. There it receives a charge of endothermite and passes to the running shed, where it is at once boarded by a chauffeur, who takes it out immediately for a run of fifty miles round a special track provided with all sorts of devices for testing every part anl all the qualities of the car.

Fitting, etc.

We have seen something of the manufacture of the parts of the car, with the exception of the engine, but are not permitted to say anything about it. The principle is mass production throughout on highly specialized machines. Some of the tools are like gigantic full automatics. The stub axles, for example, go in as rough drop stampings and emerge machined all over and are borne straight off to the hardening shop and thence to the grinders.

We were informed that not a single gauge is to be found anywhere in the shops, and that not a single measurement of any kind by anyone but a tool setter is permitted. Mr. Mass holds that no gauges are so good or so cheap as the parts themselves. He says that if you make one hundred parts that have to fit another hundred parts, and you take one or two pairs at random and try them together, if they fit it is certain as can be that all the others will do so, too. To put this principle in practice, light high-speed runways traverse the machine shops. Every now and then a boy snaps up a part and drops it into a tray on these runways. It is carried forward to another part of the works, where another boy takes it and tries it against the part it has to fit. Exchange of this kind goes on continuously all day. In the event of a part failing to fit, the boy informs the foreman, who presses a button, and instantly all production of all kind in that building is arrested. This happened two or three times in the early days of manufacturing, but Mr. Mass told us that not a single case had occurred for three months, and he does not see why one should.

Of course, there is no drawing-office in the factory—there is one in the tool works—for there is nothing to draw, and Mr. Mass is resolved that there shall not be. No alteration of any kind will be permitted in the car for at least five years, when he hopes to have written off his whole capital, and can then think about changes—if any are needed

After this all-too-hurried survey of the factory, we returned to Mr. Mass's room. It would be wrong to call it an office, for Mr. Mass holds that the rooms in which we have to pass a very large part of every day should be as attractive and comfortable as those in our homes. "Now, tell me," he said, as we settled down to a cup of tea, "what struck you most in the factory?" We replied that though we felt it was not what we were expected to say, the things that had given us the greatest surprise were the

lack of haste and the lack of noise. He appeared to be delighted with the answer.

"The essence of all progress, the essence of all science," he exclaimed, "is harmony. The music of the spheres is not audible music, but the harmony of movement of the stars in their courses. The beauty of a machine is of the same order—observe the harmony with which the corporate parts interact. So, too, with science of all kinds; the laws of all science are harmonious, and if any law seems to clash with other laws, if it makes a discord with them, we know it is at fault. A great factory, this beautiful factory you have seen to-day, is founded on harmony. All the parts fit together with perfect concord. Of course, there is no hurrying; why should there be? Hurry is the result of a lack of harmonious arrangement. If you tether a donkey with a hackney, the donkey will have to hurry and strain to keep up, but put two hackneys together and they work together with an ease of effort that gives us pleasure to observe. If part of these works were slower than other parts, the slow parts would be donkeys. The secret of success is for all parts to work at the same pace. The departments of this factory are geared together with the exactness and precision of the wheels of a watch. That is why you saw no hurrying.

"You perhaps observed that the factory is cut up into twenty exactly similar units, and perhaps wondered why it was. Let me tell you. Suppose there were twenty men with but one stomach between them; if that stomach got a pain in it, all the men would be laid up at once. But if each man had his own stomach—you see, of course. Each unit of this factory is complete in every detail; it has its own power-house, its own staff, its own operators, its own railway lines, its own plant. Each delivers its quantum of cars quite independently of the others every day. They all feed the common store. The only other things in common are a single selling agency and a single purchasing agency.

"Let us turn to the question of harmony. All our workpeople are in harmony. You will have noticed that there are no women or girls about the factory. Sex is prone to cause discords—that is why. Every man in the place is an original shareholder; every one paid his £50 for his car, and all will receive their cars in due rotation. There is not a man in the place that belongs to a union or is classed as a workman. They are all well educated, many of them highly educated, and without exception they have a taste for art in some form or for literature. They can do anything in the factory, and they all do; we all can. If a man falls sick, it is sometimes my privilege to take his place. I enjoy a week or two in the towers immensely, and the members of whatever gang I happen to be working with treat me exactly like their missing fellow. Sometimes I get terribly chipped because I am a bit clumsier than the regular hands. By moving the men from one job to another their interest is maintained, but nearly all the work is, as a matter of fact, fairly interesting. At least, there is no monotonous drudgery. Whenever drudgery has to be done we get a machine to do it. At first I bought the few chains we used, but when I had seen them being made I resolved never to buy another. Go to a chain factory and you will understand why. It is hateful to me to see a woman or young girl seated all day, week after week, pushing little bits of steel into a punching machine. It is gross degradation of humanity. Machines make all our chains from start to finish. They are complicated machines and the men take great pleasure in them. You saw our little axles being made. In most works single-operation lathes operated by girls would be used for such work. Here you saw them finished complete by machinery.

"You saw also our system of inspection and noticed our nippers picking up parts here and there, and chucking them into the conveyors. Happy young rascals! They only work in the shops for two hours a day—the rest they spend in our school where we are making future men of them—and as you may have noticed, they enjoy the sport. We put lads on the job because we want a little mischief in it. The more tricks they get up to, the more completely they test our interchangeability. The conveyor system keeps a measure of control over them, and their masters, who go into the shops with them exercise beneficent restraint.

"One word more, and that on the question of noise. Noise is absolutely abominable to all of us, both because it is inharmonic in itself, and because it simply shouts of inharmony in the machine producing it. A perfect machine is noiseless. We have not yet reached that state of perfection, but I am delighted that you noticed we were getting near to it.

"There, there, I am monopolizing the conversation, but it is your own fault, you appeared to be interested."

We assured him that we were.

"Are there any points you would like me to explain?" he asked.

"Many," said we. "First, there is the engine. The patent drawings—"

He burst into laughter. "There is not a single patent in the whole car."

"What!" said we in surprise.

"Not one," said he. "After June 1st any one that likes may copy our car. It isn't patents that make success, but the means of production. We have got the start of the world and defy others to catch us up, let them try never so hard."

As I rose to leave him, I addressed a final question.

"No, sir," he said, "we have no agents, but we are arranging depots for spares all over the country. Good-bye. Do come on June 1st and drive one of the cars. There is nothing to learn. Good-bye; good-bye!"

ACCURATE GAUGES OF PLASTER OF PARIS

By Donald A. Hampson.

Every business has its pivot men—men who are scarce and about whose skill the whole fabric swings—men who correspond to the tenor of the opera and the baseball pitcher. In the manufacture of straw hats, there are two such positions and one competent man in each takes care of the wants of a plant of about five hundred other employees. These men are known respectively as the "whittler" and the "moulder."

The whittler is a wood carver de luxe. His work is to make wood patterns or models for all the various sizes and shapes of hat crowns and brims, to make plaster of paris casts from these, duplicates and many other parts that require the hand and eye of an artist. The moulder makes spelter dies from the plaster casts and dresses them up to a degree of smoothness and fit. These dies go in presses and the sewed forms are then pressed into hat shapes to suit the modes of a season. (The hat business uses or has used practically every mechanical movement in its presses and various hydraulic and steam presses as well.)

A whittler named Blake was one of the best in the business and, being mechanically inclined, had devised many improvements in other branches of the work than his own. His broad experience made him a man sought after and he frequently contracted for a year away from the home shop.

It was while he was thus working several hundred miles away that I made the acquaintance of his plaster of Paris gauges. Our experience in the line and the patterns we had gradually made up brought us repair work from distant points. Usually the old parts were sent, but Mr. Blake's method was to make a cast in reverse of the part wanted and send that to go by for the important measurements.

The male piece was always just the size the slot should be planed in the mating casting, and the female piece just how much freedom should be allowed for a sliding fit of the tongue. Without knowing it, some of these gauges that he made were of surprising accuracy, and the fact that they were unaffected by temperature was an important item. Though this man never saw a micrometer, these parts, which he would call ordinary work, could not be made closer than 0.001 in. than they are and show the kind of fit that is wanted.

All of which goes to show that there are other ways than ours, and that this one might sometimes be copied by machinists in general

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The Betson Plastic Fire Brick Co., Inc., Rome, N.Y., have issued a folder descriptive of the Betson one-piece permanent baffle for water-tube boilers.

Troubles in Electric Furnace Operation

Mechanical and Electrical Features of Furnace Design Which Are Liable to Give Trouble if Not Guarded Against. Most of These Are Simple in Themselves, But Cause Much Inconvenience

By W. F. SUTHERLAND

NOT so very long ago an engineer who ought to have known better asked an electrical furnace operator in a Canadian plant just what burned inside and how the heat was generated. While his knowledge embraced a wide range of subjects, it did not extend to the subject of electro-metallurgy. His position in many respects corresponds to that of many plant engineers who have the purchase of equipment of this character in their hands.

In its essentials a comparatively simple mechanism, the proper design of both mechanical and electrical parts has a lot to do with successful operation.

The engineer, purchasing a furnace of any type, should carefully examine its design and the following sources of trouble may serve to indicate some of the weak spots.

The design of the doors is an important item. They should be so constructed as to present considerable resistance to the warping action of the hot interior of the furnace and the guides should be designed with this in view. Reasonable tightness is desirable and the more nearly gas tight the door is, the larger will be the life which may reasonably be expected.

The subject of counterweighting is one which should be carefully studied. Doors which require three or four men on the end of the counterweight lever to open them are worse than useless and money will have to be spent in the remodelling of the equipment.

Electric furnaces are built without exception with removable roofs or tops and the provision for changing roofs should receive attention. Not only should the roof be easily removable but the design should be such that the refractory brick can be laid up easily. It should also be borne in mind that the fewer the openings and the smaller their size —the longer the life which may be expected.

Electrode Gears

Electrode breakage is a very material item of expense in the operation of some furnaces and attention might well be paid to the design of the electrode gear for its minimization. In some designs a jib holding the electrode clamp projects from a structural steel mast and is arranged for vertical travel in this mast. The usual means of effecting this travel is to have wheels fastened to the jib and bearing on the inside of the flanges of the steel members of which the mast is made. It is obvious that the diameter of these wheels must be less than the width between flanges, but if there is much more than ¼ in. clearance trouble may be expected.

With the electrode hanging free in the furnace and not in contact with the charge the bottom guide wheels on the jib bear on the flange of the I-beam or channel furthest from the electrodes and the top ones bear on the near flange.

Should the electrode travel downwards until it is in contact with the charge, the position of these guide wheels is reversed owing to the release of the weight and the pressure upwards. This results in the turning of the electrode through a small vertical angle, depending on the wheel clearance and if the latter is of sufficient magnitude the electrode will likely bind on the charge and roof-ring of the furnace or may pinch in the electrode hole with resulting breakage. In one case, it was no uncommon occurrence to break several electrodes during the course of the day's run from this cause alone.

The jib is usually raised and lowered by means of a wire cable running over sheaves to an electrically operated winch. The method of attaching this cable is of some importance, for if it is simply passed through a punched hole in a plate cutting may be expected. Thimbles should always be used for the fastening of cables in this manner.

Mention has been made of the clearance of the jib guide wheels in the mast. Of almost equal importance is the clearance in a direction at right angles to the former. If this is not made of small amount, the electrode and its supporting mechanism will wobble sideways with harmful results.

The tilting gear is of much importance and it is essential that the motor be of a rugged type and its location well protected from splashings of hot metal and flying slag, to say nothing of the miscellaneous foundry dirt which is sure to find its way into the pit. The tilting motor control should be of an extremely rugged type and totally enclosed. All connections should be made in conduit.

A worm gear drive is usually incorporated into the tilting mechanism and it is of importance to notice that the worm gear should be of bronze. Cast iron is not a suitable material and is liable to cut. For the sector gears cast iron is suitable if the proportions are correct and allowance made for the heavy work which has to be performed. In some types of furnaces the sector gears take more than half the total weight of the furnace, and the importance of proper design can hardly be overestimated. Any failure of the tilting mechanism when pouring involves much inconvenience and at times considerable loss.

Direct current is usually used for operating the electrode and tilting motors when it is available and in this case dynamic breaking is usually resorted to. When alternating current is the only kind available, recourse must be had to solenoid-operated brakes for checking electrode travel and tilting. In this case, it is important to properly proportion the solenoid for proper current carrying capacity coils for heat dissipation. Burned-out coils are a source of annoyance and expense which can easily be obviated by proper design.

With automatic regulation it is important to see that a no-voltage attachment is provided. Without it, if the power supply is cut off through line failure the transformer switch opening, the regulator immediately starts the electrode travelling downwards with disastrous results to the electrode or its gear. With the no-voltage feature the regulator immediately ceases to function and the electrodes remain stationary unless hand control is used or until the power comes on again. It is important also to notice whether this no-voltage feature functions properly. If it does not, it is worse than useless since it only gives one a sense of security which is utterly false.

Ammeters are usually provided and in most cases they are installed in the regulator circuit. Care should be taken to see that they are of the proper scale to correspond to the current transformers. Thus, if the current transformers have a ratio of 4,000/5 amps., the ammeters should show a full scale deflection of 4,000 amperes when traversed by a current of 5 amps.

The ammeters should also be correctly installed in the secondary circuit of the transformers. This circuit is essentially of the series type, although modified by a parallel connection to the regulator rheostat. The ammeters should be installed in such a manner that all of the current generated by the secondary e.m.f. of the transformer passes through them and so that none of it is shunted by the rheostat above mentioned.

Low Tension Leads

Soldered connections should never be used on the low tension leads since any local heating is sure to melt the solder. Lugs should be cast on the leads or clamp connectors, if used, should be designed for ample current carrying capacity.

It is preferable to have an inverse time limit relay installed in connection with the transformer oil switch. This feature minimizes outage time particularly in the breaking down period.

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Queer Ideas About Schools

THE chairman of the Toronto Board of Education is Dr. Noble. In his remarks at the first of the year on the occasion of the first meeting, he is reported to have said that he would not teach a child to read until a desire was created to get information from the printed page. Spelling he would teach hardly at all and geography only incidentally. "Why teach arithmetic in an age when we have adding machines?" he asks. Dr. Noble would have cafeterias, dancing, swimming tanks, etc., also movies.

Toronto is the reputed educational centre of Ontario. It is quite right that other places should look to this city for sane leadership in these matters.

It has not been claimed that Dr. Noble was misrepresented, and so it seems that his strange statements must stand.

"Why teach arithmetic in an age when we have adding machines?"

There would be equal sense in crying out: "Why teach or allow children to walk when we have automobiles?"

The adding machine is representative of fine mechanical work. It is a triumph to the brains of skilled inventors, designers and mechanics. Had Dr. Noble's childlike philosophy been in vogue, there would be no adding machines, there would be no gramophones that he urges for the schools.

Ask the mechanic who takes his trade seriously if he regrets having learned arithmetic. He will tell you that his regret was not that he learned it, but that he did not learn more of it.

Then there is that strange idea of not teaching the child to read until a desire had been created to get information from the printed page. Follow that to its logical conclusion and we have this: If the child has no desire to secure this information, let him slide. The sliders would be more numerous than those who had been roused by "the desire to obtain knowledge from the printed page."

The school system of this country should, more and more, bend to the practical. There are enough frills hitched on it now.

As far as this paper is concerned, we would much rather take the word of a man like Robert Patterson, of Stratford, who for 20 years was Master Mechanic of the Grand Trunk shops at Stratford, and an outstanding success in the matter of training apprentices. Would he urge less attention to mathematics in the schools? Not much. He would urge more attention. Would he pile on frills at the expense of essentials? He would not.

Only a few weeks ago CANADIAN MACHINERY discussed these matters at considerable length with Mr. Patterson. His criticism of our education plan is not destructive, like Dr. Noble's. His ideas are constructive. He favors teaching boys in the shops, and teaching them the subjects they must excel in in order to be leaders in their trades. He realizes that the tendency of the age will, of itself, keep boys from taking work or education too seriously. He has seen too many boys, from a lack of education, from habits of drift formed in their plastic years, shuffle off into the world with nothing to sell but their brute force to do hard, manual labor.

It is too bad that Dr. Noble had not taken the trouble to consult the industrial leaders before letting fly his half-baked ideas about freak schools.

New Cause For a Strike

THE president of the One Big Union in Fernie, B.C., is William Potter. He got on the train that runs up to the mines at Coal Creek, but would not pay his fare. He was ordered off, and as a result the miners refused to go to work.

Coal Creek, by the way, is the place where the Crow's Nest Pass Coal & Coke Co. operate. It is five miles from Fernie, but nearly all the miners live at Fernie, for the very good reason that the mountains have not left enough room for them to live at Coal Creek.

In one way we're inclined to agree with Bill. Perhaps he reckoned his ride up on the mine train was not worth paying for. That has always been an open question. The best commentary on the train is that in fine weather most of the men prefer to sit around the edge of flat cars.

But Bill getting put off the train was enough to keep the morning shift out of the mines. It was, in fact, an enormous offence. The idea of the president of the One Big Union being forced to leg it up to the mines is sad. Going up to the Creek is a stiff grade—it goes up some 500 feet in five miles. Had he been kicked off on the down trip our sympathy would not be disturbed. None of it would be carried off and handed out to One Big Bill.

For years past One Big Unionists and Socialists have been telling the miners and others that some day they would own the mines and everything else. That seed probably got in behind Bill's ear and sprouted. Who knows but on that day he imagined that he had a real honest-to-goodness claim on the mine train? Small wonder that William, as he gazed upon the conductor, recognized in him one of his hired men, and felt quite within his right in telling him to be gone when he asked that Bill should decorate the incoming side of the company's books with his fare that day.

The labor market of British Columbia must be in queer shape when the mines at a camp the size of Coal Creek deem the chucking of Bill from the train for not paying his fare to be sufficient cause for shutting down the mines for the day shift.

Publicity For Canada

THERE has been a great deal of advertising of one kind and another done for Canada, some of which, like the ice palace in Montreal, might have been well dispensed with. The Canadian Pacific Railway has been doing some real constructive advertising in Great Britain lately, which cannot fail to be of value to the Dominion. This has taken the form of illustrated lectures, the illustrations being carried out by a moving picture machine, showing the industries of the country in active operation. The first lecture was given in the Central Hall, Westminster, and the industrial views were preceded by a series of scenic subjects, which practically covered the Dominion. Then a film was shown which covered the paper-making industry, from the cutting of the tree, through the logging road, the drive to the mill boom, the sawing, barking, chipping, cooking, and so on to the finished product. The interest manifested by the audience was intense. Following this came a review of the wool industry, likewise traced from the back of the sheep to the finished cloth. Then came the asbestos mines of Quebec, and it was once more demonstrated that the bulk of the world's asbestos supply was concentrated in that Province. The explanatory lecture was introduced by a speech from Sir George McLaren Brown, European manager of the Canadian Pacific Railway, who emphasized the necessity of cementing the component parts of the Empire together in such a manner that disruption would be impossible. Educative propaganda of this kind is of the utmost benefit to Canada, and should have the effect of inducing the very best kind of immigration. We must have immigration if the great resources of this country are to be developed as they should, and scenes from the actual life of the country are a much better means of persuading the intending settler than the doubtful methods employed in the East by unscrupulous immigration agents.

Building up the Liner Fleet

REPORTS from England tell of the launching of two purely passenger liners, one for the fleet of the Pacific Steam Navigation Company, and one for the Anchor Line. These vessels are noteworthy for the fact that they are the first vessels built since the war of the purely liner type. By this it is not meant to convey that they are of the New York route class, but they are designed as liners, and not cargo boats. They also tend to illustrate the lines upon which the replenishing of the passenger fleets of Great Britain will be carried out. The luxurious fast passenger vessel of the "Lusitania" and "Aquitania" class will not be built in the immediate future. The need is for the intermediate type of passenger boat, with a moderate speed of 17 to 18 knots, having ample passenger accommodation, coupled with a relatively large carrying capacity. They will be economical of fuel, and in many cases, in fact, the majority, will be fitted to burn oil fuel. The propelling machinery will be geared turbines. Many of the existing ships of the large passenger lines are being converted from coal burners to oil burners, the greatest of all being the "Aquitania," which is being altered and reconditioned at the yards of Armstrong, Whitworth on the Tyne. The Cunard, Anchor, Anchor-Donaldson, and Anchor-Brocklebank lines are building between them 34 ships, aggregating about 400,000 tons, every one of which will be oil burning, and geared turbine driven. While standardization, as it was understood during the war, cannot be applied to these specially-designed ships, shipowners will build numbers of vessels to the same design, thus allowing them to order all the material for a series of ships well in advance, to the same specifications. The building of the liner fleet, which is so much needed to maintain Britain in the forefront of the maritime world, will proceed from now on with speed and regularity, till she is once more in the forefront, where she can be trusted to remain.

Inaccuracy in Reports

WHILE the average technical article is reliable, and great care is taken to make it so both by the author and the editorial staff of the paper in which it appears, still occasionally someone slips up and an error or false statement palpably inaccurate creeps in. We are referring to a recently-published statement in connection with radiation loss. The point at issue is in the figure of 502° appearing on a chart as the temperature of the exterior wall of the setting. This is pretty warm.

An Iowa inventor has obtained a patent upon a unicycle that is driven by an electric motor and prevented from falling by gyroscopic fly wheels.

On the principle of spring window shades, but operated horizontally, an index that can be attached to desk telephones has been invented.

An international exhibition for the reconstruction of the industrial, agricultural and commercial life of France will be held at Lille from May until October, 1920.

Flames from an oil or gas stove do not come in contact with the food cooked on a new broiler, which consists of hollow tubes, through which pass heated gases generated in a combustion.

A subterranean river in the Philippines is navigable by small boats for two and a half miles from its mouth, passing through several large stalactite hung caverns.

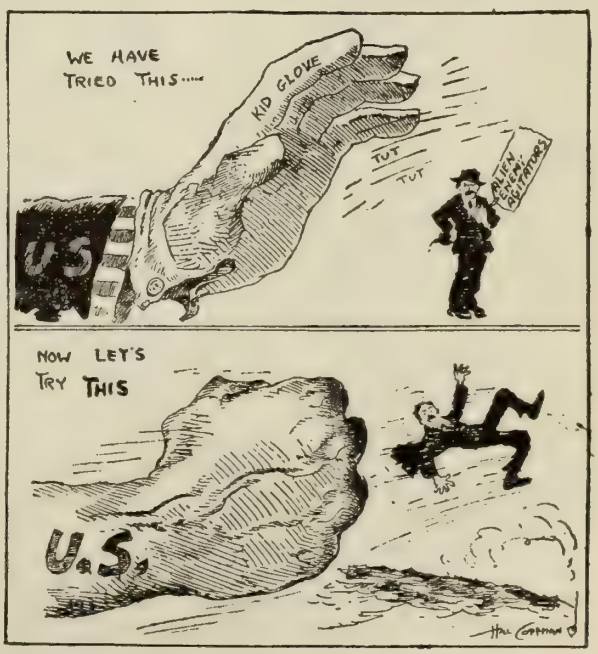
A partitioned metal tray has been invented that telescopes to fit a desk drawer of any size.

An inventor has equipped the back of a small brush with rubber suction cups to hold it on a wash bowl or other smooth surface for the convenience of one-armed persons.

Chiefly for photographing machinery, a camera has been invented large enough for a man to enter it to change the plates.

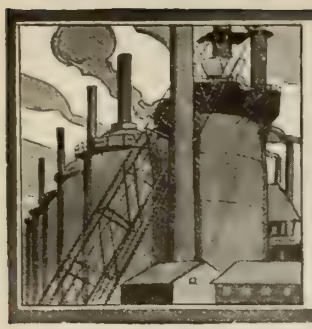
To make a motorboat of any craft, an inventor has mounted an engine, shaft and propeller in a hollow fin which he used to replace the boat's keel.

An automobile speedometer has been invented that can be set to regulate the speed of a car and prevent it being



ABOUT TIME.

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MARKET DEVELOPMENTS



High Prices and Shortage Still Here

Little Material in Warehouses—Pipe Prices Advance—Production in the Steel Mills is Still Behind—Future Chances of Catching Up Are Not Certain

IN practically all branches of the steel trade a shortage is noticed. There is the same story of depleted stocks from warehouses, and production in the mills nowhere near catching up with the demand. Under these circumstances, there is no difficulty in getting premiums, and sheet mills that have been getting $10 for first quarter, have placed business for second quarter at the same rates. Whether the scarcity will continue into the future or not is a question on which the experts differ. Some think it is a temporary effect caused by the strike, and other adverse factors, and that the mills will catch up when given a reasonable time. Others incline to the opinion that there will be heavy buying by the railways in the near future that will effectually preclude the chances of replenishing stock. The coke situation is improving, but not rapidly enough to suit all parties concerned.

In Toronto there has not been so much activity this past week. Climatic conditions may have something to do with this, and it is expected that a revival will take place with the coming of spring. There has been a good business in small tools, and a large enquiry is out for the Canadian National Railways. Warehouses here are just as short as any other centre.

There has been some good buying in the New York market, in machine tools, a good percentage of which was for woodworking machinery for shipyard use.

MONTREAL STILL SHORT OF BLACK AND GALVANIZED SHEETS

Special to CANADIAN MACHINERY.

IT is reported by local steel dealers that the demand during the past week has declined slightly, but the volume of business is comparatively fair in view of present conditions. The prospect for greater production is looked for in some quarters as a result of the recent calling off of the steel strike, but it is the opinion of some of the dealers that this development will have little material effect upon the operation of the mills, as the situation has gradually adjusted itself until at the present time there are few men still out. It is believed that the early return of the American railroads to the former owners will be the signal for the placement of large orders for railway equipment, and the heavy inquiry for plates is some indication of early future developments. The tube situation maintains its strong position, with supplies hard to obtain. Current prices, in general, show an advance over those of last week, although some prices are never lower. On some of the smaller sizes of seamless the prices are a little easier, but tend upward on the larger tubes. Four-inch is now $85 per hundred feet, an advance of $10 per hundred. Lapweld prices show an approximate advance of 5 per cent. over those last quoted; 1½-inch are now $28, and four-inch are $58.75.

The feature of the week is still the marked scarcity of all classes of sheets, both black and galvanized; it is almost impossible to obtain any of the former and the inability to obtain these keeps the galvanizers from operating at capacity. Warehouses are completely stripped of the majority of sizes in black and galvanized sheets. The prices quoted are those accepted for delivery at convenience. Urgent requirements for 2 to 3 months' shipment are sometimes made at premium prices, but definite data in this regard is difficult to secure. The early spring demand may occasion a much stronger market with a corresponding advance in prices.

Strength Still a Feature

A strong market still prevails in nonferrous metals, and a fair demand marks the week's activities. Copper has fluctuated a little and the current quotation shows a higher price than last quoted. Lake is 25½ cents and electro 24½ cents, an advance in each case of ½ cent per lb. The strength of the English tin market has been reflected here and a nominal price of 72 cents is the base of dealer's quotations. Lead is stronger on good demand, the price of 10¼ cents representing an advance of ¾ cent per lb. Antimony is also ½ cent higher at 12 cents per lb.

Manufacturers Meet Exchange

The delivery on new equipment continues to be the feature of machine tool activity, as shipment of tools coming in from the States cannot be guaranteed for many months. The average period is from six to eight months, and in some instances 1921 has been specified. The rate of exchange now effective is causing some anxiety on the part of both manufacturer and purchaser, and this factor of present business has a tendency to place considerable more business in the hands of Canadian firms than would otherwise be the case. Some American firms are taking this situation into account and dealers here report that U. S. manufacturers are willing to meet prospective buyers on the question of exchange and allow for same if necessary.

Apart from the high exchange rate the tendency is for higher prices on many tools. The week's transactions denote a quieter inquiry for new machines. The demand is widespread and general in character. Considerable business is still done in rebuilt machine tools.

Machinery Scrap Still Leads

With the possible exception of ma-

chinery scrap, which is still to the fore as regards demand, the general situation is comparatively quiet and dealers report few developments of an interesting character. There appears to be a revival in the inquiry as to steel and iron scraps, but little to indicate that buying in the near future will be out of the ordinary. Dealers here state that the market is quite firm, particularly in irons, but some lines of non-ferrous scraps are weakening. Prices, however, are unchanged, but should be considered as nominal.

IS STEEL SHORTAGE OVERRATED NOW?

Some Think So, But Fact Remains That Warehouses and Stock Racks Are Empty

TORONTO.—Business has not been particularly brisk during the week in the Toronto field. It may be that the weather has had the tendency to keep people away from here. Inquiries have been fair, though, and it is fully anticipated that the coming of spring, with its attendant expansion, will see a revival of business in all lines of machinery, small tools, steel, iron, etc.

One of the big questions is that of catching up with the orders that are already on the books of machinery and steel houses. There is a feeling, expressed quite often, that the shortage of steel is being exaggerated in some cases, not so much as affecting the present figures, but in regard to the ability of the steel mills to bring up their production figures to something sufficient to give consumers all the steel they want in reasonable delivery time.

Against all this sort of talk is the fact that there is a shortage in the warehouses. There is a shortage in the stock racks of the consumers. This does not apply only to Canadian, but to American conditions as well. One of the warehouse men who has returned from the States reports that affairs are even worse there than they are in Canada.

"I went to Cleveland, Chicago, Pittsburgh, and other of the best warehousing centres. I wanted to see what the condition was there, and if we were any worse off than those in the same business across the line. There does not seem to have been the same rush of business here as there, for the warehouses in United States are cleaned out entirely in many of the much wanted lines. They are, for the most part, staying with the price schedule that was announced on March 21, but they have nothing to deliver, so what difference does their price list make? The scalpers and the adventurers have been having a good innings lately," he continued. "I believe they can get about any price that comes into their head to ask for. As far as I could see, they were not looking for any immediate relief to the situation, as the mill deliveries are not improving to any extent.

"For instance, it is almost correct to say that you cannot buy tubes now. The warehouses where I visited couldn't sell them because they didn't have them, and saw no chance of replenishing their stocks. Here is something that will show the way some of the prices are going in the States: A firm in Cleveland got a line on 500 tons of blue annealed sheets. Now, remember that the March 21 price was 3.55 base for these, and then put it down that the price asked for this 500-ton lot was 6.50."

This line of material is used largely for tank work, smoke stacks, etc.

There is still some difficulty in securing shipments of British-made goods for this market, but, according to several of those who are following the situation closely, there will be an improvement in the not far distant future.

Progress is being made in putting the war material on the market here, but much of it is scattered in several shops, and it makes it very hard for those in charge to get out definite lists to send to the trade. There was a quick clean-up of desks, chairs, typewriters, and other lines of office furniture that the Ordnance Department had to offer, and practically all that material has gone.

The Machine Tool Market

The buying of equipment for the St. Malo shops of the National Railways has been one of the largest lists sent out to the trade this year. There are some 13 tools in all, and tenders have been sent in by several of the dealers in this district. There is some little criticism regarding the way the Government buys. Dealers claim there is such a long time between the date the tender is put in and the time the business is placed. In that period there is apt to be several changes in prices.

One firm making several lines of grinders announce a five per cent. increase at once.

Dealers handling small tools report a good business. In fact one of these dealers stated that he had done as much business in a week in January than he had turned over in the whole month last year. Deliveries are none too good on some lines of cutters.

POINTS IN WEEK'S MARKETING NOTES

Sheet mills find no trouble in securing a $10 premium.

Foundry pig iron is selling for last half of 1920 at $39, Buffalo.

The belief that railroads would be very much in the market for steel seems to be doubted in some quarters, as the roads will have financial troubles to attend to them.

Most of the large jobbers in United States are selling on the March 21 list, but they have a scanty assortment for sale. The scalpers and adventurers are making merry, though, over all material that comes their way.

Some of the independent pipe mills announce an advance of $10 or $11 a ton on oil country goods.

One maker of grinders announces a five per cent. increase, effective at once. They are paying more for their castings, and other charges have also increased.

An effort is to be made to keep bar prices in Toronto at 4.75, rather tha allow a higher figure.

The National Railways are getting tenders on a list of a dozen or so large tools for the St. Malo shops.

NEW YORK HAS A QUIETER MARKET

THERE ARE SEVERAL FIRMS THAT ARE DOING BUYING ON A FAIRLY LARGE SCALE

Special to CANADIAN MACHINERY.

NEW YORK, Jan. 22.—The largest buying of the past week has been done by the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., whose purchasing department is in the Woolworth Building, New York. The total requirements of the shipbuilding companies is about 250 machines, of which a considerable part is woodworking machinery. Some of the orders were tentatively placed before the close of the year, but confirming orders are just being given.

The Savage Arms Corporation, Utica, N. Y., is inquiring for machine-tool equipment for the manufacture of ball bearings. The Otis Elevator Co., New York, is doing a little buying to round out its recent purchases. Westinghouse, Church, Kerr & Co., New York, are buying the equipment for the extensions of the American Rolling Mills Co., Middletown, O., which will probably include some machine tools.

The General Electric Co., Schenectady, N. Y., continues to buy for its Rochester, N. Y., plant, and has issued new lists totalling about thirty machines.

Otherwise the market is somewhat quieter than it has been for several weeks.

ANNOUNCEMENT

General Forgings and Stampings, Ltd., is the new name of the Canada Pole and Shaft Company, Ltd., Merritton. This change of name has been found advisable owing to the fact that the business has been gradually changing from that of a pole and shaft and woodworking business to that of a forging and stamping business. For a considerable period the company has been operating only on automobile forgings and stampings. This line will be followed exclusively from now on.

IS FUTURE TOO MUCH DISCOUNTED ON THE SHORTAGE IN STEEL MARKET?

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 21.—The pig iron and steel markets present certain appearances of growing stronger. Sheet mills that had been obtaining $10 a ton premium, or thereabouts, on first quarter contracts have lately been able to place some contracts for second quarter at the same prices. Some foundry pig iron has gone for the second half of the year at $38 to $39, both f.o.b. valley furnaces and f.o.b. Buffalo furnaces. These, and a few similar items, would suggest that the period of scarcity, which has produced such high prices of late, is expected to be prolonged.

It is too soon, however, to draw general conclusions. Fundamental conditions, particularly financial conditions, are very far from satisfactory, according to the views of nearly all bankers. Then there is the fact that anyone can ascertain by just a little investigation, that the steel market has been relying on some favorable factors that do not really exist. There is, for instance, the expectation, generally entertained, that the railroad companies will be larger buyers immediately, or soon after the lines are returned to their owners March 1. If that were the case, as it seems to be generally assumed in the steel trade it is, railroad men themselves would, presumably, know something about it; but it is quite plain that what railroad men have on their minds at present is the group of serious financial problems they have, to finance the debts they will owe the Government for improvements made during the control period, making it that the lines will be returned to their owners in better condition than when received, and to finance various obligations to mature in the near future. In other words, the steel market appears to have discounted a favorable development that is not going to occur.

Another reason that makes it unsafe to assume that scarcity of pig iron and steel will continue indefinitely is that not enough time has elapsed to test the effect upon the situation as to supply and demand of increasing production. Just now the consuming industries are feeling keenly the effect of the curtailment in production due to the iron and steel strike. While the strike, as a strike, was almost over by December 1, the scarcity of fuel produced by the coal strike, and the car shortage that developed promptly upon the resumption of mining, have operated to retard greatly the resumption of full activity by the iron and steel industry. Even at this date, the production of steel has scarcely returned to the rate obtaining in September, just before the strike started, that rate having been in the neighborhood of 83 per cent. of capacity. When pig iron and steel production rise to 95 or 100 per cent. of capacity, the situation will, presumably, be altered. It is true there are some in the producing ranks who speak as if there is little hope of the industry operating efficiently, and they may be right; but it certainly would be a curious situation for the merchant blast furnaces and the steel mills to be unable to operate satisfactorily, but for the customers of these producers to be able to operate well and to be prepared to take maximum tonnages of their pig iron and steel materials.

Coke Supplies

Production of coke has been increasing steadily at the by-product ovens since the middle of December, when coal was released, as a result of the mining settlement; but the increase has been slow, and much slower than desired. Production in the Connellsville region suffered a back-set at holiday time, while since then it has been at the same rate as obtained the week before Christmas. The Connellsville coke operators have been complaining loudly of car shortage; but it must be remembered that the shortage is in relation to the increased production they desire and their customers desire. In the past three weeks they have been getting as many cars as they were getting before Christmas. The coke supply prevents a number of idle blast furnaces from blowing in, and a few furnaces actually in blast have had to run at less than capacity because of not receiving full supplies of coke. In active times industrially, a shortage of coke at this time of year is the rule rather than the exception, and the shortage is generally relieved before the end of January. In this instance, the shortage may last longer; but even at that, the balance of probability is that there will be an ample supply by the time the worst of the winter weather is over. Present prices, under Government control, $6 for furnace and $7 for foundry, per net ton at ovens, Connellsville region, are very profitable to the producers; but when Government control is removed, the furnaces will be quite willing to pay still higher prices, if they are needed to stimulate production.

Pipe Advance

Several of the independent pipe mills have advanced oil country goods for $10 or $11 a ton, and they can readily obtain the advanced prices for such deliveries as they can make in the next few months, since the producers holding to the old prices are filled with business for a long time to come. Advances in standard steel pipe are also being made. While it is stated there is no concerted action, it is very probable that all but one or two of the independent pipe mills will advance their prices three and a half points, or about $7 a ton, thus putting their card on a 54 per cent. basing discount that ruled from December 12, 1918, to March 21, 1919, when the 57½ per cent. basing discount was adopted, at the time of the Industrial Board's efforts to stabilize prices generally.

Pig Iron

The foundry iron furnaces are sold up tight for several months, and orders for prompt lots can be placed only at premiums, $40 valley being a relatively low price for single carloads of No. 2, while for extended delivery, say late in the second quarter or for second half, the market is firm at $38, valley. A carload of high silicon iron, 3.00 to 3.25 per cent. silicon, has just sold at $46, valley. Bessemer and basic, on moderate sales, are up $2 a ton, to $37, valley, for basic and $38, valley, for Bessemer; but these grades are cheap relative to foundry iron.

There is better news in the nail trade. For some reason or other, the steel strike affected the wire mills, as a whole, more than other branches of the steel industry, and the nail-making departments were especially hard hit. When the strike was practically over elsewhere, nail production was still relatively light. In the past ten days, reports have been of employment being much better in nail departments, and of production increasing very decidedly. The market does not reflect, as yet, any loosening up in the supply, as independent mills are still able to get $4.25 to $4.50 for deliveries over a few weeks, against the American Steel & Wire Company's settling price with its regular trade, which has been $3.25 ever since last March. The great shortage in production is evidenced by the high prices obtained during a period when nails were really out of season.

VENEERING PRESSES

The West Tire Setter Co., Rochester, N.Y., are manufacturing a gluing press that is adaptable to the requirements of paper box and veneer factories, piano, furniture and other woodworking concerns. It is of the hydraulic type, equipped with a belt-driven pump, and is built in various sizes, according to specifications. One of the presses was recently installed by a concern manufacturing cedarized cigar boxes, in which the stock consists of paper veneer over a wood body.

The company reports good business from France in heavy motor car wheel-setting machines.

It is commonly supposed that the Thermos flask was invented in America or Germany. The real facts have been made known by the successful application by Sir James Dewar for an extension of his patent, No. 13,638 of 1904, for, inter alia, the application of a method of absorbing gases to the production of high vacua. In scientific books the Thermos is called the Dewar flask.—Engineering.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Steel bars, 2 in. to 4 in. base	6 00
Steel bars, 4 in. and larger base	6 50
Iron bars, base, Montreal	4 25
Steel bars, base, Montreal	4 25
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	72 00	60 00
Spelter	11 50	10 75
Lead	10 25	8 75
Antimony	12 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld		
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld		
2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Boray crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill ..... list plus 5%
At warehouse ..... list plus 25%
Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 25
Premier, 10¾ oz.	....	9 65
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.
Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.03

Prices per lb. unless otherwise stated

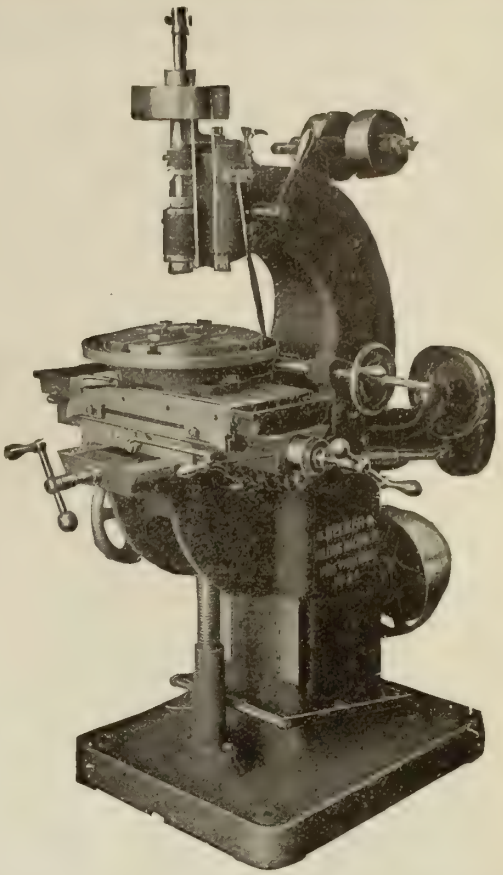
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Belt Driven Millers

The Machine that gives the Smooth Finish

Stringent shortage of labor during the war put a premium on machinery of superior productive ability. Never was the capacity and value of Becker Millers better emphasized than during that period. And Becker Millers will always continue to demonstrate their ability to return maximum production for minimum expenditure of manual effort.

Send us blue prints of your work and other data and we will submit estimates on Becker production. Adopt this "safety-first" course; it may mean added profits to you.



The A. R. Williams Machinery Co.
LIMITED, TORONTO

Acid Electric STEEL CASTINGS

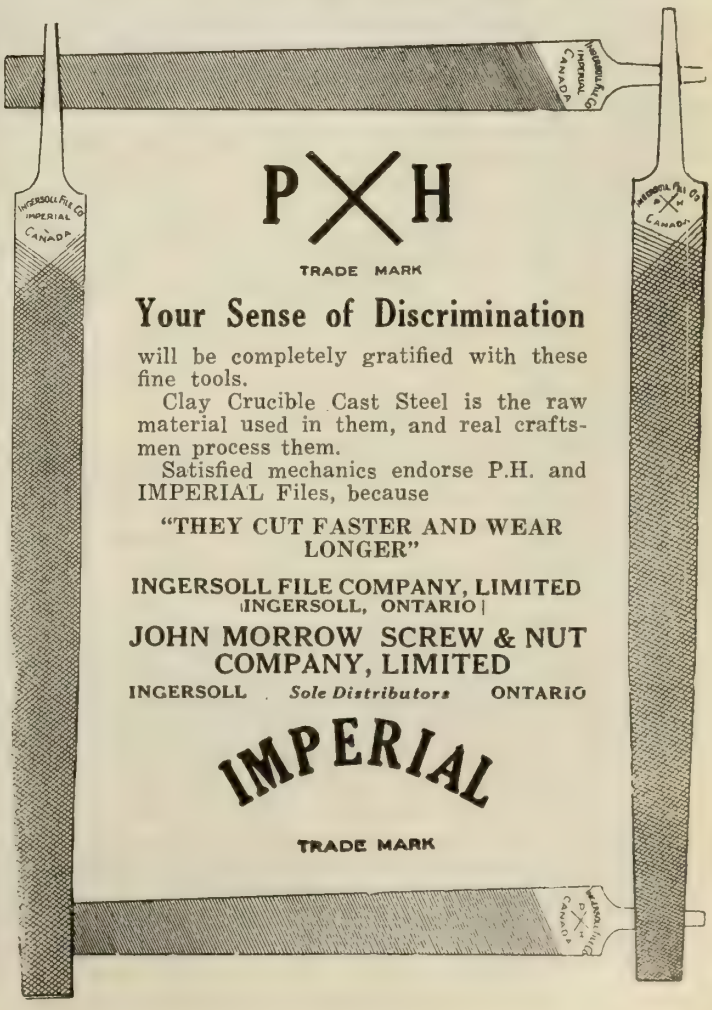
Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

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Steel Foundry Division, Lachine Canal
Head Office: 187 Delisle St. MONTREAL
Phone Victoria 1492



P H

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Your Sense of Discrimination

will be completely gratified with these fine tools.

Clay Crucible Cast Steel is the raw material used in them, and real craftsmen process them.

Satisfied mechanics endorse P.H. and IMPERIAL Files, because

"THEY CUT FASTER AND WEAR LONGER"

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(INGERSOLL, ONTARIO)
JOHN MORROW SCREW & NUT COMPANY, LIMITED
INGERSOLL *Sole Distributors* ONTARIO

IMPERIAL

TRADE MARK

The Week's Events in Montreal Industry

During the past week the Montreal branch of the Manufacturers' Associations has been busy distributing some 200 of the latest industrial census forms for the Dominion Bureau of Statistics. These forms should have been filled out a year ago, but many firms neglected to do so. Every effort is being made to compile these statistics at an early date to avoid the penalty provided for in the Order-in-Council enforcing the sending in of such information.

It is reported that a settlement for compensation may shortly be made to Sir Chas. Ross for the use of the Ross Rifle Factory during the war. It will be remembered that the plant was taken over by the Government and following the expropriation the owner filed a claim for damages to the extent of $18,000,000. The action has been in abeyance for some time, but the Government has again opened negotiations with a view of making an award for the use of the property, which will probably be around $2,000,000.

Canada's present standing and her future possibilities cannot be better shown than by a statement appearing in the recently published annual of the Port of New York. In part it reads: "An interesting point is the fact that Montreal, if a port of the United States, would rank second or next to New York, the value of the foreign commerce now exceeding $700,000,000 in value. As it is, Montreal holds second position in the value of foreign commerce among the ports of the American continent." In regard to other phases of Canadian activity, it is interesting to note the favorable comment that is made in connection with the proposed canalization of the River St. Lawrence, and the bearing it would have on supplying the central American States through the medium of comparatively cheap water transportation.

Many prominent engineers and Government officials are expected to attend the annual business and professional meeting of the Engineering Institute of Canada, which will be held at the Windsor Hotel, Montreal, on January 27-29. The preliminary work of the convention will be conducted by the retiring president, Lieut.-Col. R. W. Leonard, of St. Catharines. Following the elections, which will take place on the first day, the new president, R. A. Ross, one of the Commissioners of Montreal, will take charge of the proceedings. The first session will be devoted to the discussion of training of engineers, while the second will consider the education of engineers in provincial industries and the activities of the Provincial Government in relation to water problems.

POOR HEALTH FORCES MR. HUMPAGE OUT

General Manager of Wilt Twist Drill, of Canada, Leaving Shortly for the South

Mr. F. R. Humpage, Vice-President and General Manager of the Wilt Twist Drill Co., of Canada, has resigned his position, to take effect March 31st, 1920.

Mr. Humpage has been in ill-health for some time, and felt it necessary to divorce himself, for the time being, from all business activities, and is leaving for Miami, Florida, the latter part of January, where he expects to remain a sufficient length of time to secure entire restoration of health.

Mr. Humpage has been connected with this company for about three and one-half years, during which period of time he has been successful in more than trebling the output and sales of the factory, and has also added new lines to the company's products, among them being that of the manufacture of reamers and milling cutters on a large scale, and more recently the manufacture of a full line of special Ford reamers.

During the three and one-half years, this company has arisen from one of comparative obscurity to that of a leader in its line of business, one indication of that growth being that they are one of the largest users of high-speed steel in Canada.

Mr. Humpage has always taken an active interest in all matters pertaining to manufacturing in Canada, and has been instrumental, and particularly active, in endeavoring to raise the standards of the drill, reamer and cutter manufacturing industries in Canada.

He has always been a strong advocate, and has put into practice the idea of selling the company's products on a cost plus a reasonable profit basis, and also the proper protection of the jobbers, and this, together with the large export business which has been successfully developed during his regime, has been most instrumental in the great development in the company's business which has taken place during that period.

Mr. Humpage has been active in other lines, among them being the development of a cleaning compound, which he expects to place on this market as soon as his health is entirely restored and he is again able to take up active business.

ARE TURNING OUT LOCOMOTIVES NOW

Old Country Firm Has Turned From War to Peace Lines in Short Time

Locomotive Engines.—The vast new locomotive shops that have been equipped and organized at Scotswood-on-Tyne, by Armstrong, Whitworth & Co., are probably as remarkable an example of the change-over from war to peace production as the United Kingdom, or any other country, can show. For many years before the outbreak of war, these Scotswood works had been devoted to the manufacture of armaments. The site, on the banks of the Tyne, is over a mile long, and a large staff of skilled men are making locomotives on orders from many countries, amounting in value to over £3,000,000. It is said that orders have been secured from every country in the world except South Africa.

Not one per cent. of the old machinery, it is stated, has been of any use for the new industry that has thus been founded on the Tyne; and yet, after only eight months of reconstruction work, the shops are approaching full capacity of output, and full capacity will, it is anticipated, be attained next April.

Great interest was taken in the official trials of the first railway engine constructed by Armstrong, Whitworth's, at their Scotswood works during this month. A large company was present when Sir Vincent A. Raven, chief mechanical engineer of the North-Eastern Railway Company, from whose designs the engine was constructed, drove the vehicle through a barrier of national colored ribbons. The new engine is one of fifty that are on order for the North-Eastern Railway Company, and two more are ready to be delivered; then the output will be one per week for three weeks, and eventually it is hoped to produce three each week. The new engine structed for heavy goods traffic, and has 20-inch cylinder, with 26-inch stroke; the hauling capacity is, approximately, 1,000 horse-power; and many special features are embodied in the new engine. All the material parts, such as boiler plates, wheels, frame plates, connecting rods, piston rods, etc., have been made at one or other of the various works of the Elswick Company, at Openshaw, Manchester, or Elswick.

GEOMETRIC



SELF-OPENING DIE HEADS

"YOU CAN'T BEAT 'EM"

It is not the manufacturers of Geometric Self-Opening Die Heads who make this statement, but the users of the tools.
This is the reason that besides being the originators, we are known as the

LARGEST AND BEST KNOWN MANUFACTURERS OF AUTOMATIC THREADING TOOLS

The big question is: Have you applied Geometric Screw Thread Cutting Tools to your threading work?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.

If interested tear out this page and place with letter s to be answered.

PIG IRON TRADE

Selling of basic iron in large quantities is now in evidence. The sale of pig iron for first half is also swelling in volume. Following are reports from various U.S. centres:

PITTSBURGH.—A contract for 30,000 tons of basic, to be delivered 5,000 tons monthly, has been closed by the Crucible Steel Company. The settlement is to be made on the basis of the monthly average of the trade papers. Small tonnages have been sold as high as $40. No. 2 foundry is also selling around $40. Production is increasing, several furnaces having been blown in.

BOSTON.—The market is very strong here, and 2.25 silicon to 2.75 has been sold at $43. The base grade is selling around $41 furnace. Foundries are coming into the market more, and some business for second half has been placed. Enquiries for this period are numerous, two of them being for 10,000 tons.

NEW YORK.—There is a good demand in this market, while tonnage is not very plentiful. The prevailing price is $42 to $42.50 for 1.75 to 2.25 silicon, and $43 to $43.50 for the next grade. Bessemer is around the $40 mark, Eastern Pennsylvania furnace. Some of basic was sold for $39, Eastern Pennsylvania furnace.

PHILADELPHIA.—There have been some big sales of basic during the week, for first and second quarter delivery. The price was approximately $40, delivered, and the total tonnage runs close to 60,000 tons. Foundry iron has sold well, at $42 Eastern Pennsylvania furnace for No. 2 plain, and $43 to $43.50 for No. 2X. There has also been a good demand for malleable, the price ranging from $43 to $43.50, delivered Eastern Pennsylvania.

BUFFALO.—While there is a shortage of iron, opinion is divided between makers as to whether it is an unusual shortage or otherwise. This, of course, causes a difference in quotations. Some furnaces are quoting $38 base price on both first and second half business, while in other cases the second half base price has been jumped to $42.

CLEVELAND.—There is a brisk inquiry developing for last half tonnage, but producers are keeping clear of any large acceptances for this delivery. The quotations are mostly on the basis of $40 furnace for 1.75 to 2.25 silicon.

CHICAGO.—With the market steady at $40 for 1.75 to 2.25 silicon, only small lots are being sold. Local producers are pretty well sold up for first half. Some Southern makers are taking orders, the price being $40 Birmingham for 1.75 to 2.25 silicon.

CINCINNATI.—Furnaces are well sold up, and will not look at second half business. Under these circumstances, the market is merely nominal, although prices are advanced.

ST. LOUIS.—Furnaces are sold up, and the market is at a standstill. Business for second half is not being looked for, and, in fact, in some cases, has been refused. Makers think that prices may be better later on.

U.S. SCRAP METAL

The scrap iron market is showing new strength. Some large purchases of steel have been made, which have stiffened this grade. Following are reports from U.S. point:

PHILADELPHIA.—There is a brisk market in this district, which is not confined to any one grade. There have been heavy sales of heavy melting, amounting to about 90,000 tons, at a price around $27, delivered. There is a good demand for all grades.

BOSTON.—There is a good demand for cast scrap and steel scrap, and other grades have advanced. No. 2 machinery scrap is now quoted at $32, and in some instances a mixture of No. 1 and No. 2 machinery has brought $35.

PITTSBURGH.—There has been an advance in the price of steel-making scrap, heavy melting having been sold at $27.50, and baled sheets at $24.50. Re-rolling rails are in a firm position, sales having been at better than $36 delivered Newark. Foundry grades are in good demand, but scarce.

NEW YORK.—There is an upward movement in practically every variety of scrap material. The advances are from 50 cents to $1, though heavy cast and machinery cast went up $2. Heavy melting is quoted at $20.

BUFFALO.—There is a good market here for most grades of scrap, and a rising price list. There is still a shortage of cars, but a fair amount of trading marked the week's work. Heavy melting is now at $26, with small available supply.

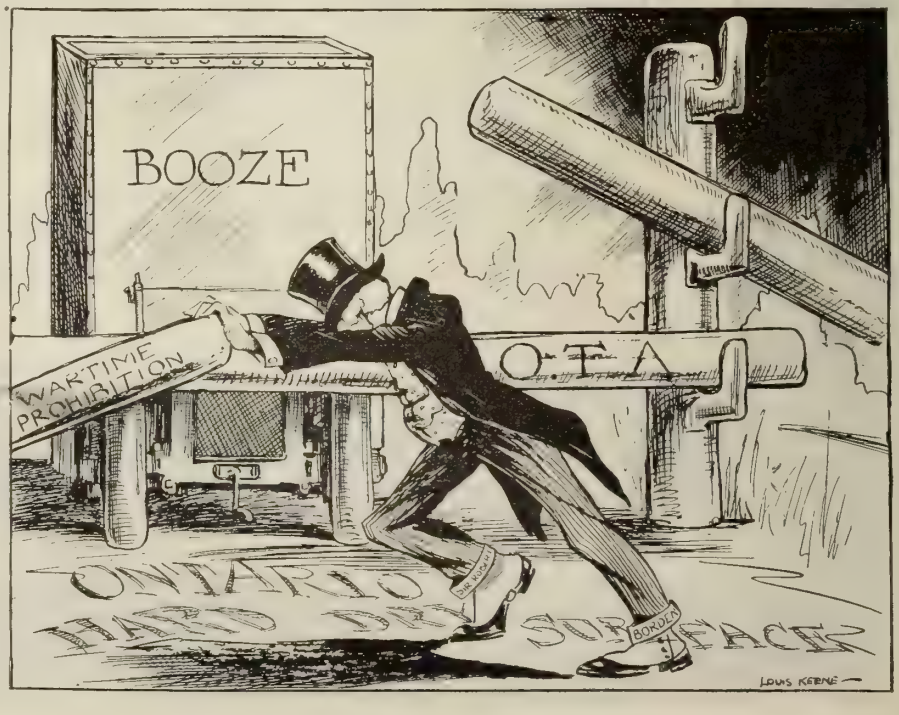
CLEVELAND.—Good demand, small supply, and rising prices is the story here, as in other districts. Steel scrap which has been selling around $24.50 is now $25 to $26. Malleable has also advanced from $1 to $2 a ton. Cast borings have advanced $1.

CHICAGO.—There is a strong market for scrap material of all kinds, and prices are at high levels. In fact, they are not much short of the figures reached during the war. Railroads are offering about 7,000 tons scrap.

CINCINNATI.—Heavy melting is in great demand, and has advanced in price. Most of the other grades are also figured in the inquiries, and the market is generally very strong.

ST. LOUIS.—There is good demand for nearly every grade, and the available supply is light. Prices have advanced from $1 to $2 a ton. There is not much railroad scrap offering, though the roads have been ordered by the administration to realize on their scrap piles.

A. C. McKenzie has been appointed Engineer Maintenance of Way on the C. P. R., with headquarters at Montreal, succeeding Mr. Frank Lee, transferred.



ATKINS

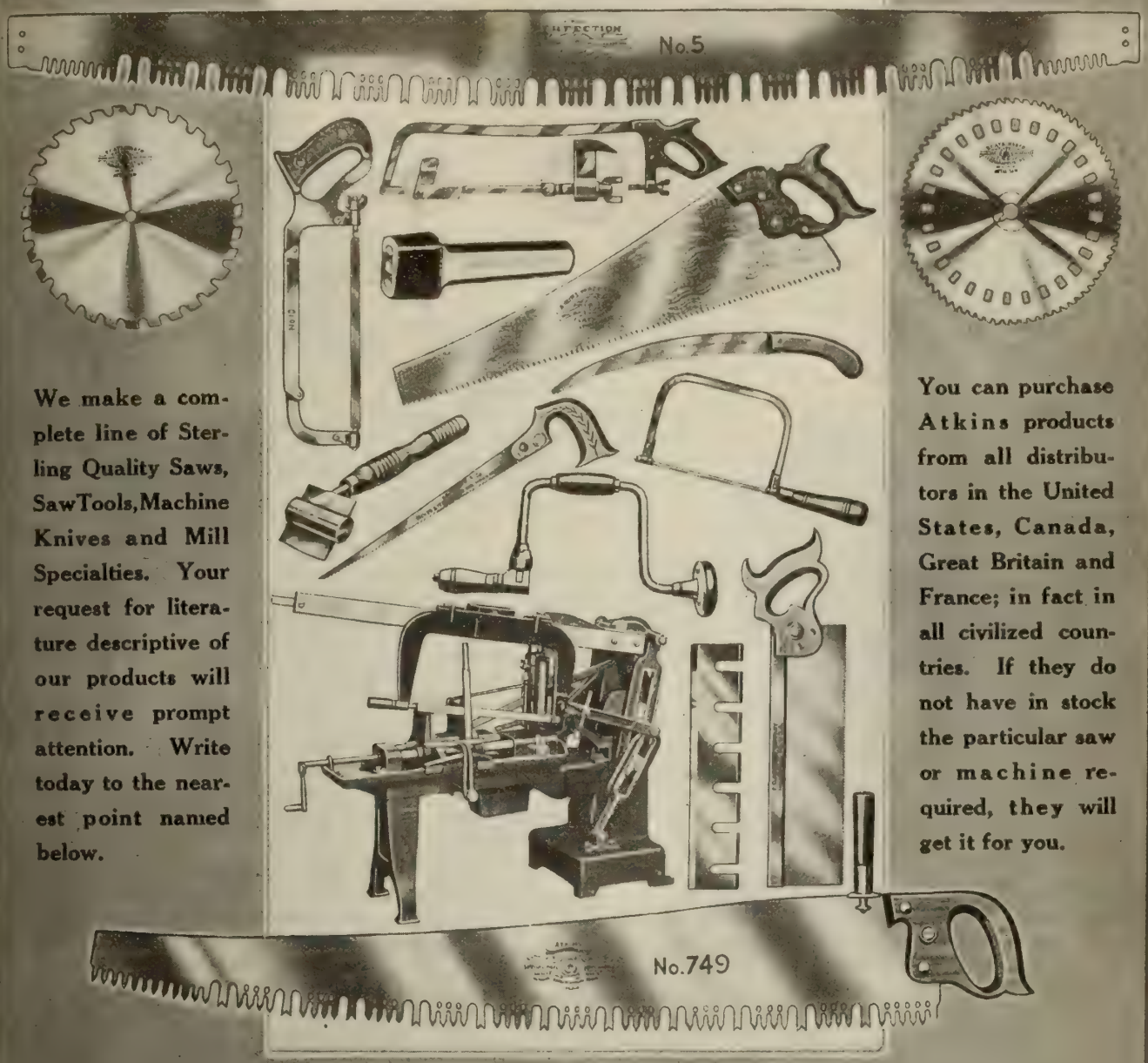
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There is No Universal Panacea for Unrest

Personal Observations of W. R. Basset, President of Miller, Franklin, Basset & Company, of 347 Madison Avenue, New York City

QUACKS want us to believe that there is a magic formula which can be invoked to cure all of the labor diseases in whatever plant or part of the country they may be found. Some have secret processes guaranteed to bathe the face of the erstwhile discontented workman with peaceful, beatific smiles of content.

One demonstrates how pretty five-room cottages with a trellis and a garden hose undoubtedly made self-satisfied, hard-working pillars of society out of I. W. W.'s in a certain town. Another proves that in an Ohio factory the men settled down to a life work of making the boss happy as soon as they were given a voice in the management of the business. And so it goes through the whole list of the cures, whether they be profit-sharing, old age pensions, collective insurance, lunch rooms or baths.

The deuce of it is that every one of these cures have been effective in many plants in bettering the temper of the men. But in many other plants, the same methods have failed miserably.

The trouble is age-old. It is another manifestation of the belief in panaceas, the philosopher's stone, and the fountain of youth. They can't be found.

A pleasant home makes life worth living for self-respecting men, and so conduces to his being better content with his job. But there are a lot of manufacturing concerns which cannot finance such a development. Then there are a lot of foreign-born workmen who will in a week turn a model home into a pig-pen. I know, for I've seen it.

Giving the men more or less of a voice in the management of a business has worked fine in plants where the men really wanted to be happy at their work; where they still retained a wish to be craftsmen. But in a plant where radical teachings have sunk into the men; where the direct-actionist idea of seizing all capital has a hold—the plan is too mild to suit the men. Strongly unionized plants under the dictation of powerful labor leaders are not as a rule to be successfully organized under Industrial Democracy.

Piece rate wage-payment plans are usually successful with a thrifty set of men. But in one plant I recently studied a wage incentive failed to spur workers to an easily obtained maximum earning. This plant was in a small town where the living costs were low. Had it been in a large city where it cost more to live, the workers would undoubtedly have needed more money and might have increased production to get it. As it was, we had to invoke the fear of the fellow-workman's disapproval by means of the group economy bonus.

And so it goes. We have a thousand or so industrial districts in the United States, each with its own living conditions. The workers differ in their ideas, outlook on life, education and nationalities. In some districts the men are largely thrifty; in some not. Some are largely home-owners—capitalists in a small way; some are irresponsible floaters. In some towns there is a preponderance of American born workers with their respect for American ideals of government; elsewhere they are mostly foreigners, here only to get the money and go back.

Here we find most of the men have at least a common school education and read good papers; there they do not speak nor read English but get their information from imported radicals and "reds."

With such wide variations in the type of labor from town to town and between different industries, it should be apparent that the employer's problem is almost an individual one. That makes it out of the question to buy a ready-made "system" which can be put into operation in any plant.

I know of factory owners, in every branch of manufacturing, who have no labor problems. They have without exception studied their workers and devised some method of handling them which fit the peculiar conditions. None of them attempted to buy a patent medicine cure.

Although I'm a disbeliever in "sure cures" there is one thing which I believe would lay a foundation for quieter labor conditions in all industries. That is education in the fundamentals of business economics. It is ignorance of this that makes so many formerly contented men prey to the inflammatory false reasoning of agitators.

The source of wages, for instance, is a mystery to most workmen. They are accustomed to cartoons of a fat capitalist with bulging money bags—from which, presumably, he doles out as little as possible in the way of wages. We know that wages are not paid out of capital but from production—but most workmen don't. If they did, it would be easy to convince them that they can reduce the high cost of living by turning out more work in a day.

Few workmen realize that relatively little capital is in the form of money. They don't stop to think that anyone who saves and buys a house or a piano is a capitalist, and that if capital were confiscated, he would suffer with the other, richer capitalists.

He demands interest from the bank on the savings he puts by for old age—but he forgets that the capitalist who builds the plant he works in is also entitled to interest.

We don't teach these fundamentals of economics in our public schools, and you may be surprised therefore to find that even some of your well-up executives are not well enough informed on these basic principles to offer a better argument to Bolshevik teachings than "Oh bunk!"

The radicals know of this ignorance and work upon it. We should combat their false teachings with true ones.

I have perhaps digressed from my main subject—but I did want to show that there is a need for basic education throughout the whole labor structure.

With this fundamentally sound faundation each employer can then go about getting the co-operation of his men in his own way with a much better chance for success.

He can do this in any way he pleases; but if he is wise, he will be careful about experimenting. If he has time, let him search out another concern in his own line, with surrounding conditions and labor supply the same. If this concern has a plan that has worked well, let him adopt it.

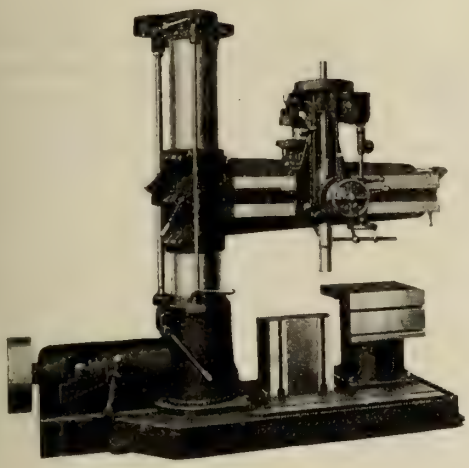
Or he may take advantage of the advice of experts, industrial engineers who have installed methods of every sort in all kinds of plants. The wise employer, however, will not, in blind hope, grab any system which has made good elsewhere, perhaps under entirely different conditions.

Just as employers have different interests and ambitions, so workers differ. Some method can be found which will stimulate them to greater production and to a degree keep them contented with their jobs. But exactly the right method must be chosen.

The production of nitric acid in the United States in 1914, according to the Census of Manufactures, was 78,589 tons of nitric acid of average strength and 112,124 tons of mixed acid. According to other data given in the census, these figures represent about 89,000 tons of 100 per cent. nitric acid. All of this acid was produced from nitrate of soda, consuming about 160,000 tons of nitrate. The pre-war importations of nitrate of soda amounted to about 560,000 tons per annum; hence the normal consumption for purposes other than the manufacture of nitric acid was about 400,000 tons. The present rate of importation is about 1,600,000 tons of nitrate per annum. Since very little is going into storage, and the total consumption for purposes other than nitric acid, manufacture has increased but slightly, if at all, it may be estimated that at least 1,000,000 tons of nitrate per annum are being converted into nitric acid at the present time. This is equivalent to 650,000 tons of 100 per cent. nitric acid, of which nearly five-sixths is being used for the manufacture of military explosives.

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New Machines in Stock



4-Foot Plain Radial Drilling Machines

The Ryerson 4-Foot Plain Radial Drilling Machine is massive and of very rigid construction. The feed is of the positive all geared type and has four changes which can be varied by a conveniently located lever. The tapping, starting and stopping mechanism is operated by a horizontal lever.

Drilling cap. 3½″; Tapping Cap.; 4″ pipe tap; Travel of arm, 34½″; Travel of Head, 40¼″.

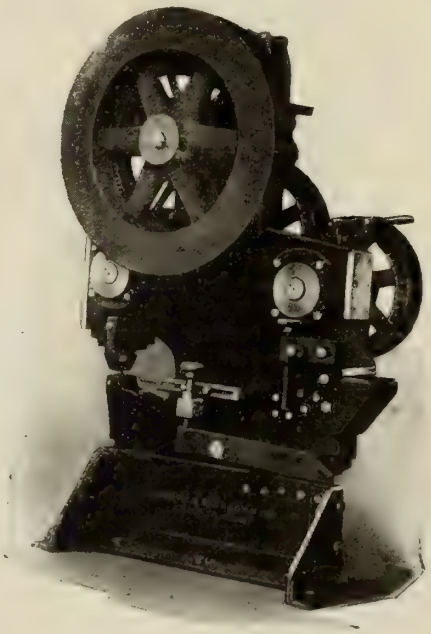
Quadruple Combination Punching and Shearing Machine

No. 4 SCAP- Power Driven

The Ryerson Quadruple Combination Punching and Shearing Machine embodies four single tools in one, handling punching, shearing of plates, round and square bars, cutting of angle, and tee iron as well as coping and notching work. All of this can be done without interchanging the attachments for the various operations or having to maintain a number of single machines for each operation.

We can furnish this machine arranged for either belt or motor drive. If direct electric drive is required, the machine is supplied with motor bracket, gear and rawhide pinion.

Punching Cap. ⅝ x ⅝″; Plate Shearing Cap. ½″; Coping Cap. 5″ Sections. Notching Cap. 3 x 3 x ¼″. Bar Shearing Cap. 1¼″ Round Bars, and 1″ Square Bars.



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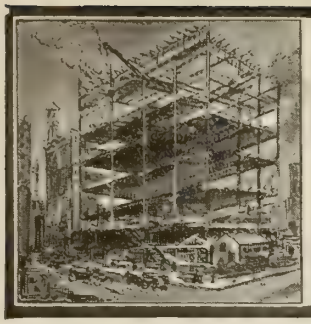
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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Toronto Harbor Commissioners are calling for tenders, to be received up to February 6, 1920, marked Tenders for Harbor Head Walls. All information can be obtained by application to the Commissioners at the Harbor Commissioners' Building, Toronto.

Restricting Immigration.—Reminders are being sent to shipping companies, calling attention to the order-in-council effective from Dec. 31st last to March 31st, under which any immigrant who is a laborer, mechanic, or artisan, must be in possession of the sum of $250, in addition to their transportation.

Big Contract for Vancouver.—The firm of J. J. Coughlan & Sons have secured from the Dominion Government a subsidy contract for the building of the large drydock at Vancouver, the estimated value of the dock being $3,750,000. The firm will finance the construction, and get a percentage subsidy when the work is completed.

$60,000 for Trucks.—Toronto will shortly spend $50,000 on trucks, if Street Commissioner Wilson gets the authorization he is asking for from the Work Committee. The trucks include tanks for the street cleaning department, trucks for the road oiling section, and also for the refuse collection department.

Miners Sign Agreement.—An agreement has been reached between the Dominion Coal Company and the representatives of the United Mine Workers, and will go into effect as soon as ratified by the local union. The agreement which standardizes wages and grants a general increase, is good for one year, with provision made for revision at stated intervals.

C.P.R. Not to Electrify.—Mr. Grant Hall, vice-president of the C.P.R., made a statement relative to the report that his company had planned to electrify the system. "There is no truth in this report," he said, "either as regards the company or my own alleged opposition to the scheme. The matter is not at present under consideration."

New Coal Operators' Association.—The coal operators in Alberta have split their organization, and a new one has been formed called the Red Deer Valley Coal Operators' Association. Out of 42 members in the original association, 19 resigned, among them being W. R. Wilson, the president. His place has been taken by O. E. S. Whiteman, manager of the International Coal & Coke Company, Coleman, Alta.

New Interests in Canada Car.—New interests have acquired a controlling interest in the Canada Car Co., in a very unassuming manner. Mr. Francis H. Clergue, well known in Canadian financial and industrial circles, bought the stock up on the open market at around 51, and the preferred at a little under par. Mr. Clergue then disposed of one-half his holdings to the new interests.

Briquette Plant Being Pushed.—The briquette manufacturing plant which is being constructed by the Lignite Utilization Board of Canada, at Bienfait, Sask., will be actively proceeded with as soon as the season opens. Some of the machinery contracts have already been let. The capacity of the plant will be 30,000 tons per annum, and production should start in August next.

The Ross Rifle Claim.—Negotiations are proceeding with a view to the settlement of the claim of the Ross Rifle Company against the Federal Government. The claim had been referred to the Exchequer Court, but will now likely be settled outside of Court. The Government offered a sum of $3,000,000 as compensation for the expropriation of the factory, but the company claimed a much larger sum.

Dominion Bridge Statement.—The report of the Dominion Bridge Co.'s working for the past year is considered very satisfactory. The net earnings are $1,343,305, or $522,412 less than last year. The ratios of earnings to common stock are 20.66 per cent. this year, as against 28.7 per cent. last year. In view of the fact that there was no ammunition business, and bridge building and structural work not fully developed, the showing is very good. The usual 8 per cent. dividend was declared, and an amount of $823,305 carried over to profit and loss account. The working capital has been increased by $683,982, and stands at $3,867,406. The profit and loss account has a balance of $3,848,613.

New Brantford Industry.—Announcement was made, following a special trip made to St. Louis by 30 Brantford capitalists, that a plant would be established in Brantford for the manufacture of Bluebird electrical appliances. Local capital to the extent of $200,000 already has been subscribed, and the new company promises to employ 1,500 hands within two years. J. B. Detweiler, general manager of the branch of the Steel Company of Canada in Brantford, will be president of the new company, and will sever his connection with the Canada Steel. The directorate of the Brantford Motor Trucks took the initiative in bringing the new industry to Brantford, and the plant built by the United States Government for munitions will probably be utilized.

New Engineering Firm.—The firm of Clayton, Neil & Jones, with head office in Montreal, and the Toronto branch at 152 Bay street, Toronto, is the latest addition to the engineering industry. The new firm will manufacture all lines of general machinery, and make a specialty of marine auxiliary machinery, including deck winches, steering engines, pumps, etc. Mr. Clayton is very well known to the shipbuilding firms of the country, with whom he has a valuable connection. Mr. Neil, who will look after the manufacturing end, is a practical production engineer of great ability, while Mr. Jones is a specialist on pumping machinery. The firm should have a very prosperous future.

MARINE

Quebec.—The Three Rivers Shipyard Company has received a contract for the construction of six steel vessels, of 7,200 tons. Work is being pushed ahead, and in the early spring it is expected that 3,000 men will be employed.

Cleveland.—Chartering for the opening of navigation has been commenced, half a dozen steel steamers having been placed for grain at 4 cents from head of Lake Superior to Buffalo, and 4¼ cents storage in Chicago and spring delivery in Buffalo.

Montreal. — The Canadian Pacific Ocean Services are to add three steamers to their fleet, and these are being at present constructed in Scotland. They will be called the Montcalm, Matapedia, and Montmorency. They will be of 16,000 tons each, fitted for burning oil fuel, and will be in commission during the latter part of 1920.

Collingwood.—The Canadian Farmer was launched successfully from the

yards of the Collingwood Shipbuilding Company during the Christmas season. The steamer is the fourth one built in this yard for the Canadian Merchant Marine. She will be fitted out during the spring and go down the canals at the opening of navigation.

Victoria, B.C.—The construction of the first demountable ship will be commenced in Seattle very shortly, according to Mr. John Arbuthnot, the originator of the plan. The demountable ship is really a cargo of lumber put together in the form of a ship, and supplied with oil engines and sails, with which the cargo transports itself across the ocean.

Charlottetown, P.E.I.—The loss of the schooner Barbara McDonald was felt very heavily in Prince Edward Island. She was on her maiden voyage and only a few days before she was wrecked her captain was lost overboard. She was the second schooner built on the island recently, the launch of her predecessor, the Victory Chimes, being looked on as the revival of shipbuilding, which once flourished on the island.

Cleveland.—Ice in the Great Lakes caused some damage to belated vessels and caused some of them to be diverted from their destination. The steamer "Stadacona," bound for Buffalo, with grain, was diverted to Port Huron. The B. F. Berry, ordered into winter quarters at St. Ignace, went into the slip without lightering. Some vessels sustained damage to hulls, and one or two lost propeller blades.

Halifax. — Dartmouth, just across the harbor from Halifax, has been chosen as the site for a branch of the Winnisimmet Shipyards, of Chelsea, Mass. The announcement was made by C. N. Delaite and Maxwell Jackson, who have spent the past few days in Nova Scotia looking for a suitable location. W. R. Green, the president of the company, will come to Halifax shortly, to conclude the deal.

Montreal.—The British War Department has turned the former German liner Prince Frederich Wilhelm over to the C.P.O.S., and she will sail from New York shortly to England, to be refitted. She will be placed on the Canadian service when repairs are completed. She was formerly owned by the North German Lloyd, and is of 17,082 tons gross, 590 feet long by 68 feet by 38 feet. She will make the passage from Liverpool to St. John in less than seven days.

St. John, N.B.—The Mayor and Council of St. John have been receiving letters of complaint from owners and agents of steamships which have been compelled to wait in the harbor until a berth could be found for them. One vessel claimed that some perishable freight had been spoiled by cold, due to the vessel having been awaiting a berth for seven days. The harbor commissioner stated there was little chance of the congestion being relieved in the immediate future.



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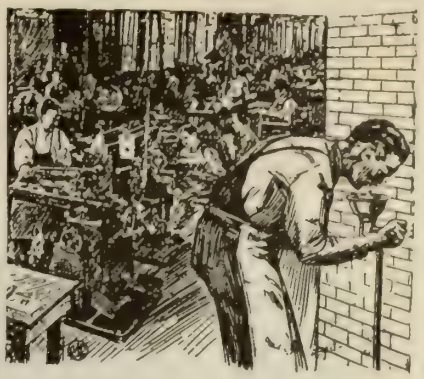
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Toronto.—The Dominion Shipbuilding Company successfully launched the full canal-sized freighter, "Torontonian," from their yards recently. The vessel is as sister ship of the "T. L. Church," launched a few weeks ago. The launch was made interesting from the fact that the ice in the bay had to be broken and kept broken by tugs preparatory to the launch. The vessel was christened by Mrs. C. H. Easson, wife of Mr. C. H. Easson, general manager of the Standard Bank of Canada. This makes the ninth vessel to be launched from this yard in the past twelve months. Six of these vessels have been delivered.



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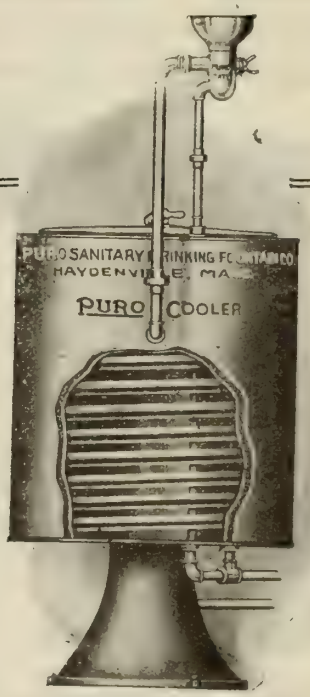
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OBITUARY

The death occurred at his home, 326 Montrose avenue, Toronto, of Mr. George J. Moore, of Moore Bros., machinists, 61-67 Nelson street. Mr. Moore has been connected with his brother in this business for the past twenty years. He was born and educated in Brantford, and is survived by his widow and two children.

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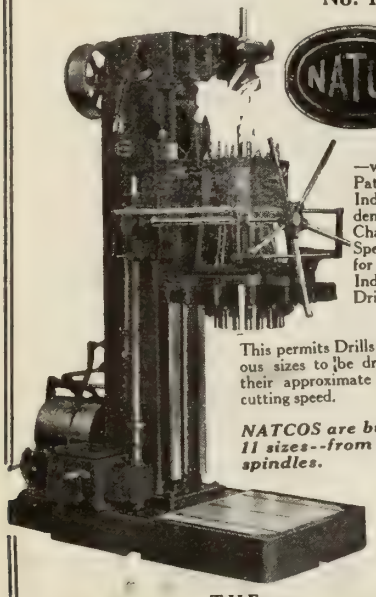
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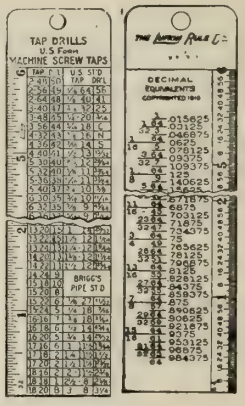
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2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
7—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
1—Robertson Hydraulic Press with pump and extra set of columns.....	24	27	800

LATHES

6—11" Blount Speed Lathes, 5' bed.
4—No. 2 Warner & Swasey Speed Lathes.
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2—Wells Cutter Grinders.
1—12" x 72" No. 4 Cincinnati Universal Grinder.
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	Size of Outlet	Displacement per rev.
1—Root Positive Blower	8" Vertical	3.3 cu. ft.
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1— " " "	6" Horizontal	1.5 " "
1—Boland Positive Blower	4" "	

3—Desk Fans.

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	Volt	Phase	R.P.M.	Cycle
1—Type Dumore	115 with buffing spindle.			
1—Garage Pump and Motor	110	1	1400	25
1—10 H.P. Westinghouse	200	2	1245	60
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5—50 H.P. Westinghouse	200	3	715	25
1—75 H.P. Westinghouse	200	3	720	25

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11—No. 3 Brown-Boggs Trimming Machines.
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4—2½" x 18" Screw Jacks.
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		2/3 Phase, 25 Cycles.		
450	550	125	24 x 40 x 36	
1000	240	107	24 x 48 x 42	150 lb.
		2/1 Phase, 60 Cycles		
75	2200	720	18 x 18	
165 K.V.A.	2200	225	20 x 18	80 lbs.
300	2300	150	18 x 30 x 22	120 lbs.
1000	2400	100	28 x 52 x 46	150 lbs.
		3 Phase—60 Cycles.		
18½	2400	360	7 x 8	100 lbs.
30	2300	250	30 H.P.	
50	2300	300	12 x 13	
75	600	1200	14 x 20	
75	2300	276	13 x 15	
100	2300	180	10 x 18 x 24	150 lbs. steam
100	2300	257	14 x 14	
100½	240	277	14 x 14	125 lb.
170 K.V.A.	2300		4 cylinder	
200	2300	200	Cross compound.	
250	2300	200	15 x 29 x 22	
300	400/480	150	14 x 28 x 30	
325	2300	150	18 x 36 x 24	
325	2300	120	24 x 36	
400	240		22 x 42	
400	600	150	24 in.	
450	2300	100	22 x 42 x 48	150 lbs.
500	480	120	20 x 40 x 36	
500	600	150	21 x 32 x 30	
550	480	171	26 x 32	
600	2300	150	20 x 38 x 24	
600	2300	150	23 x 40 x 30	200 lbs.
800	600	100	24 x 48 x 48	150 lbs.

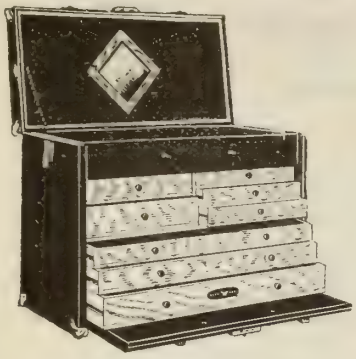
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Machinist's Tool Chests



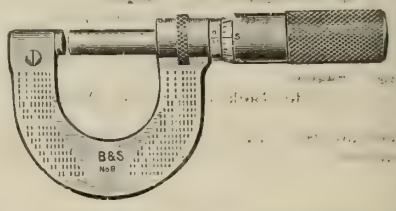
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Clinch beneath the surface of the belt on the pulley side — no part in contact with the pulley. They maintain uniform grip the entire width of belt and never weaken from wear.

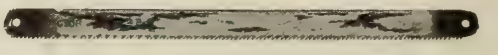


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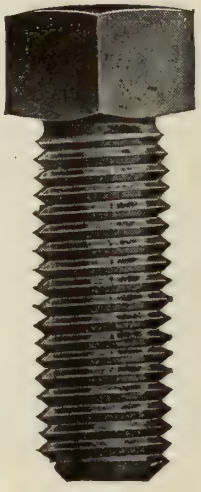
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2—60" Bullard Vertical Boring Mills
1—60" Niles Vertical Boring Mill
No. 4—B. & S. Plain Miller
1—36" x 36" x 8' Gray Planer, two heads
No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
14" x 6' New Carroll-Jamieson Quick-Change Lathe
15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
15" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 17"
17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
25" x 14' New Sidney D.B.C. Quick-Change Lathe, swing 27"
33" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
5' Bickford Single Pulley Drive Radial
100-lb. New Little Giant Hammer
50-lb. New Little Giant Belt Hammer
25-lb. New Little Giant Belt Hammer
30-ton Watson & Stillman Hydraulic Press

FRANK TOOMEY INC.

27 North Third Street PHILADELPHIA, PA.

ACCURACY



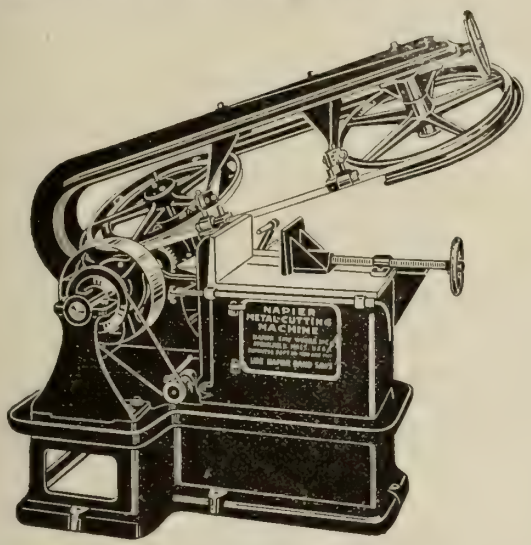
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GALT MACHINE SCREW CO., LIMITED
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Continuous Cutting

The Napier band cuts all the time—no back stroke—and every tooth does its share.

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The Napier Metal Cutting Machine will do more cutting than any other three power hack saws.

Saves Metal

The Napier band's kerf does not exceed .049". This means several dollars a cut in some metals.

Cuts True

The roller guides, close to both sides of the work, hold the inch-wide Napier blade so true that the Napier Metal-cutting Machine can well be considered a precision tool.

More and Better Work

—at lower cost—is what users are getting from Napier Metal-cutting Machines. Does this interest you?

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Napier Saw Works, Inc.
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Shelby Seamless Steel Tubing

Material

Made regularly from steel containing .15% to .20 carbon, and also from steel containing up to .55 carbon, and from 3½" nickel steel.

Sizes

Shelby Seamless Steel Tubing is cold drawn in sizes from ⅛" O.D., to 9" I.D., and hot drawn, in sizes up to 20" O.D., or larger on special orders. Wall thickness covers a wide range for each size O.D. In our Montreal warehouse we have now

Over 400 Sizes in STOCK

Anneals

Shelby Tubing is stocked in Finish Anneal, which is best suited for general work. It can also be supplied very soft, or unannealed, if required.

Uses

Shelby Seamless Steel Tubing is being used in more than a thousand ways in up-to-date shops. It saves time, lowers production costs, improves the product—and PAYS. We have

A New Booklet

—giving detailed information on Shelby Tubing, and suggesting many ways of using it. Would you like a copy?

Made by
National Tube Company
Pittsburgh, Pa.

Canadian Distributors:
Lyman Tube & Supply Co., Limited
Montreal Toronto Winnipeg New York

If interested tear out this page and place with letters to be answered.

You're Next!

The Board of Commerce attacked the Packers, and there was, on the whole, general rejoicing. The Packers were few—those who enjoy bacon many. Doubtless many—in ignorance of the facts—thought the Packers were "gouging."

Then one of the Commissioners criticized the farmers. It was a false step—a skid which he has probably lamented and has endeavored to repair, for it has lost him much popularity.

Now the Board of Commerce is setting prices for the retailer. It has dealt with some grocery lines—with clothing.

THE FINANCIAL POST brings out the dangers of the Board of Commerce's course. Dealing with this price fixing, THE POST'S expert writes:

> "For instance, the percentage of profit on bacon and boned ham is set at 20 per cent. The merchant naturally asks on what basis he is to reckon his 20 per cent., and there is nothing in the published report of the ruling to assist him. Does it mean 20 per cent. on the price he actually pays for the goods? That is probably the viewpoint that any court would take of the matter, yet as every sound merchant knows, 20 per cent. on a buying price is just 16 2-3 per cent. of the selling price, and it is only the profit on the selling price that represents the actual profit to the merchant.
>
> "The lowest cost of business for such retail stores is between 18 and 21 per cent., according to the class of business done. Take the cost of doing business at the modest average of 19 per cent. and on bacon selling for 60 cents a pound the retailer on the basis of profit outlined above loses 1 4-5 cents on every pound of bacon sold. If he slices the bacon he is permitted to take 2 cents a pound more; that would seem almost to let him out even.
>
> "There is, however, the large element of waste to be considered here; the ends of the ham or bacon must, of necessity, be a complete loss, which the merchant who slices his bacon has himself to meet. That the two cents per pound margin is pitifully small to cover these items of loss is illustrated by the fact that the New York City fair price list sets the margin for slicing bacon at 5 cents a pound, believing that it requires that amount to cover the element of loss in the process."

If you are a grocer or a clothing merchant you want to follow the actions of this Board—to have the clear light of understanding brought home as THE POST brings it home. If you haven't been touched yet—well, **"You're Next"** and equally you require to be informed.

To this end subscribe for this business man's paper—

THE FINANCIAL POST

For its wide information on business—for its news on financial matters, but perhaps most of all for its sane, balanced viewpoint THE POST has value for you.

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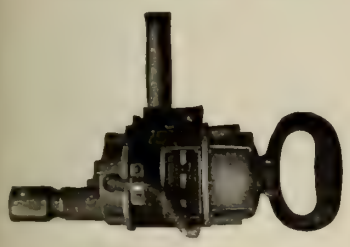
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Save Time, Labor and Money



They can be attached to any lamp socket.

For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

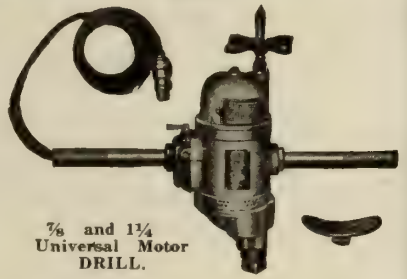
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Manchester, England.

Machine Tool Makers.

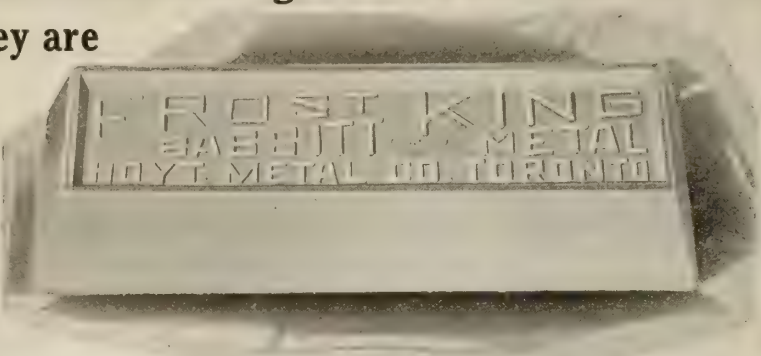
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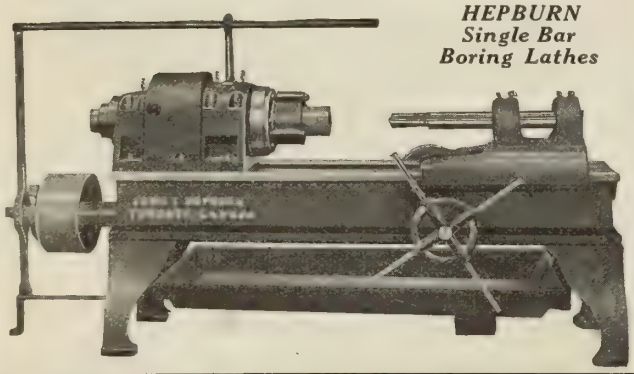
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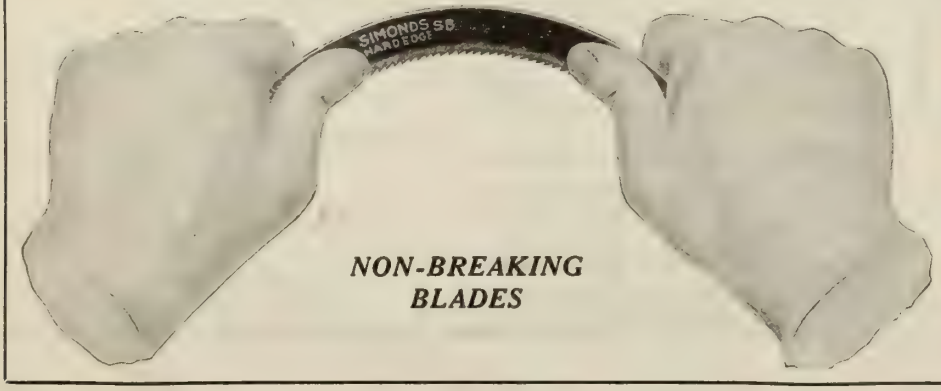
> **"Of course we would not have sold it without letting people know it was here, that is obvious, and thanks are due you for letting the people know it was for sale."**

If you have any old or used equipment for sale, let people know it's there. Your message in Canadian Machinery will be placed before the probable buyers of such equipment.

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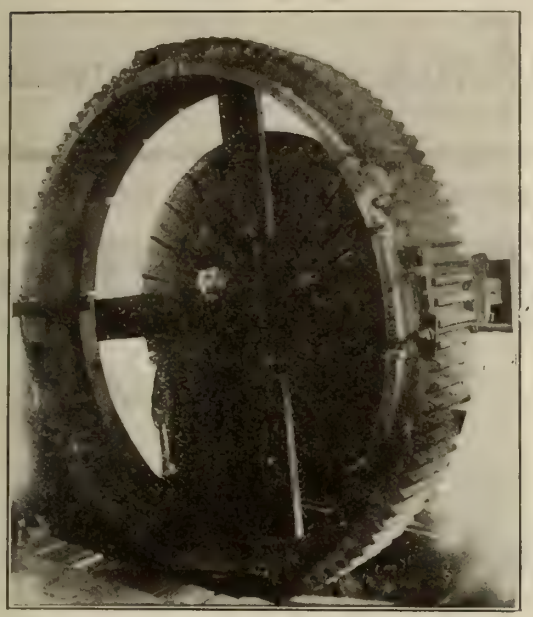
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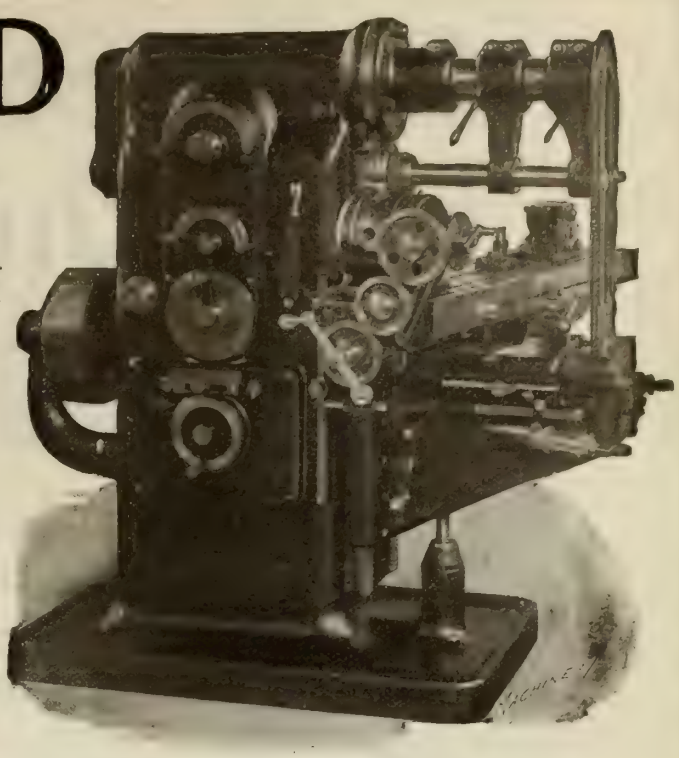
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Put the power of the "Rockford" to the severest tests. It's built to more than meet the demands likely to be made upon it. It is the pace-maker of the machine shop.

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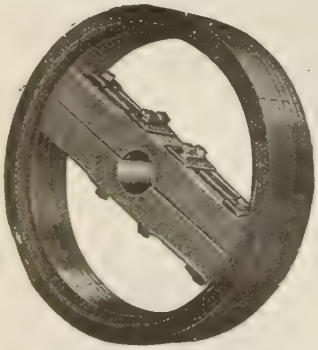


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The war is ended so far as a continuation of the bloody combats of the battlefields is concerned. But in the war after the war there will be waged lively battles for industrial supremacy wherein the advantage will lie with the plant equipped with the most economical and durable machinery.

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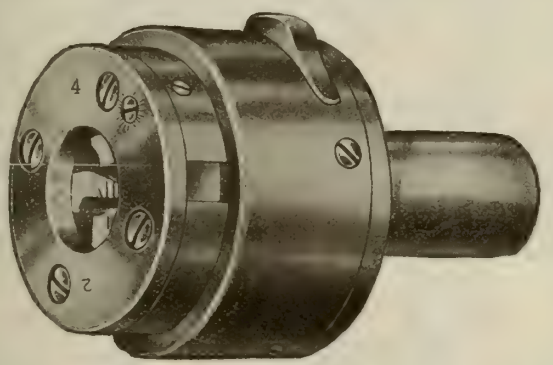
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are of small outside diameter compared with the size of work they do.

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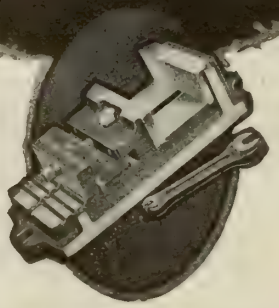
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It truly is THE HANDY TOOL.
It may be bolted to a drill, planer, miller or shaper by the ears at both ends, clamped as desired by the flange or used at right angles.

THE SKINNER CHUCK COMPANY
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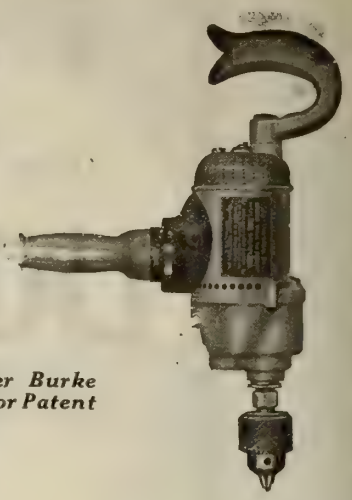
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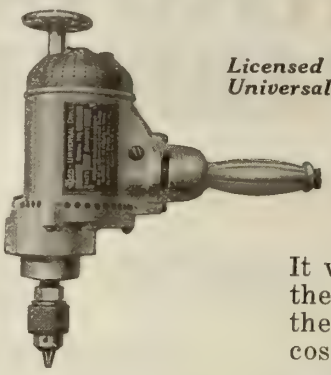
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Light, Powerful and Durable



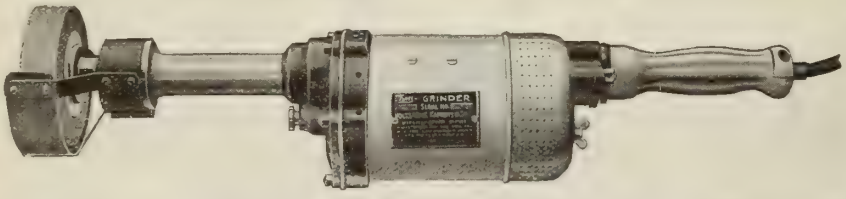
Thor Electric Tools have off-set spindles —which permit operating in close quarters—a variety of speeds, S K F Ball Bearings, four contact switches, D.C. or Universal Motors and several other features that make them the super-tools of the day. Jacobs Chucks used as Regular Equipment.



Licensed Under Burke Universal Motor Patent

PORTABLE ELECTRIC GRINDER

Equipped with Universal Motor for Operating on Direct or Alternating Current 110 TO 250 VOLTS



It will pay you to put them to the test and let them prove that they'll reduce your production cost.

For Full Particulars Write

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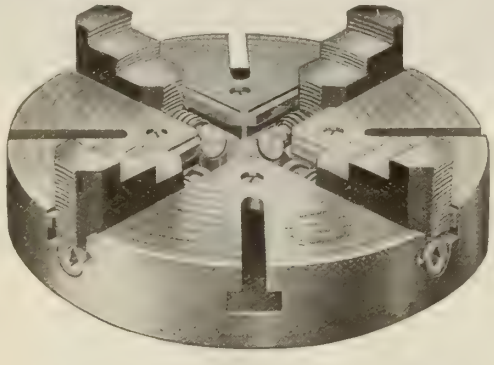
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INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

***New York Office:* 26 Cortlandt Street**

Makers of a complete line of chucks

We wanted something original—this is what we got

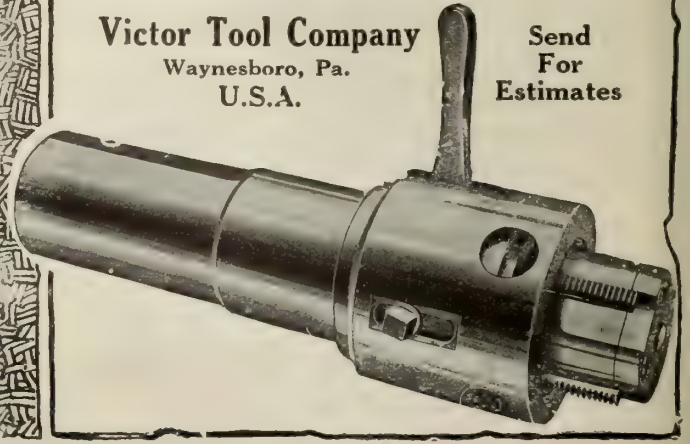
"BOTH in these operations and half another — I'll show you later — completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company

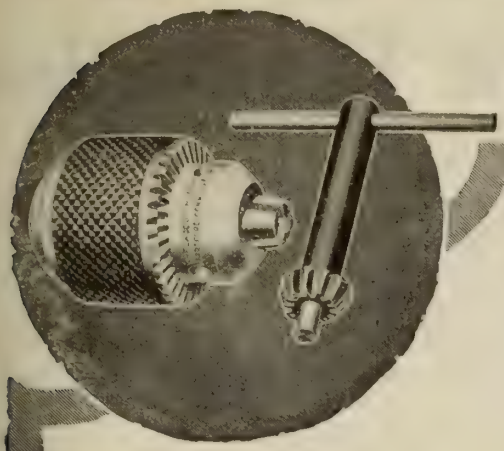
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U.S.A.

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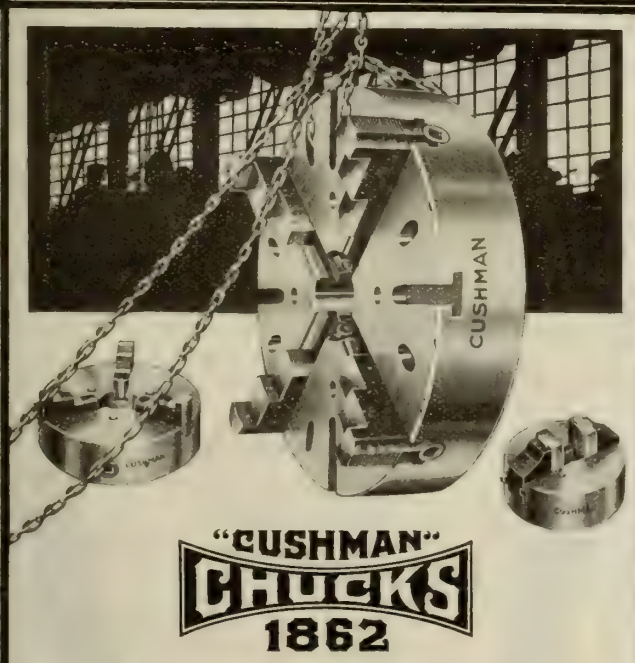
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The workman expects Jacobs as the drill chuck on his machine. He knows it does not break drills, that the toothed sleeve and key make adjusting easy and safe.

Are your machines Jacobs equipped?

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"CUSHMAN" CHUCKS 1862

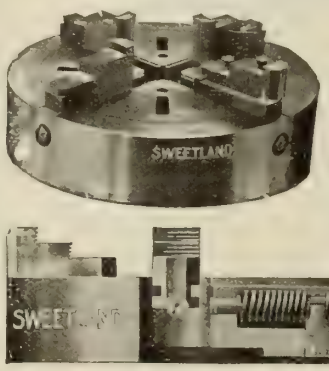
THE STANDARD FOR EXCELLENCE

WHEN THE BEST IS NONE TOO GOOD
SPECIFY CUSHMAN CHUCKS
THEIR USE IS WORLD WIDE

THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

SWEETLAND CHUCKS

Our Independent Lathe Chuck which stands for three-score years of mechanical endeavors. The gripping and gearing surfaces, both of hardened steel, are ground perfectly true. The large screws of special grade steel are flush with the body of this Sweetland Independent Lathe Chuck. The strong jaws are high-grade steel, properly hardened. Sweetland Chucks, whether they are Independent Geared, Scroll, Universal or Combination, increase production.

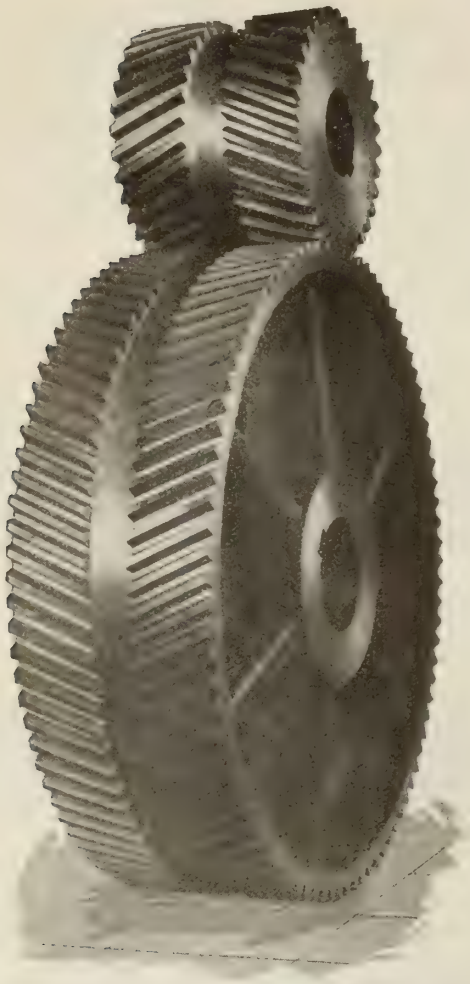


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Sold by Geo. F. Foss Machinery & Supply Company, Limited
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Double Helical Gear and Pinion with teeth accurately generated

The finest class of gear for high speeds and high ratios

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Van Horne St., TORONTO

Labor Costs More Than Files

And it costs more to-day than it ever did before.

Don't waste your workmen's time, therefore, with dull files.

Throw them away as soon as the edge begins to go, and buy new ones.

Famous Five Files keep their edge longest. They are made of highly specialized steel, accurately cut and thoroughly hardened.

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GREAT WESTERN
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Made in Canada by



A Plant Equipped in Every Detail to Suit Your Every Need



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Open Hearth, Basic and Acid, Electric and Alloy Steels.

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For Ships, Railways, Rolling Mills, Gears, Machinery and Ingots to 35 tons.

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STEEL LETTERS AND FIGURES

In shops where the highest standards are maintained the stamping equipment is generally "Matthews Made."

Matthews Letters and Figures are hand made from carefully selected steel, heat treated for hardness, insuring long service under hard usage. They make deep, clean-cut impressions that outlast the product.

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Don't Keep It--Sell It

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
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or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

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Classified Advertising Section
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Pumps for any Service—Steam Appliances—Freight Elevators—Webster Vacuum Heating System.

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Springfield, Vermont
Builders of
Hole, Hole and Face and Deep Hole Grinders

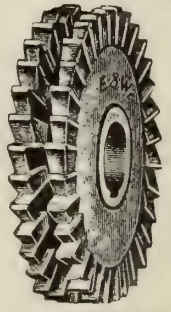
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CRANE
LIMITED
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1280 ST PATRICK ST
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BRANCHES: Vancouver, Calgary, Winnipeg, Toronto.

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Write for our 37-page book, "Getting Maximum Pulley Efficiency."
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Standard and Special Milling Cutters of all descriptions, Gear Cutters, Hand Reamers, Shell Reamers, Chucking Reamers and Taper Pin Reamers, Lathe Mandrels and Arbors, Metal Stamping Dies, Gauges, Jigs and Fixtures, Etc.
All equipment required for rapid and economical production of interchangeable parts. Prompt attention to all work.
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Greenfield
Trade Mark Reg. U. S. Pat. Office
A universal grinder. A grinder with all attachments. A grinder that will handle all kinds of tool-sharpening as well as cylindrical, internal and surface grinding. An all-around machine for your tool-room.
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STEEL CASTINGS
ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.
PROMPT DELIVERY
Manitoba Steel Foundries, Ltd.
1204 McArthur Building
Winnipeg - - - Manitoba

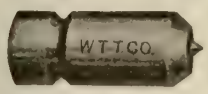
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MANUFACTURERS OF

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Goods Submitted on Memorandum if Desired

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All Mountings Fully Guaranteed

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Speed in Cutting Off

Hurlbut, Rogers Cutting-Off & Centering Machine

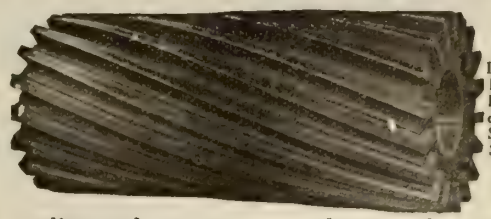
TWO CUTS AT ONCE—one up, the other down. This is what makes the Hurlbut, Rogers Cutting-Off and Centering Machine virtually double the output and reduce the cost per piece one-half.

You should learn more about it. Write for description to-day.

The Hurlbut, Rogers Machinery Co.
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FOREIGN AGENTS: England, Chas. Churchill & Co., Ltd., London, Manchester, Glasgow and Newcastle-on-Tyne.

Taylor-Newbold Milling Cutters



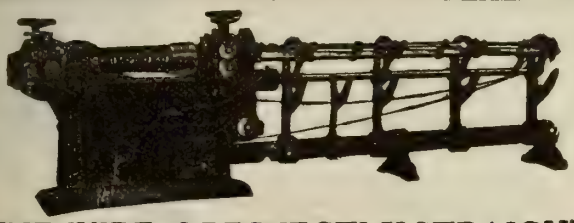
Will outlive and out-cut any other on the market

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METALWOOD MANUFACTURING CO. DETROIT

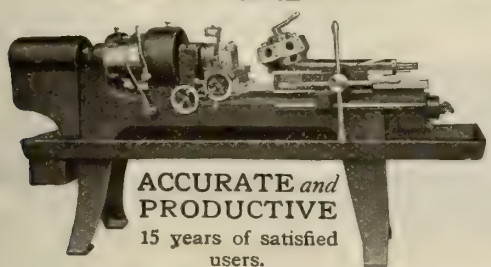
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ACCURATE *and* PRODUCTIVE

15 years of satisfied users.

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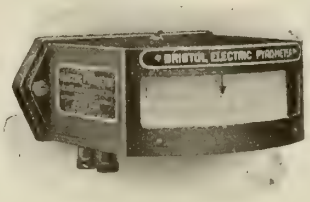
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BRAZIL INDIANA USA

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BRISTOL'S

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There is no additional complication. You need these Pyrometers in your heat treatment room.

Laboratory Accuracy During Shop Use.

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Send for complete catalogue showing 50 styles 10 to 100 tons capacity.

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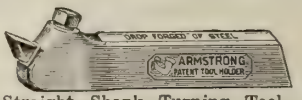
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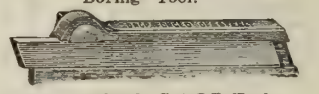
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Straight Shank Turning Tool.



Boring Tool.



Straight Shank Cut-Off Tool.

Armstrong Tool Holders

Make One Pound of High Speed Steel go as far as Ten Pounds in Forged Lathe Tools.

Grand Prize Winners at Panama-Pacific Exposition

Complete Catalog Free

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"The Tool Holder People."
306 N. Francisco Ave., Chicago, U.S.A.

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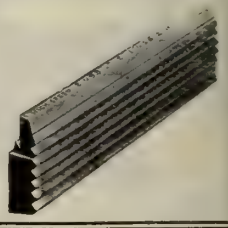
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Davis-Bournonville Oxy-Acetylene Welding and Cutting Apparatus
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AT NIAGARA FALLS, ONT.
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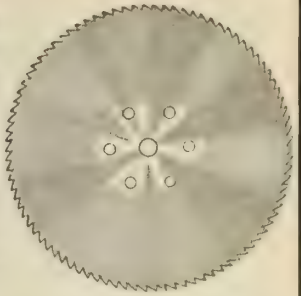
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OAKLEY CHEMICAL CO
44 THAMES STREET NEW YORK

HUNTER



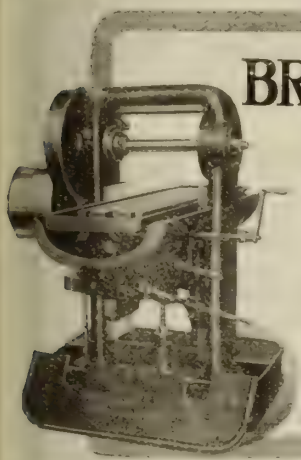
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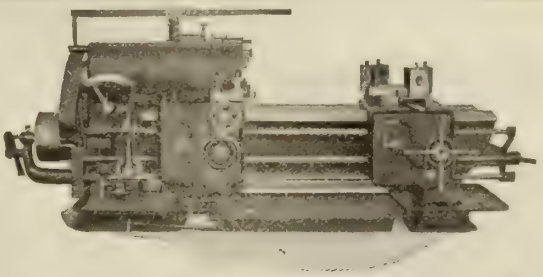
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Canadian Representatives: Garlock-Walker Machinery Co., Ltd., Toronto; Williams & Wilson, Ltd., Montreal.

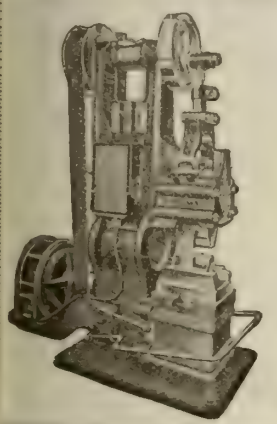


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Belt or Motor Drive

These Hammers Embody a Design and Workmanship that are unsurpassed.

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A type and size for every requirement.

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High Speed Reamers, Cutters and Drills

IN STOCK HERE

Prompt Service

The J. A. M. Taylor Tool Co.

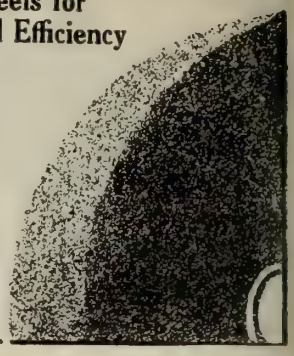
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318 Stair Building Toronto

Buy Your Grinding Wheels Direct! Brantford Wheels for Durability and Efficiency

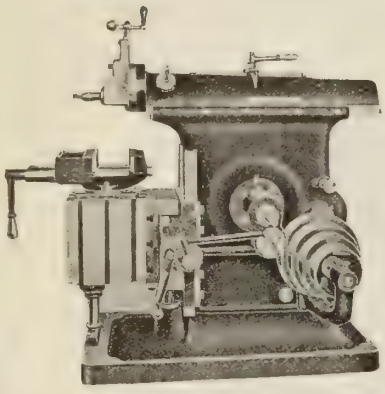
Remember this when you are considering an order for Emery Wheels: We sell direct to the user—you save the middleman's profit. Then you can depend upon our wheels giving the most efficient service — our wheels represent highest quality in raw materials and manufacture.

Give them a trial.



Brantford Emery Wheel Co.

Brantford, Ontario



"RAE" CRANK SHAPERS

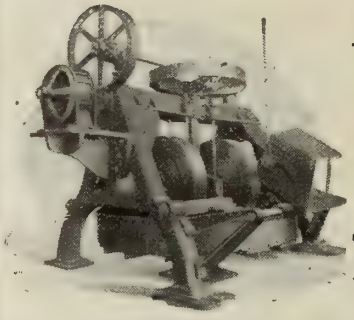
An exceptionally strongly built machine with very high productive power. Range of speeds have been carefully graded. Each one will be found practical and useful.

Ask your dealer. If he cannot supply you, write us.

Rae Machine Tool Works, Limited

HAMILTON, CANADA

Canadian Steel Foundries Need Frost Improved Sand Mills

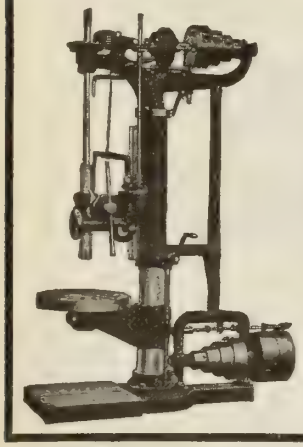


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Unloading Device
Motor or Belt Drive

The Frost Mfg. Co.

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instantly obtained, are but one of many advantages provided

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For 64 years these upright Drilling Machines have served well in the States and Canada.

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Brantford Emery Wheel Co., Brantford.
Canadian Fairbanks-Morse Co., Montreal
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
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ACETYLENE GENERATORS
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACORN DIE AND HOLDERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

ACCUMULATORS, HYDRAULIC
Canadian Fairbanks-Morse Co., Montreal
Garlock-Walker Mach'y. Co., Toronto.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

AIR COMPRESSORS
See Compressors.

AIR CONDITIONS, DEHUMIDIFYING—HUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

AIR CYLINDERS
Smalley-General Co., Bay City, Mich.

AIR RECEIVERS
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Welding & Supplies Co., Montreal, Que.

AIR WASHERS
Can. Blower & Forge Co., Kitchener.

ALUMINUM
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Tallman Brass & Metal Co., Hamilton.
Williams Mchy Co, Ltd., A. R., Montreal

ALUMINUM SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.

ALLOY, STEEL
Armstrong, Whitworth of Can., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Samuel Osborne (Canada) Ltd., Montreal.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ANCHORS
Fellows Bros., Ltd., Chadley Heath, Eng.

ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

AUTOMATIC METAL CUTTING-OFF MACHINES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Furniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

BAND SAWS
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., Ltd., A. R., Montreal

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., Ltd., A. R., Montreal

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy & Supplies, Montreal.
Williams Mchy Co., Ltd., A. R., Montreal

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
U. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

BLACKSMITH WORK
St. Lawrence Welding Co, Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St. Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams & Wilson, Ltd., Montreal.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co.,, J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co. Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co, Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd. Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York, Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co, Ltd., A. R., Montreal

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Williams Mchy Co, Ltd., A. R., Montreal
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.



If interested tear out this page and place with letters to be answered.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found'a & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont
Globe Engineering Co.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N Y

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTER SINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A R., Montreal

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

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Canada Found'a & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg Co., Hartford, Conn.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F. Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co. Ltd. Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
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Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
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Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Oliver Mach. Co., Grand Rapids, Mich.

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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co.
Stoll Co., D. H., Buffalo, N.Y.

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Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

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Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

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MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
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Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.
Williams Mchy Co, Ltd., A. R., Montreal

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Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

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John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal

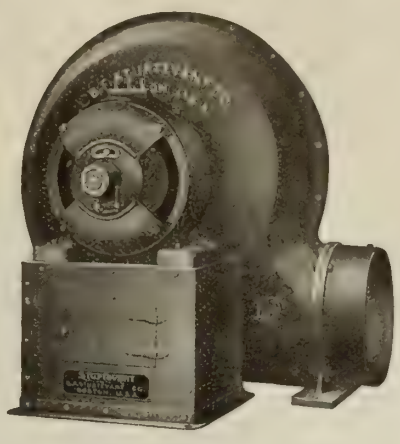
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Bilton Mach. Tool Co., Bridgeport, Conn.
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Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
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Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
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Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
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Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
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Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

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Can. Fairbanks-Morse Co., Montreal.
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Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Williams Mchy Co, Ltd., A. R., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
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Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville
Williams Mchy Co, Ltd., A. R., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co. Sherbrooke Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

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Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
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Goad Engineering Co., Toronto, Ont.

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Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Kaslo Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
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Curtis Pneumatic Machy. Co. St. Louis
Williams Mchy Co, Ltd., A. R., Montreal

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Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

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Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

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ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

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Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.

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Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Dom. Steel Products Co., Ltd., Brantford.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.

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Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
St Lawrence Welding Co. Ltd., Montreal
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Sheldons, Ltd., Galt, Ont.

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Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
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Barry Mfg. Co., Chicago, Ill.

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Can. Wire & Iron Goods, Hamilton, Ont.

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Elk Fire Brick Co., Hamilton, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FIXTURES
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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
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Can. Found. & Forgings, Ltd., Welland.
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Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland
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Williams Mchy Co, Ltd., A. R., Montreal

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Williams & Co., J. H., Brooklyn, N.Y.

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Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont
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C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. C., Boston, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. C., Boston, Mass.

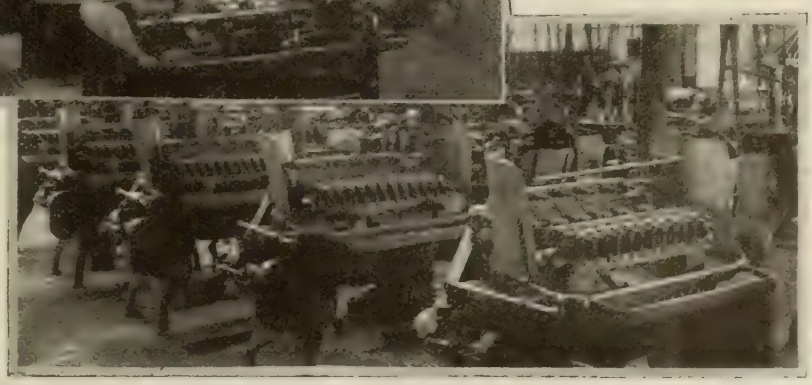
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Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
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Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
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Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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Haskins & Co., R. C., Chicago, Ill.
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Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
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Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I
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Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
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Independent Pneumatic Tool Co., Chicago
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Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co, Ltd., A. R., Montreal

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Norton Co., Worcester, Mass.

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Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

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Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co, Ltd., A. R., Montreal

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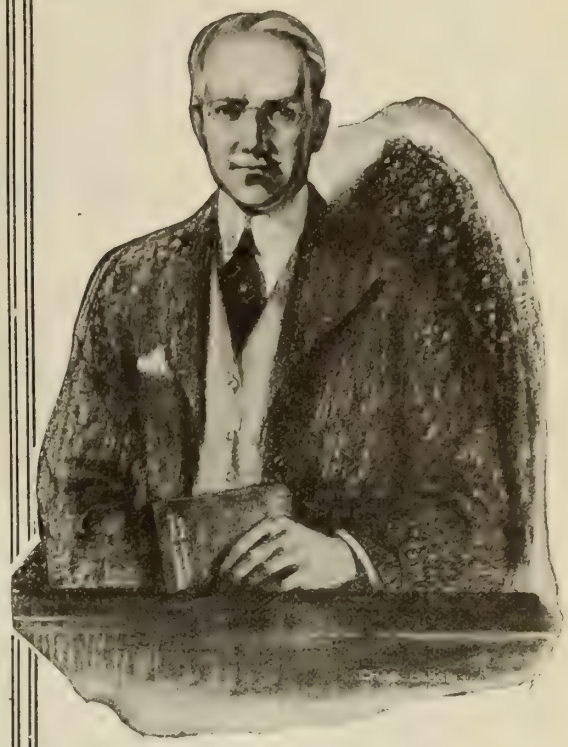


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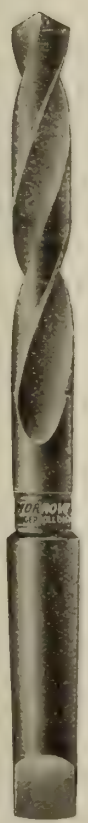
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Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
Williams Mchy Co, Ltd., A. R., Montreal

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Volta Mfg. Co., Welland, Ont.
U. S. Ordnance, Toronto, Ont.
Williams Mach'y Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.
Williams Mchy Co, Ltd., A. R., Montreal

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal
St. Lawrence Welding Co. Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Sudden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont.

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Mchy Co., Ltd., A. R., Montreal

PLANING AND SHAPING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Keriton, Ohio.
Perrin, Ltd., William, Toronto.

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St. Lawrence Welding Co. Ltd., Montreal

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
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PRESSES, PNEUMATIC
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co. Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, HYDRAULIC
Bertram & Sons Co., John, Dundas.
Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., Ltd., A. R., Montreal

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O
Williams Mchy Co, Ltd., A. R., Montreal

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
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Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co, Ltd., A. R., Montreal

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
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REAMERS, ADJUSTABLE
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Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pilewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
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Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que,
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Wells Bros. of Can., Galt, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.

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Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
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Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

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American Pulley Co., Philadelphia, Pa.

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REGULATORS, PRESSURE, TEMPERATURE
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Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St. Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland

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Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
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Can. Ingersoll-Rand Co., Montreal.
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High-Speed Hammer Co., Rochester.
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Williams Mchy Co, Ltd., A. R., Montreal

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Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

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ROLLER CHAINS
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Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.
Williams Machinery Co., A. R., Montreal.

ROLLS AND TABLES
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ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

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ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

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ROLLING MILL MACHINERY
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Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

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Canada Machinery Corp., Galt.
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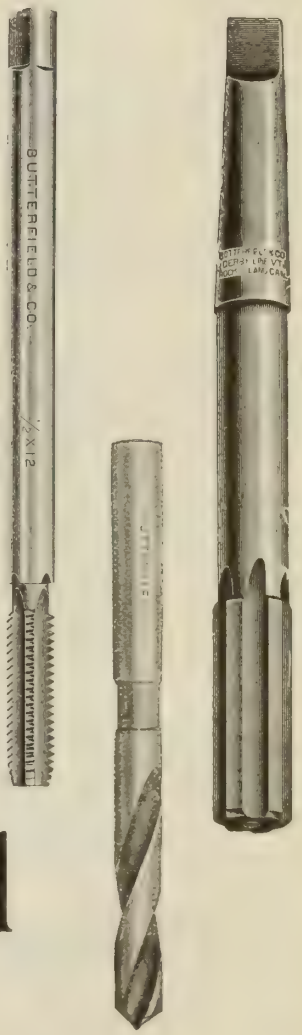
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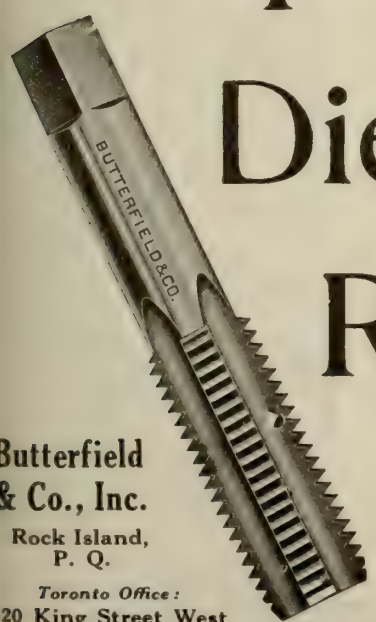
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Toledo Machine & Tool Co., Toledo, O.

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Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatter, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
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H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co, Ltd., A. R., Montreal

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The Quickwork Co., St. Mary's, Ohio.

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Toledo Machine & Tool Co., Toledo, Ohio

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

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Quickwork Co., St. Mary's, Ohio.

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Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

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The Quickwork Co., St. Mary's, Ohio.
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Williams Mchy Co, Ltd., A. R., Montreal

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Peckovers, Ltd., Toronto, Ont.

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D. H. Stoll Co., Inc., Buffalo, N.Y.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

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Dennis Wire & Iron Works, London.

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Rice Lewis & Son, Toronto, Ont.

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Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

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STAMPS, STEEL ALPHABET, FIGURES
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Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

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Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Kayser-Ellison & Co., Ltd., Montreal.
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

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Joilette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

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Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

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Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford.

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

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It is our hope that our success will be coincident with the establishing of a great many mutually profitable friendships for our Company which will in turn serve to bring into closer harmony our Principals and our Customers.

OUR whole aim will be to so conduct our business through efficient service and fair dealing as to thoroughly maintain the established prestige of the lines we represent.

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Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co,, Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS WELDED
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co, Ltd., A. R., Montreal

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Po.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

TAP EXTRACTORS
Walton Co. The Hartford, Conn.

TENSIL EMACINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal

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Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.
Williams Mchy Co, Ltd., A. R., Montreal

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

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Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton

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Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal Que
Northern Electric Co., Ltd., Montreal.
U. S. Ordnance, Toronto, Ont.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R. Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.
U. S. Ordnance, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
U. S. Ordnance, Toronto, Ont.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal.
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio.
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield.
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis
Warner & Swasey Co., The, Cleveland, O
Williams Mchy Co, Ltd., A. R., Montreal

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co,. Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, REDUCING, REGULATING
St Lawrence Welding Co, Ltd., Montreal

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.
St Lawrence Welding Co, Ltd., Montreal

VALVES, RUBBER PUMP
International Mach. Spls., Ltd., Montreal
Quaker City Rubber Co., Philadelphia.

VENTILATORS
H. H. Robertson, Lt., Sarnia, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford.
Can. Blower & Forge Co Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal.

VISE STANDS, PORTABLE
Williams & Co., J. H., Brooklyn, N.Y.

VISES, BENCH
Aikenhead Hardware Co., Toronto, Ont.
ecker Milling Machine Co., Boston, Mass.
ns Machy & Spls. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
S. Ordnance, Toronto, Ont.
Williams Mchy Co. Ltd., A. R., Montreal

VISES, DRILL
Iodgson & Pettis Mfg. Co., New Haven, Conn.

VISES, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Petrie, Ltd., H. W., Toronto.
S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

VISES, MILLING MACHINE
Brown & Sharpe Mfg. Co., Providence, R.I.

VISES, PLANER AND SHAPER
Aikenhead Hardware Co., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

VOLMETERS & AMMETERS
Northern Electric Co., Ltd., Montreal Que

WASHER MACHINES
National Machy. Co., Tiffin, Ohio.

WASHERS
Atkins & Co., Ltd., Wm., Sheffield, Eng
Barnes, Wallace, Co., Bristol, Conn.
Grafton & Knight Mfg. Co., Worcester.
Kayser-Ellison & Co., Ltd., Montreal.
London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WASTE
Wilkinson & Kompass Hamilton, Ont.
Wood Turret Machine Co., Brazil, Ind.

WASTE CLEANER AND OIL RECLAIMER
Oakley Chemical Co., New York, N.Y.

WATER-INTAKE SCREENS
Can. Link-Belt Co., Toronto, Ont.

WATER TOWERS
Toronto Iron Works, Ltd., Toronto.
St. Lawrence Welding Co, Ltd., Montreal

WELDED TANKS
Can. John Wood Co., Toronto, Ont.

WELDERS, ELECTRIC, SPOT AND BUTT
Knight Metal Products, Toronto.

WELDING, WIRE
Page Steel & Wire Co., Adrian, Mich.

WELDING, ELECTRIC, SPOT, BUTT, ETC.
Globe Engineering Co.
St. Lawrence Welding Co., Montreal.
Welding & Supplies Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

WELDING MASKS
Davis-Bournonville Co., Toronto, Ont.
Strong, Kennard & Nutt Co., Cleveland.

WELDING GOGGLES
Davis-Bournonville Co., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

WELDING RODS AND WIRE
Davis-Bournonville Co., Toronto, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Welding & Supplies Co., Montreal, Que.

WELDING SUPPLIES
Davis-Bournonville Co., Toronto, Ont.
Union Carbide Co., Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont
St Lawrence Welding Co, Ltd., Montreal
U. S. Ordnance, Toronto, Ont.

WELDLESS BOILER TUBES
Furniss, Clarke & Co., Montreal, Que.

WHEELS, BALL BEARING
Lyman Tube & Supply Co., Montreal, Que

WHEELS, CAR, STEEL
Elec. Steel & Metals, Welland, Ont.

WHEELS, SPROCKET AND TRACTION
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

WHEELS, TURBINE, WATER
Elec. Steel & Metals, Welland, Ont.

WHEELS, PRESSED STEEL
American Pulley Co., Philadelphia, Pa.

WHEEL TRUEING TOOLS
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont
Williams Mchy Co., Ltd., A. R., Montreal

WINCHES
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

WIRE, CAST STEEL AND MUSIC
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

WIRE COILING AND POINTING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Shuster Co., F. B., New Haven, Conn.

WIRING MACHINES
Quickwork Co., St. Marys, Ohio.

WRENCHES, PIPE, POWER
Peck, Stow & Wilcox Co., Southington.

WIRE GUARDS
B. Greening Wire Co. Hamilton, Ont.

WIRE CLOTH AND PERFORATED METALS
Canada Wire & Iron Goods, Hamilton.
Page Steel & Wire Co., New York, N.Y.

WIRE FENCING WIRE, COPPER, CLAD STEEL WIRE, LINK FABRIC
Page Steel & Wire Co., Adrian, Mich.

WIRE FORMING AND STAMPING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Can.
Shuster Co., F. B., New Haven, Conn.

WIRE NAILS
Page Steel & Wire Co., New York, N.Y.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Ltd., Hamilton, Ont.

WIRE ROPE
B. Greening Wire Co. Hamilton, Ont.
Samuel Osborne, Ltd., Montreal, P.Q.

WIRE NAIL MACHINERY
National Machy. Co., Tiffin, Ohio.
Page Steel & Wire Co., New York, N.Y.

WIRE, SPARK PLUG, MANGANESE NICKEL, COPPER NICKEL, MONEL METAL
Can. Driver-Harris Co., Ltd., Walkerville.

WIRE SPRING
Page Steel & Wire Co., Adrian, Mich.

WIRE STEEL, BRASS, COPPER
Page Steel & Wire Co., New York.
Steel Co. of Canada, Ltd., Hamilton, On.

WIRE, TELEPHONE, TELEGRAPH, GALVANIZED AND ELECTRICAL
Page Steel & Wire Co., Adrian, Mich.

WIRE, WEAVING, MONEL METAL, BRASS, COPPER, GOLDEN BRONZE, HIGH BRASS, LOW BRASS, NICKEL
Can. Driver-Harris Co., Ltd., Walkerville.

WOOD BORING MACHINES
Canada Machinery Corp., Galt, Ont.
Cowan Truck Co., of Galt, Galt, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

WIRE STRAIGHTENERS AND CUTTERS
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton, Can.
Shuster Co., F. B., New Haven, Conn.

WOODWORKING MACHINERY
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Cowan Truck Co., of Galt, Galt, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
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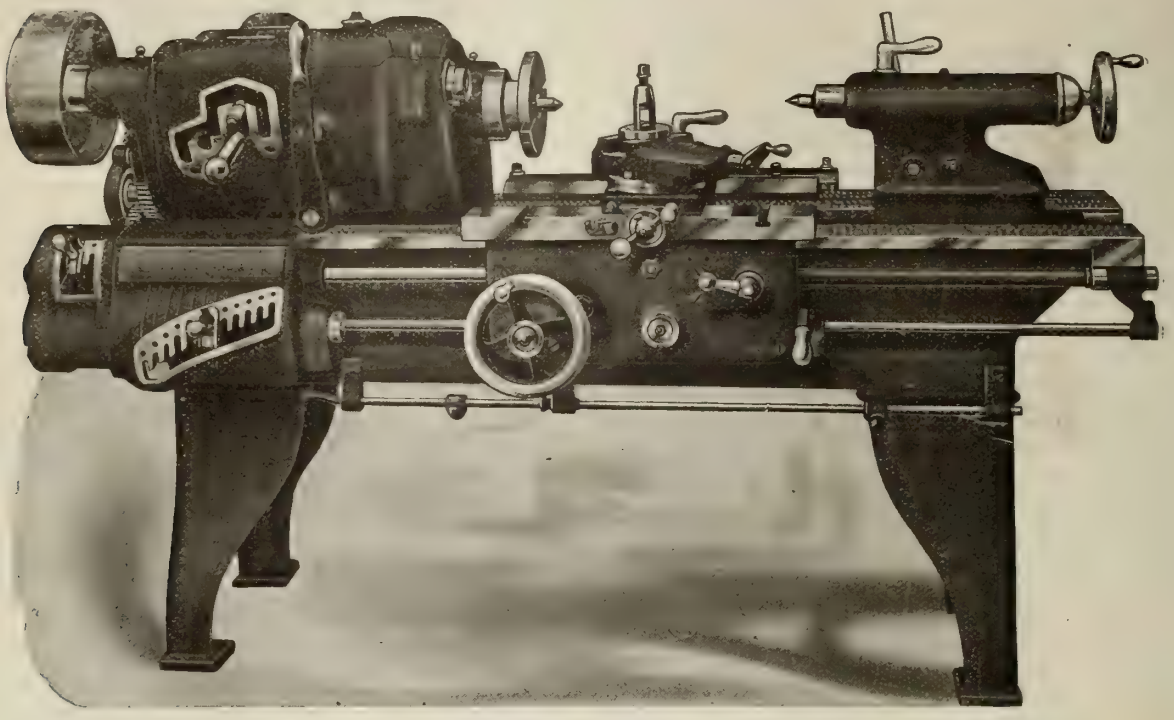
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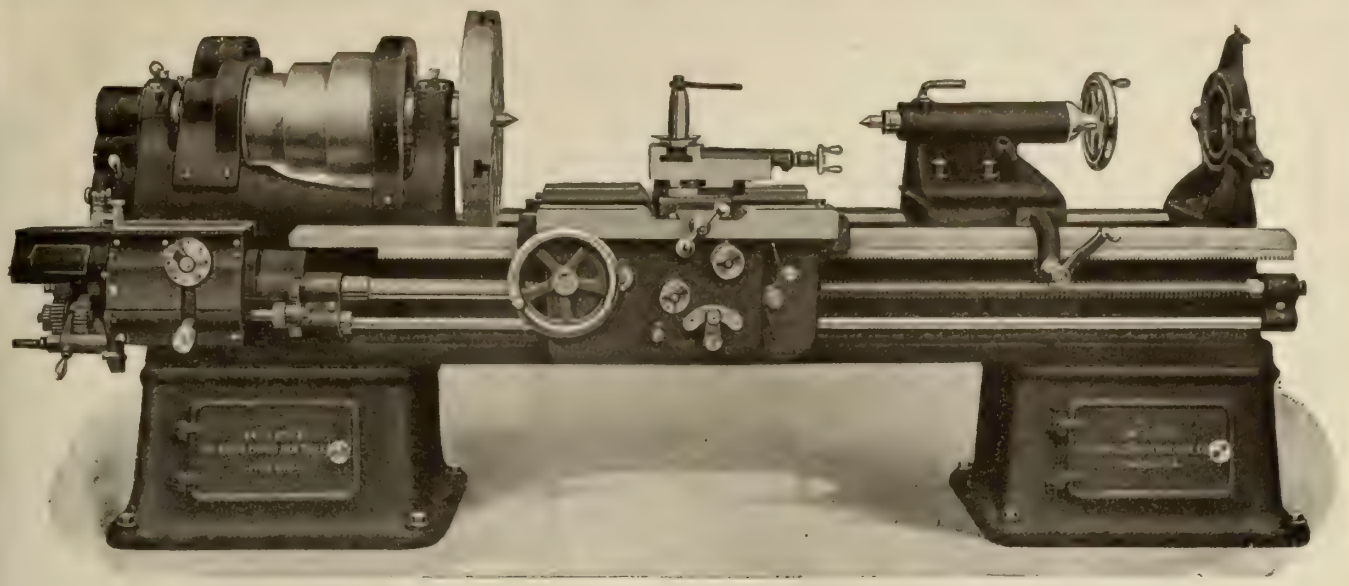
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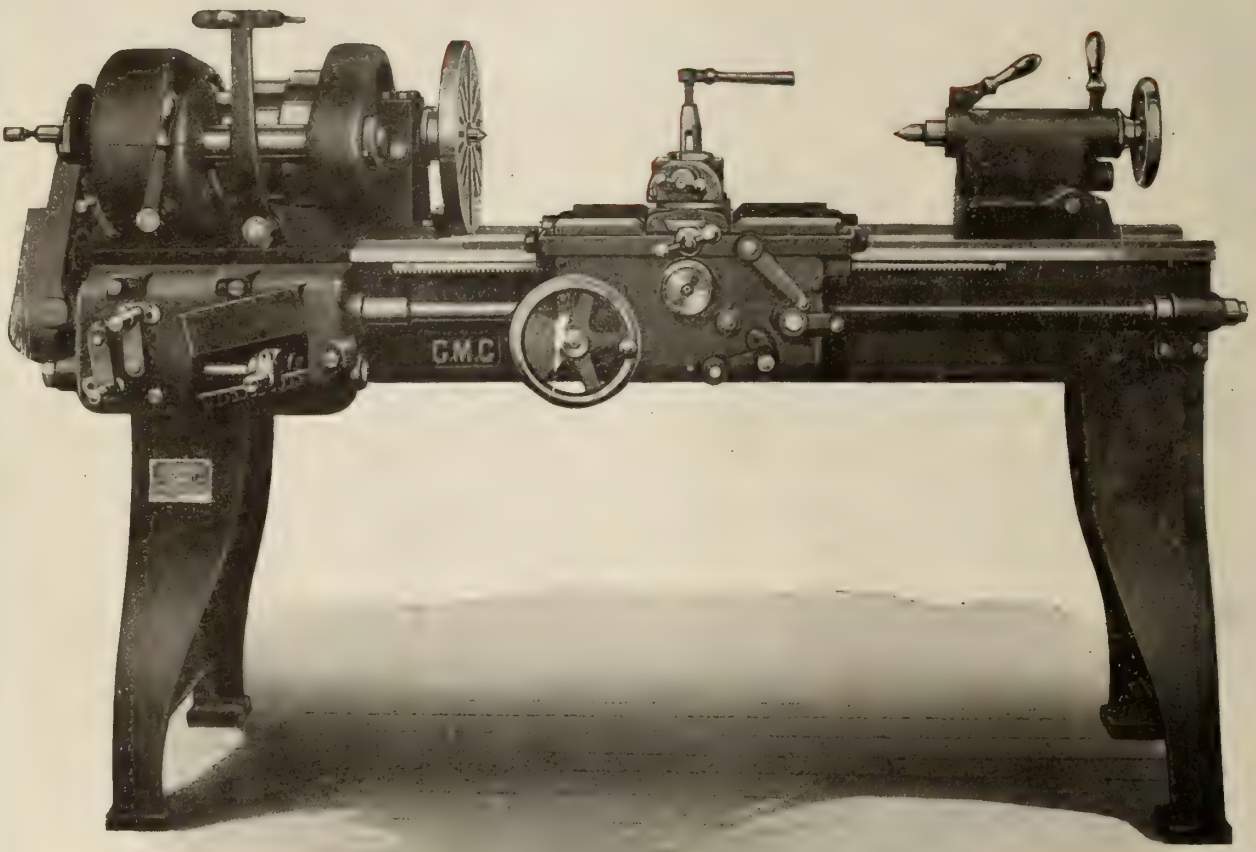
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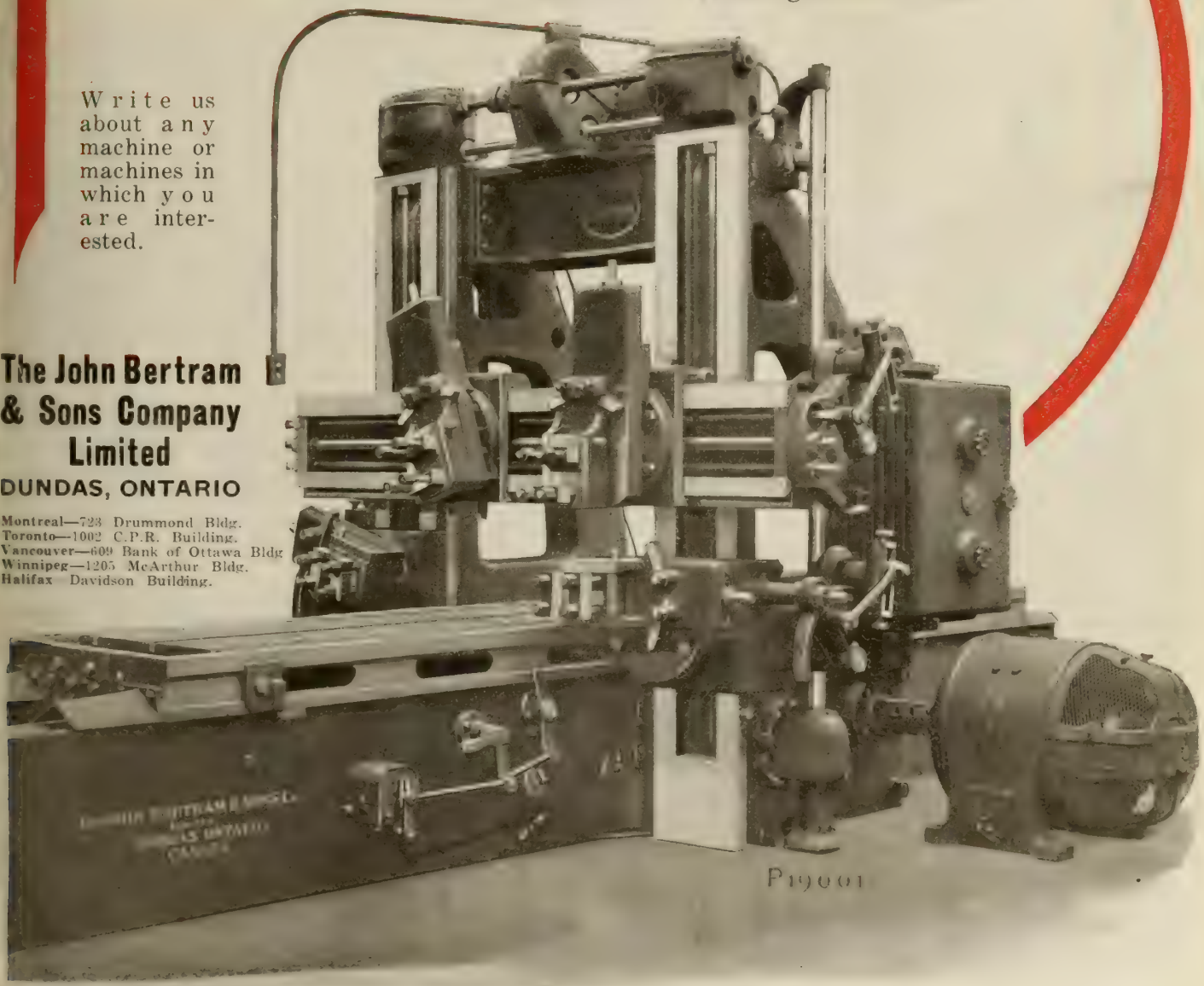
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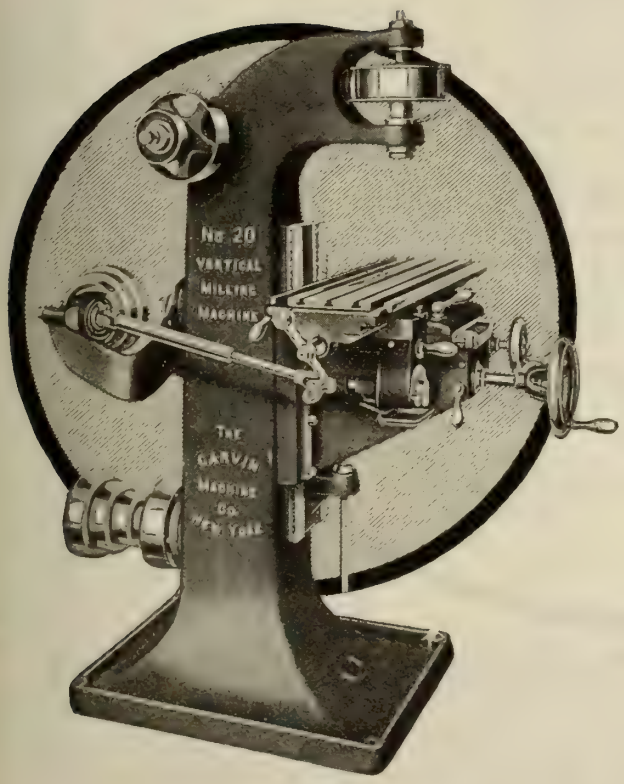
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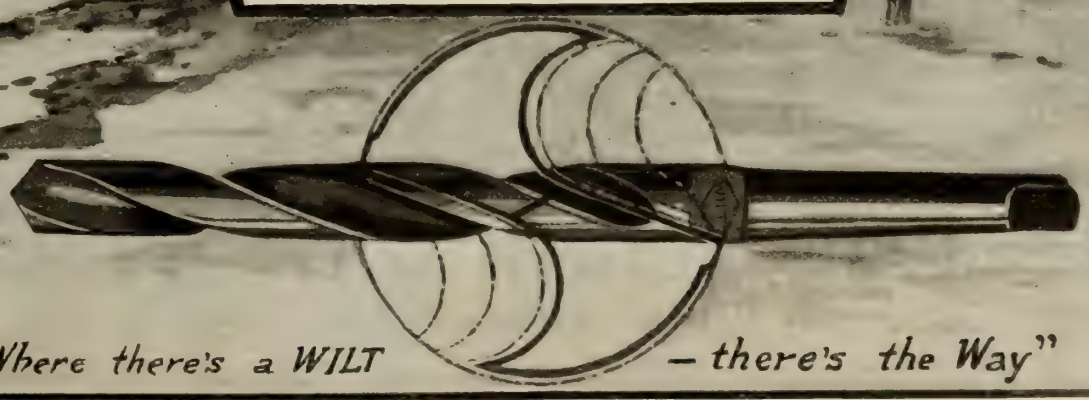
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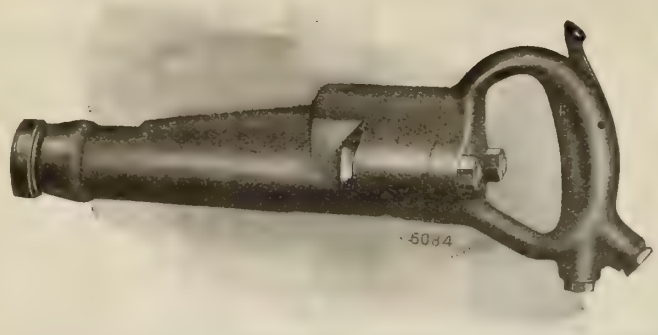
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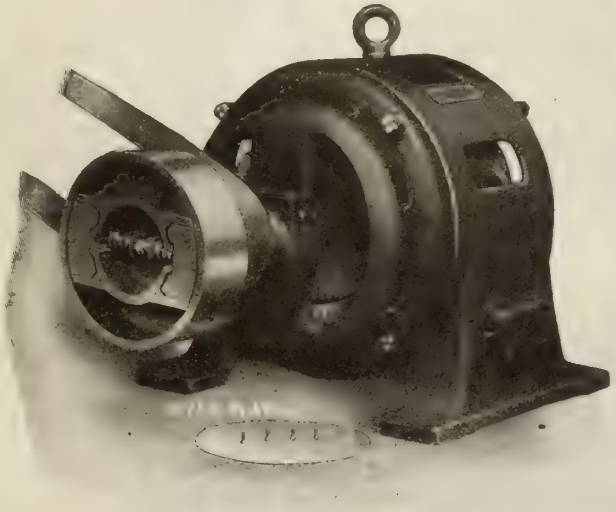
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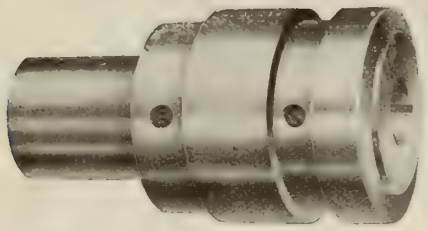
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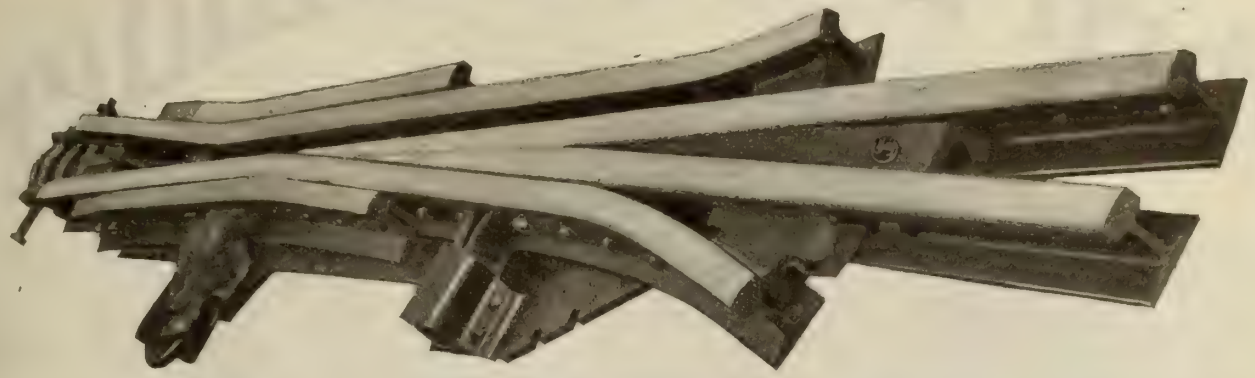
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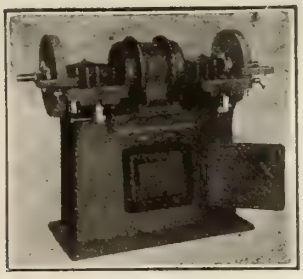
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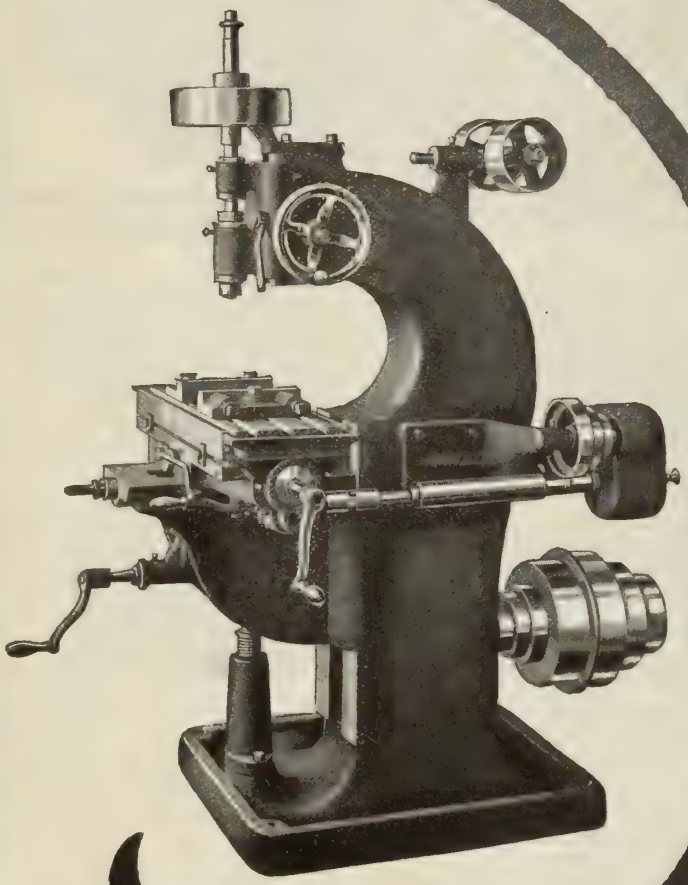
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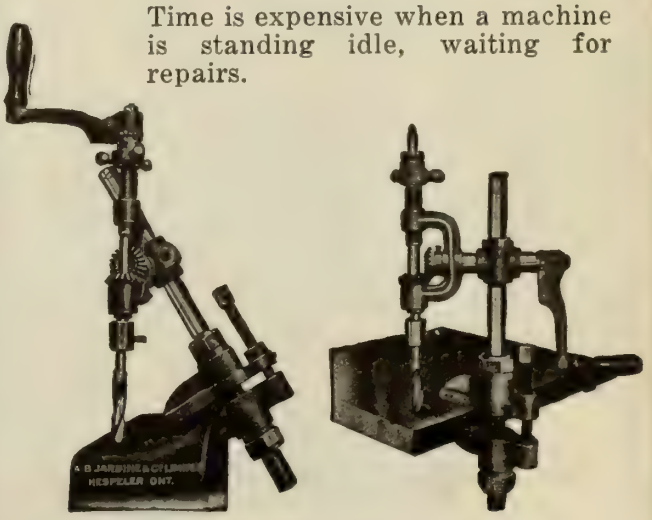
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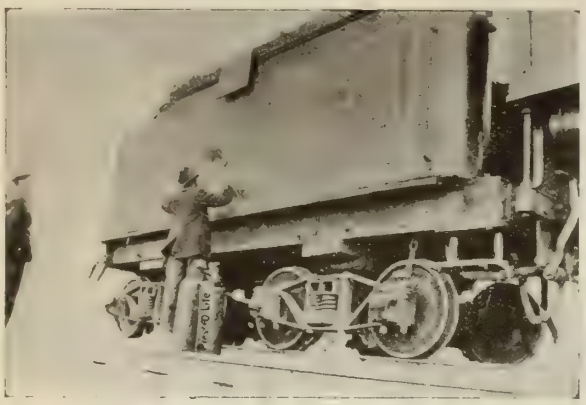
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This illustration shows an operator repairing a leaky tank car right on the track, at a trifling expense, by the Prest-O-Lite Process of Oxy-Acetylene Welding. Railroads, Mines, Factories and Machine Shops everywhere have adopted this process, and are saving hundreds of thousands of dollars annually.

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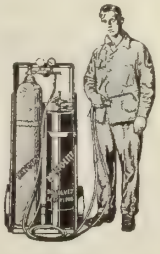
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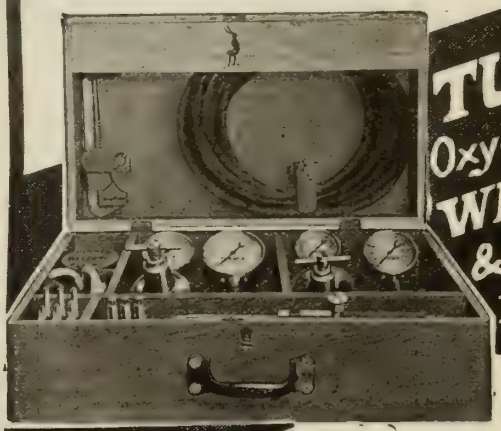
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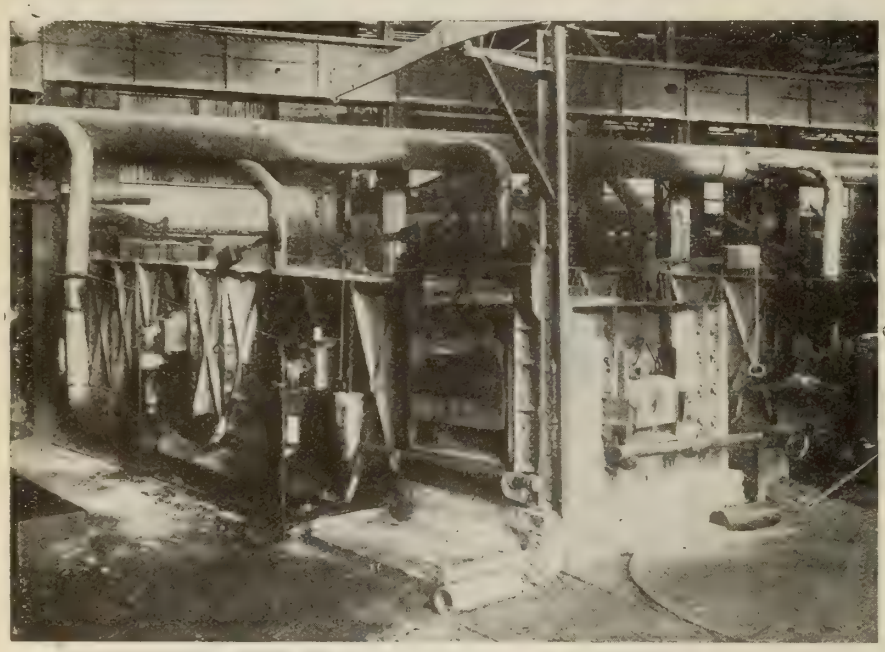
These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



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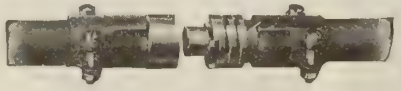
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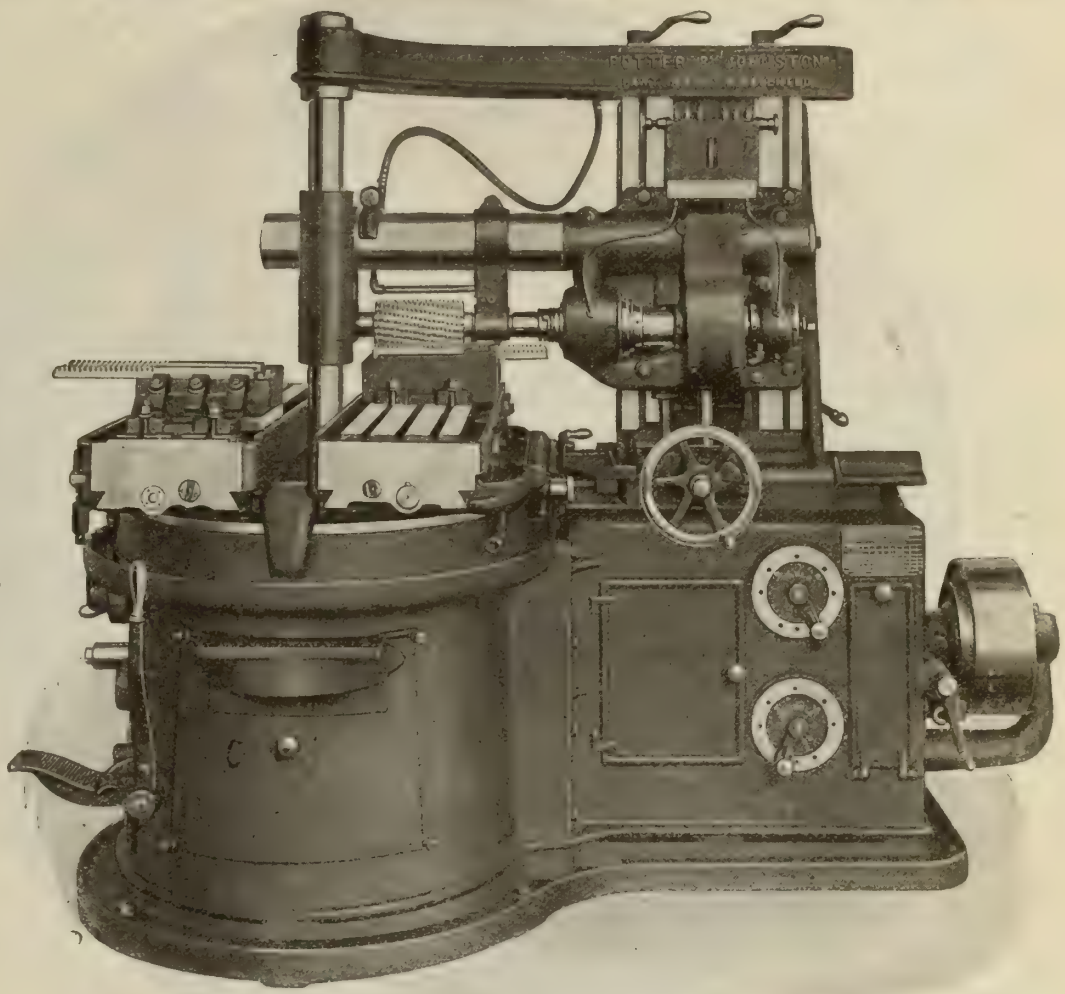


Sand rammer in operation.

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16 table feeds: 7/8 to 12 5-16". Len. of table feed: 29".

16 spindle speeds: 20 to 180 R.P.M.



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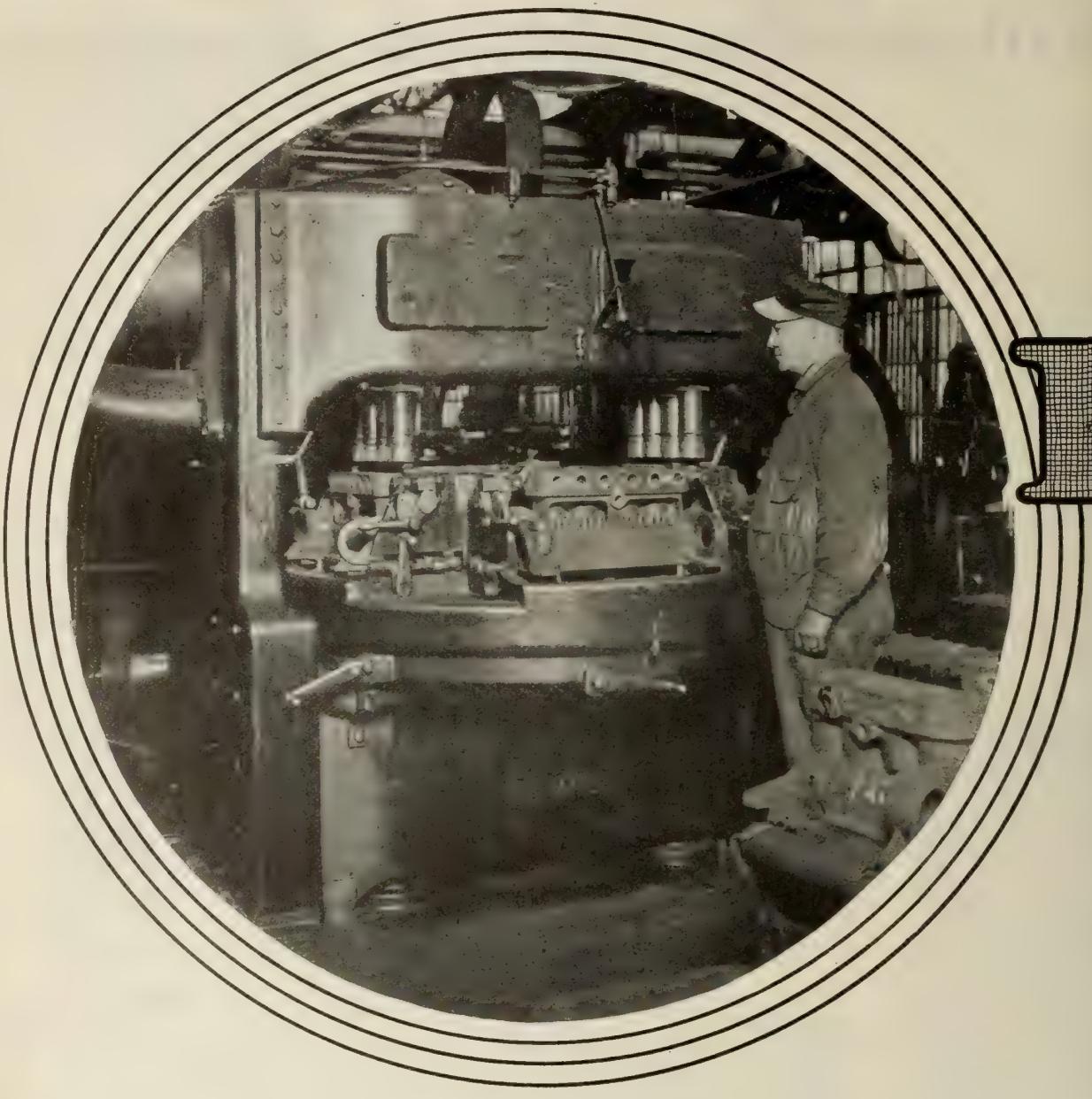
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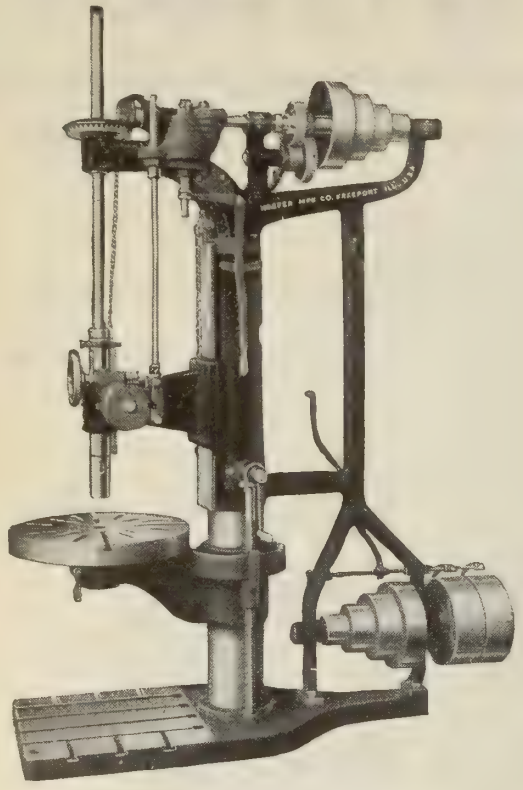
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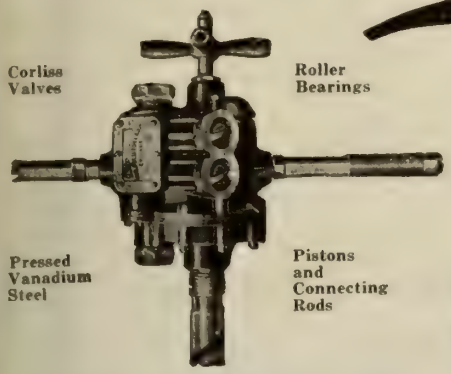
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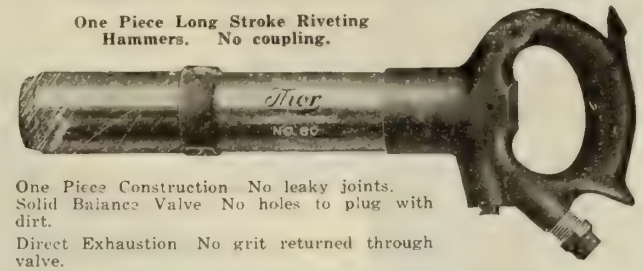
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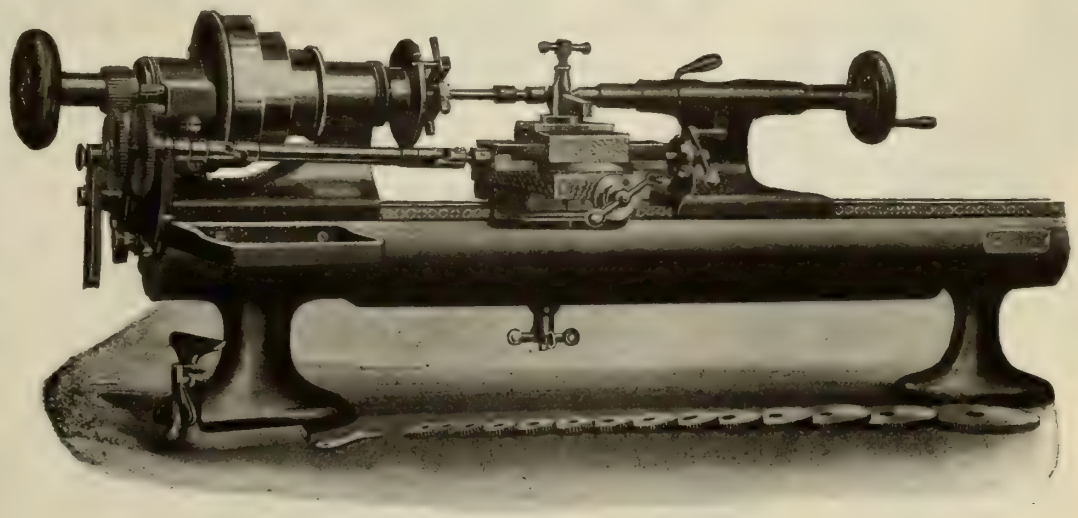
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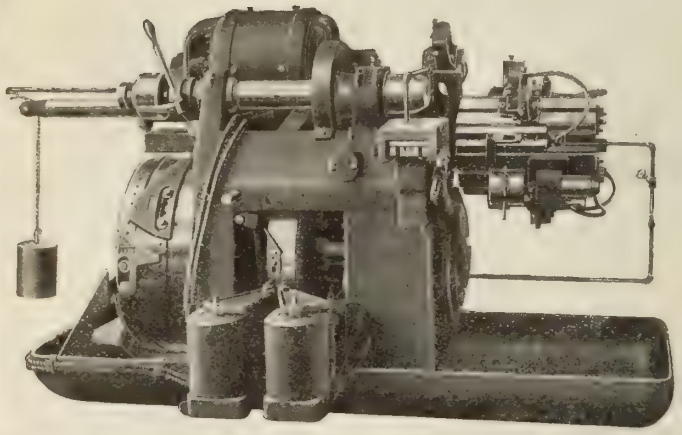
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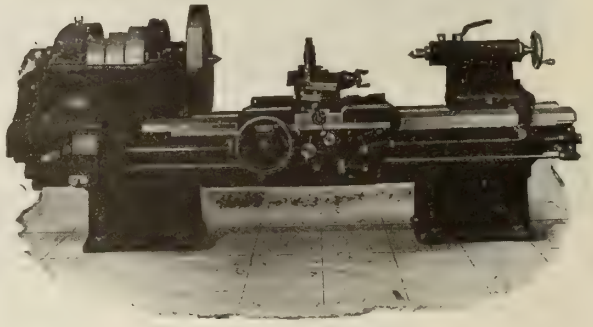
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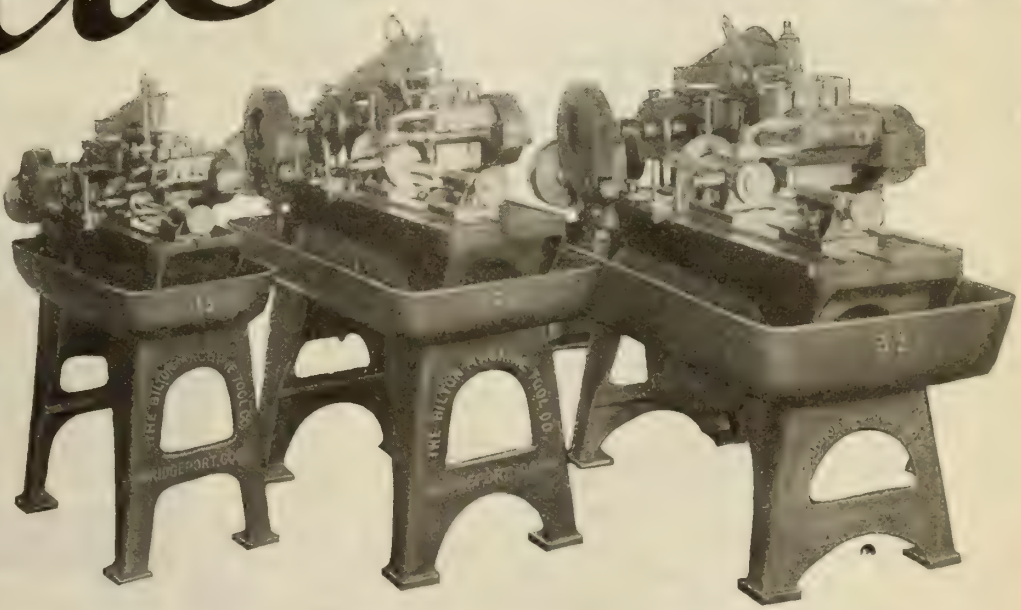
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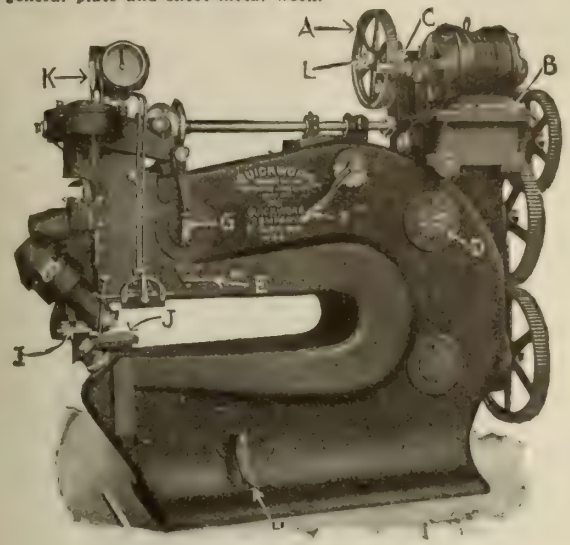
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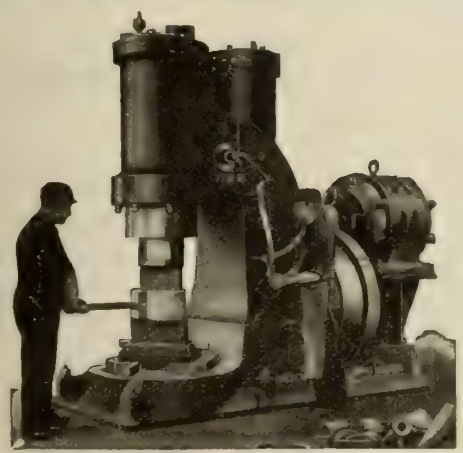
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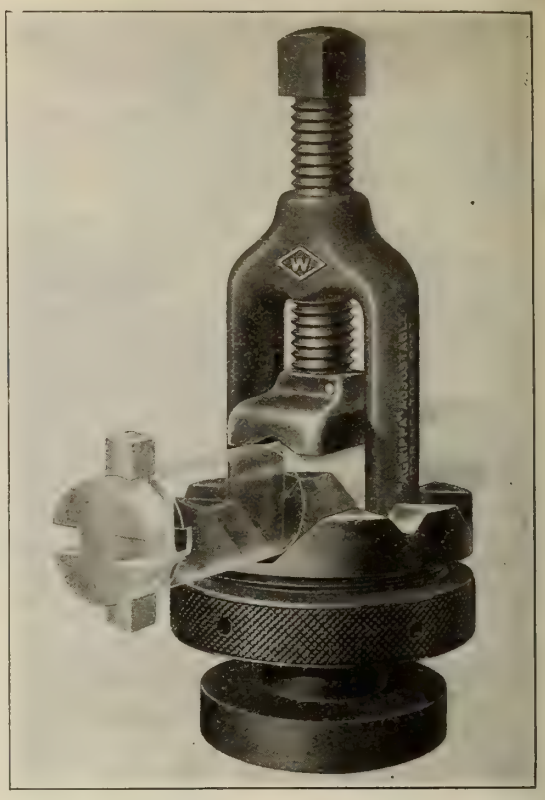
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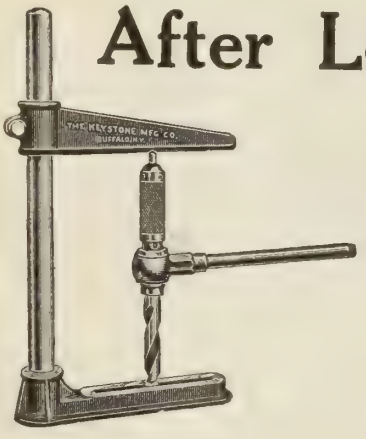
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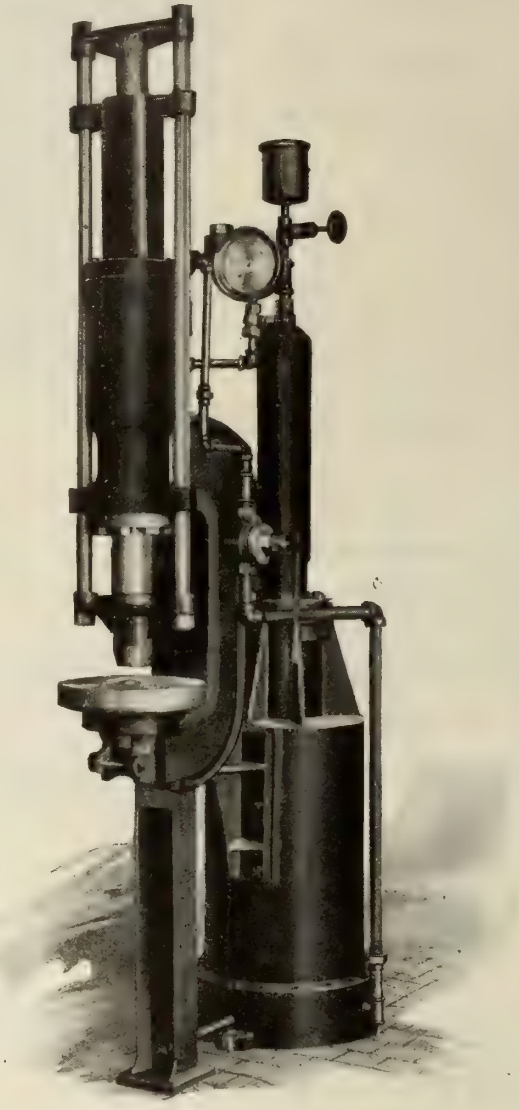
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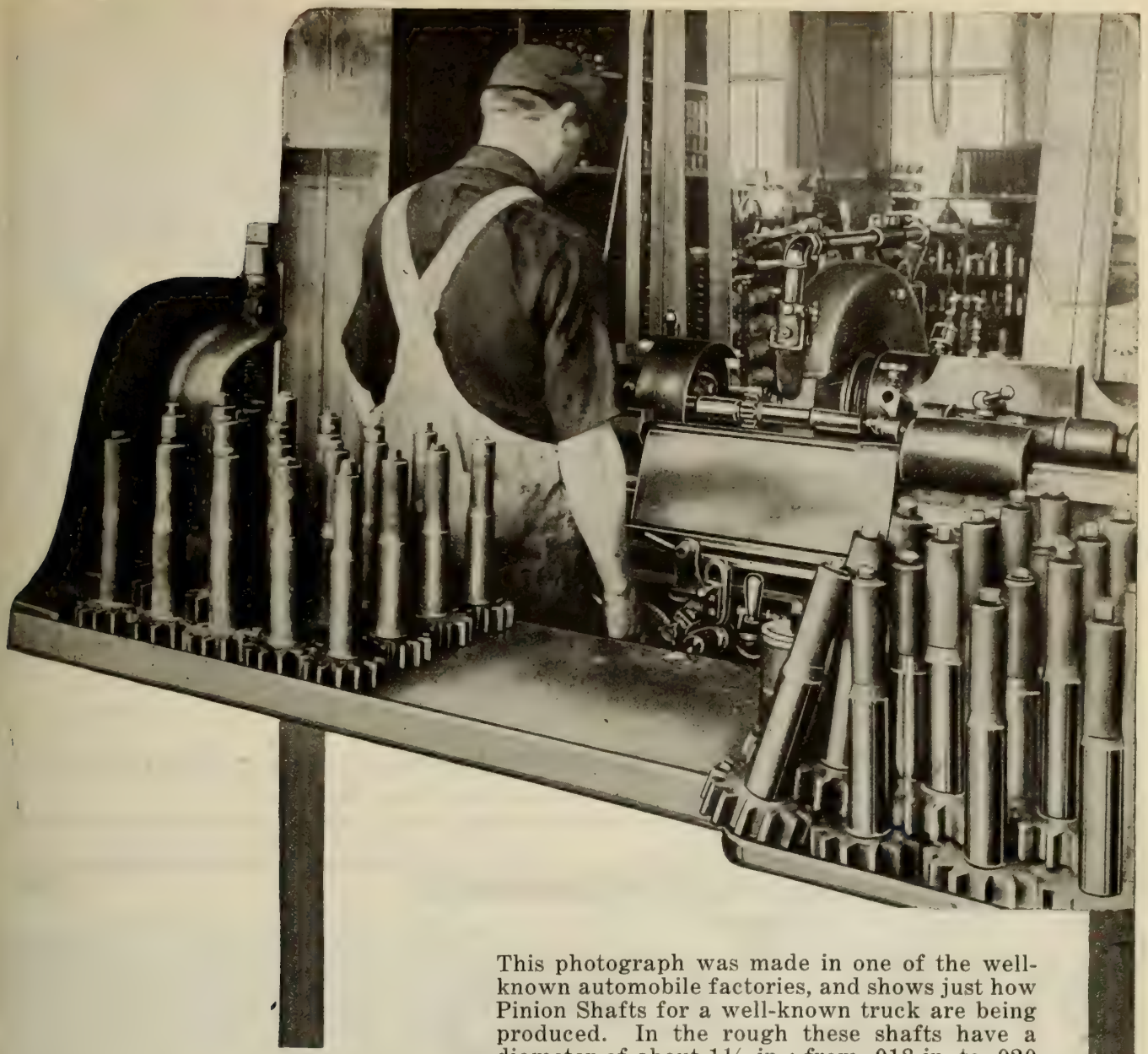
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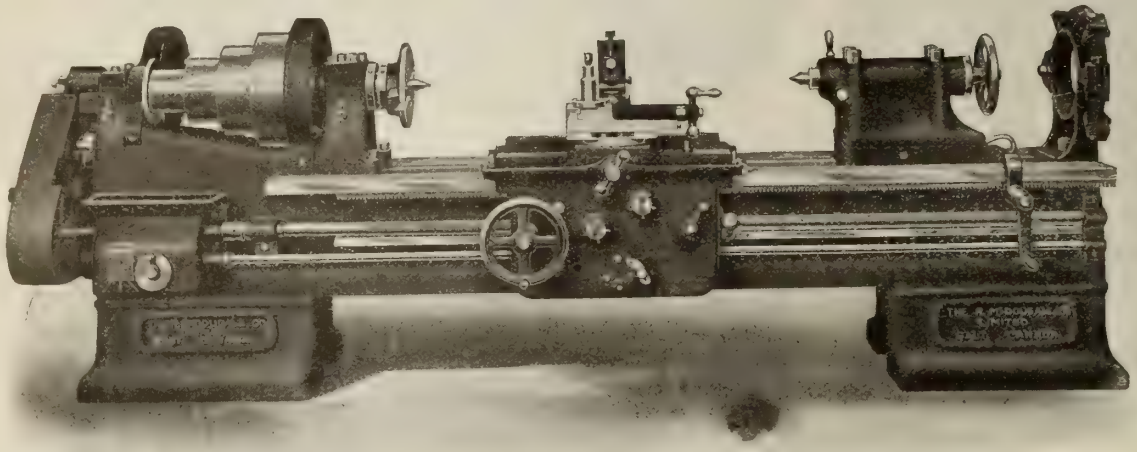
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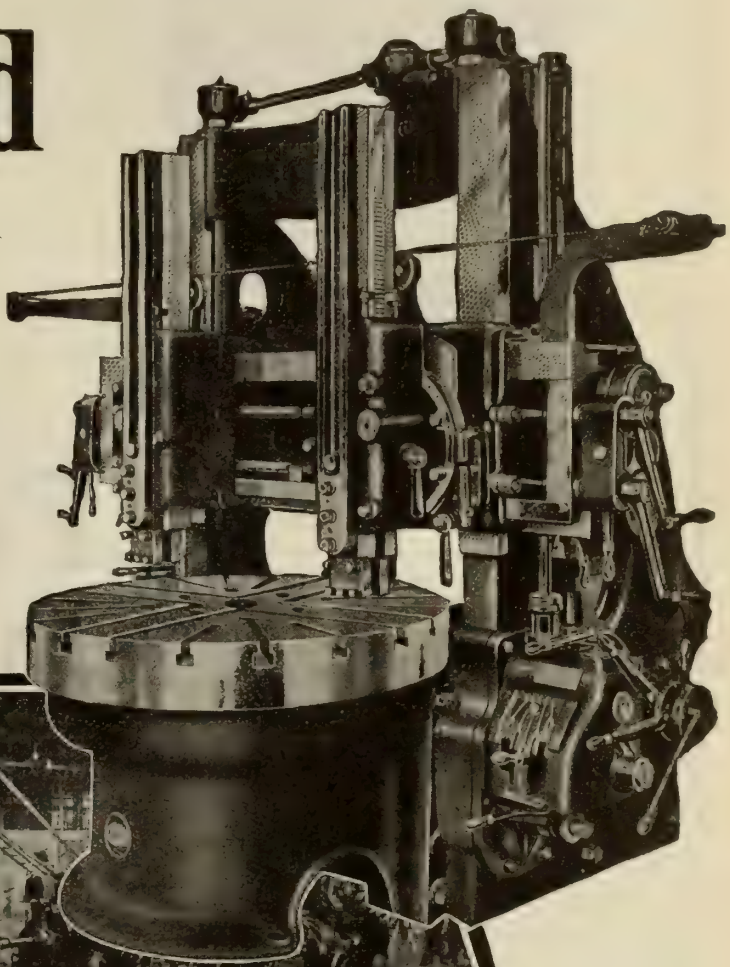
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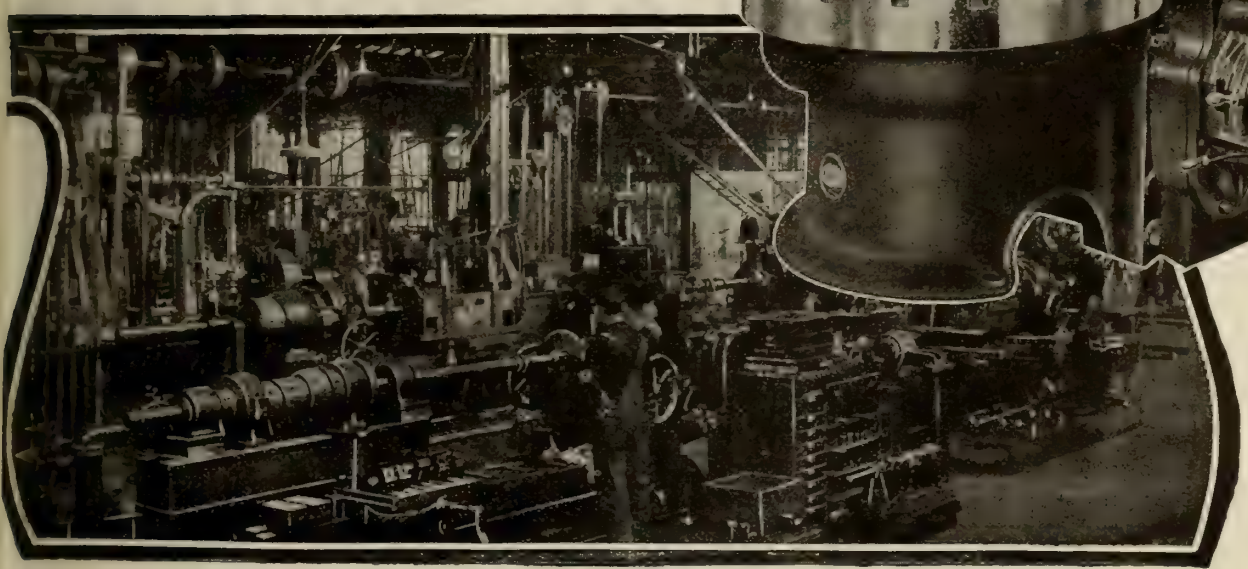
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 5 January 29, 1920

Interchangeability as an aid to Greater Production

The Need of Accurate Production in Any Line of Industry is Too Well Known to Require Comment. Herein Are Shown and Described Various Precision Tools Used to Obtain Such Results.

By J. H. MOORE

THERE was a period when the term production did not mean so much in the mechanical world as it implies to-day. Manufacturers had very little competition to deal with, never stretching themselves to produce an article in the shortest time possible, nor attempting to secure interchangeability. In fact the latter-mentioned word had an ugly sound to them, forecasting all sorts of difficulties and pitfalls.

Take for example the case of many makes of the earlier models of the Linotype. The feature of interchangeability was largely conspicuous by its absence in this case, and considerable trouble and irritation resulted from this fact.

A machine of such nature, consisting as it does of some 3,600 odd parts, is bound to get out of order to some extent. A break occurs and a new piece is required at once. Providing that all parts are interchangeable, the problem is a small one, but in those old days, when very few parts were a duplicate of each other, the fun (?) encountered was sometimes great. It was necessary to file this, grind that, and so on.

It was only natural that such a condition had to change, and change it did, for to-day this type of machine, of which there are numerous makes, is so improved, that all parts are absolutely interchangeable. In the event of a breakdown out comes the broken portion and in goes a new piece, a perfect fit, without any trouble.

How has such a sweeping change become possible? Simply through forethought, together with careful planning of jigs and fixtures, test gauges, etc. All this did not happen in a day, but has been the result of steady improvement as time went on. What holds good in the story of the Linotype, likewise applies to the use of production and inspection tools in the machine tool industry.

The writer can well remember the time when jigs and fixtures were looked upon as, well, a sort of wild dream on the part of an efficiency expert, and as for the fellow who carried a first-class set of tools in his kit, why, he was considered crazy. The idea of spending his own money to produce better work for the company was always a subject for a joke.

To-day the opposite condition holds good, for the chap who works with old-fashioned tools is out of date, a back number, and not to be classed with the other type of workman who delights in keeping his tool kit up to the minute.

From this statement it is not to be inferred that good tools make good workmen. Far from it, for we have seen a mighty poor workman handling good tools. We have also seen cases of a good workman using poor tools, with poor results, who could have obtained the best of results with the proper equipment, but in the latter case the workman soon got wise to himself.

All these facts, however, are already history, so why repeat them? Let us proceed into a talk on production and inspection of tools, taking it for granted that all readers agree with us as to the feasibility and advantage of their use.

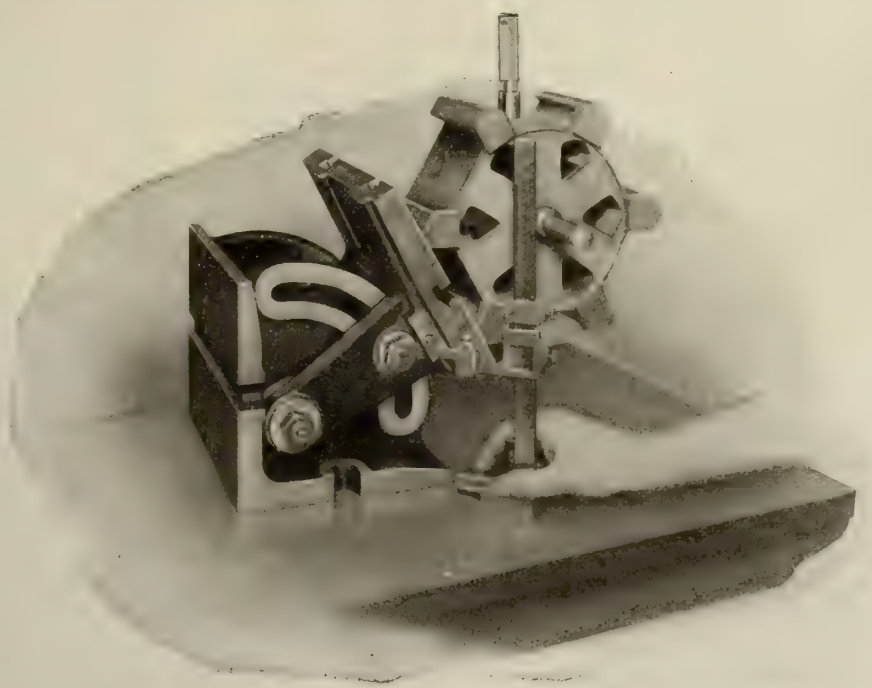


FIG. 1—ILLUSTRATING THE USEFULNESS OF THE ADJUSTABLE KNEE IN SETTING UP TO CHECK MEASUREMENTS.

To confine oneself to any particular branch of industry would be impossible, but of one thing we can speak, and that is the fact that the real problem in any manufacturing process is the designing and building of special tools, jigs, fixtures and gauges necessary for the economical production of the product no matter what it may be, making sure that all parts are interchangeable.

Of course we are taking it for granted that the product is to be turned out in reasonable quantities, for the fact of quantity enters largely into the problem of how much should be expended on fixtures, gauges, etc. A concern like the Ford Motor Car Co. can afford (no pun

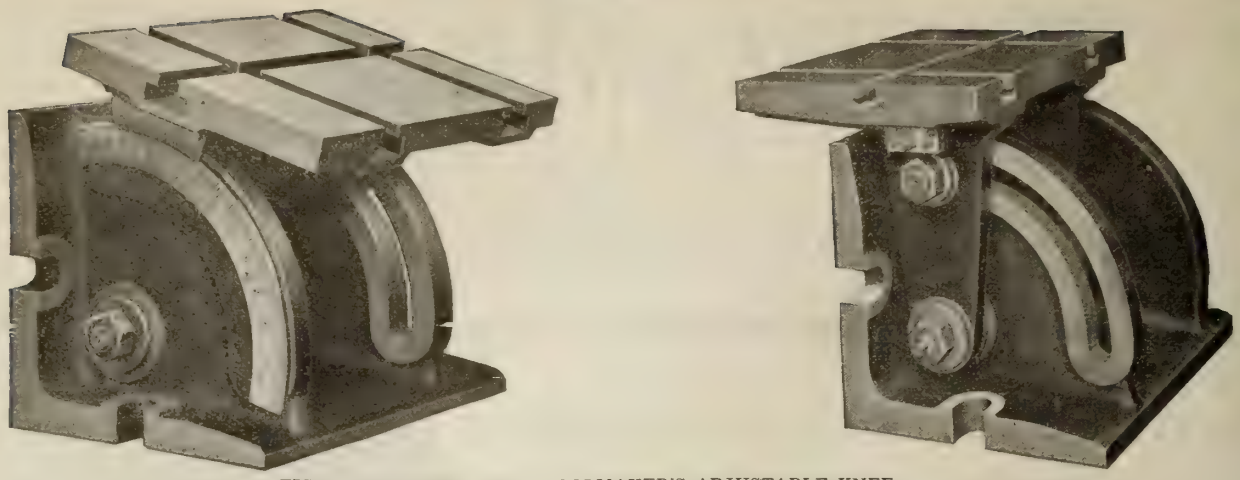


FIG. 2—TWO VIEWS OF A TOOLMAKER'S ADJUSTABLE KNEE.

intended) to spend considerable money on a special speeding-up fixture, for their production is so great, while a manufacturer turning out say only 5,000 machines a year could not attempt to equip his plant in a manner similar to the first-mentioned concern. In other words the planning of equipment expense is largely dependent on the quantity produced.

Usually the first germ of the idea is created in the drawing office. This is especially true in the case of a jig or fixture. The idea is thrashed out thoroughly, until it is at last O.K.'d, traced, blueprinted, and passed on to the tool room.

The Need of Good Tools

We will suppose the fixture designed is to be used on the lathe, the operation being the turning of the taper portion on an automobile brake rod support. The taper on such a piece is about 3 inches long, and all pieces must be exact duplicates of each other.

In order to make sure that all dimensions on the turning fixture are accurate, the toolmaker should be equipped with only the best of precision tools. Take for example Fig. 1. While this illustration does not depict a fixture of the nature we speak of, it does show clearly a good example where the adjustable knee, or swivel angle block (as it is sometimes called) can be used to advantage.

By the use of this production tool you can clamp a fixture securely, marking such measurements as you see fit, or checking dimensions, as the case may be, feeling assured that the results obtained will be accurate in every respect, providing of course you exercise reasonable care and use a good grade of measuring tool.

Fig. 2 gives two different views of this style of adjustable knee under discussion. As can be noted, it can be set to any desired angle. Sine buttons with sufficient centre distance for obtaining angles accurately, are set in one end of the knee. At the other end is a graduated section and vernier, reading to 5 minutes, which enables the knee to be set quickly to within 5 minutes of the required angle.

The working faces of the knee are provided with T slots for bolting the work to the tilting table.

Usually the height of this type of knee is 9 inches when in horizontal position, which is ample height to allow the handling of quite a variety of work. Wherever accurate tool or fixture work is being performed, a knee of this nature not only speeds up the work but helps to ensure its being correct.

The Testing of the Taper

Let us suppose the piece already mentioned is completed, all but the inspection test. In order to test the accuracy of the taper we must first have a suitable gauge for the purpose.

At Fig. 3 is illustrated a gauge of such a nature, while at Fig. 4 is shown the tool in actual use.

Such a gauge as illustrated is well adapted for use in connection with the economical reproduction of any taper within its limits. It is made up of two adjustable straight edges mounted on a cast iron body, with a convenient handle on one side by which the gauge may be held or clamped when in use. Of course, as can be understood, various sizes of this tool are made, the sizes of the test blades varying in length.

The Measuring of Angles

In the making of taper test plugs and other work of like nature it is essential that the toolmaker have some means of accurately testing his angles. For this purpose a sine bar fixture as shown in Fig. 5 is often used. Any part can be accurately laid out, made and inspected with the aid of this type of fixture. Pieces with several measurements can often be checked with one set up on the sine bar. Standard or special tapers can be accurately made, both cylindrical and flat. The bar illustrated is what is known as the improved type, and has a clamping device by which the pivot stud can be clamped at any height, independent of the clamping arrangement of the bar. Such an advantage is no doubt obvious to every reader so we make no further comment on this feature.

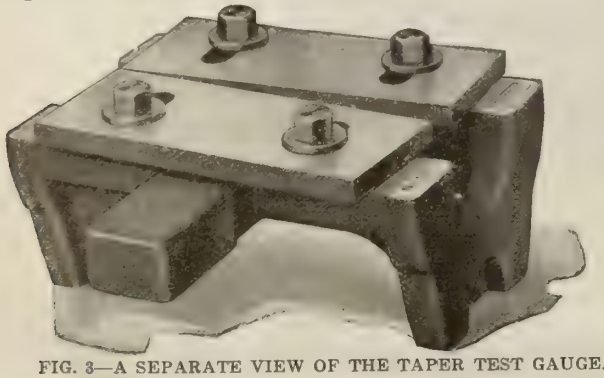


FIG. 3—A SEPARATE VIEW OF THE TAPER TEST GAUGE.

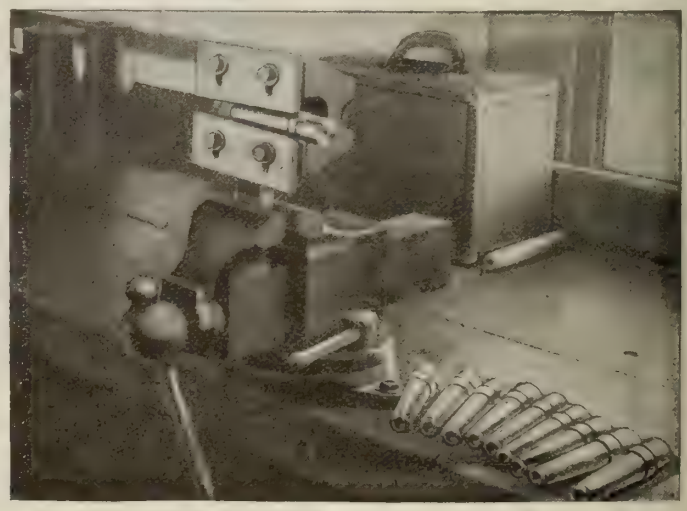


FIG. 4—IN THE ILLUSTRATION SHOWN THE GAUGE IS BEING USED FOR DUPLICATING TAPER SHANKS ON CUTTER BLANKS.

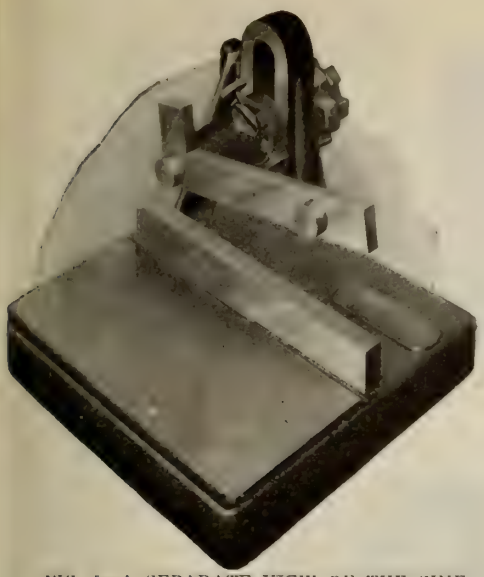


FIG. 5—A SEPARATE VIEW OF THE SINE BAR FIXTURE.

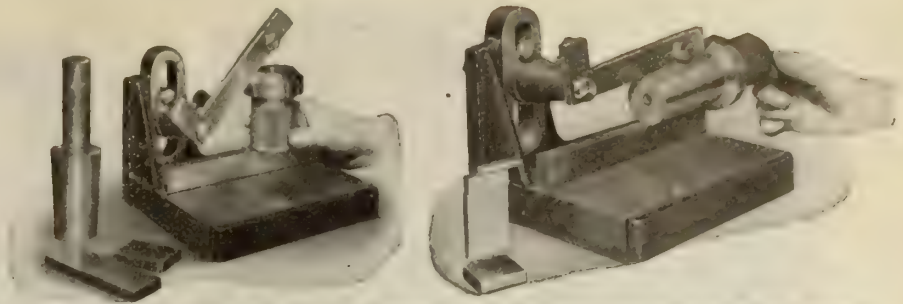


FIG. 6—USING THE SINE BAR FIXTURE FOR TWO DIFFERENT STYLES OF WORK.

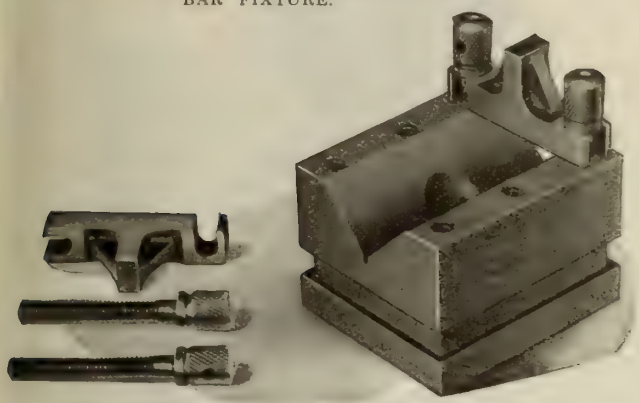


FIG. 7—ONE STYLE OF "V" BLOCK OFTEN USED.

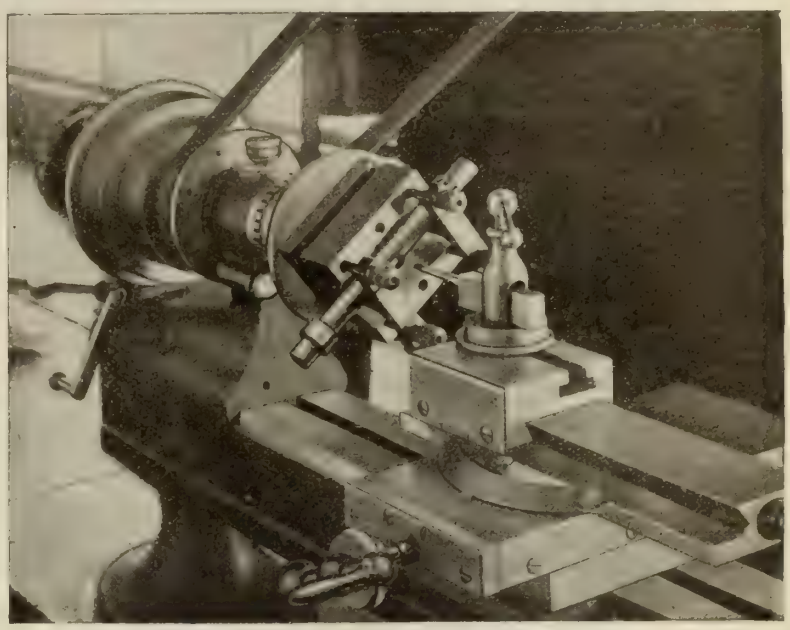


FIG. 8—USING THE "V" BLOCK AS A MEANS OF BORING A HOLE ACCURATELY THROUGH A STUD.

To illustrate how such a bar is used, let us refer to Fig. 6. Here we see two different set-ups and steps in the measurement of a taper test plug. The illustrations are so clear in themselves that it is hardly necessary for us to go into details.

The Use of the V-Block

The V-block and its uses are not as familiar to the average mechanic or toolmaker as they should be. Of course there are innumerable styles of blocks, from the common garden variety to the finer finished article.

As readers are no doubt familiar with the regular type used we will not touch on that style, but confine our attention to what is known as the universal type. Fig. 7 illustrates the appearance of such a block. It will be noted that this block is provided with a hole, central with the V, by means of which it can be quickly and accurately set with the V, central with a spindle or to some other required position.

By using a block of this nature the usual tedious task of lining up the V-block on a face-plate is avoided, for it is a simple matter to indicate the hole and adjust it until it runs true. The hole also provides a clearance space for the drill or boring tool as the case may be. The clamping holes (which can be clearly noted on the illustration) go entirely through the block and are used by inserting screws from the back. A clamping groove is also provided in each side of the block.

Fig. 8 shows one of these blocks set up for the boring of a hole through a stud. In precision work it is essential that any hole bored through a stud must be absolutely accurate. It is in cases such as this that V-blocks prove their usefulness.

Of course we would not have readers imagine that V-blocks are only used to bore holes through studs. This is not

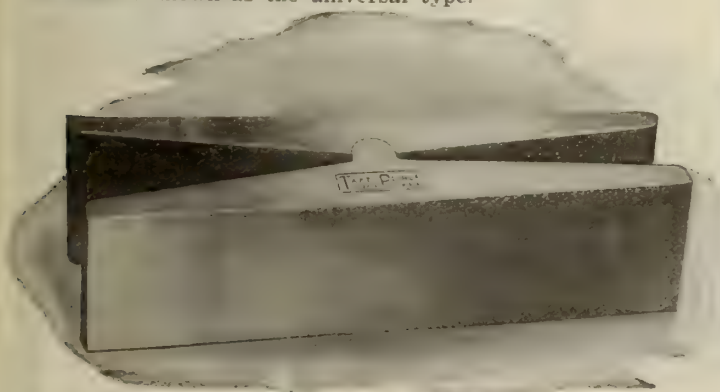


FIG. 9—A SEPARATE VIEW OF THE EQUALIZING JAW.

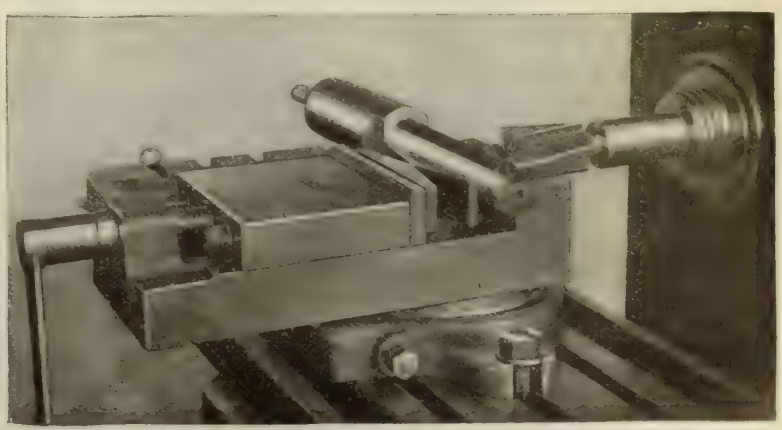


FIG. 10—THE EQUALIZING JAW IN USE, THE WORK BEING THAT OF GRIPPING TAPER SHANK.

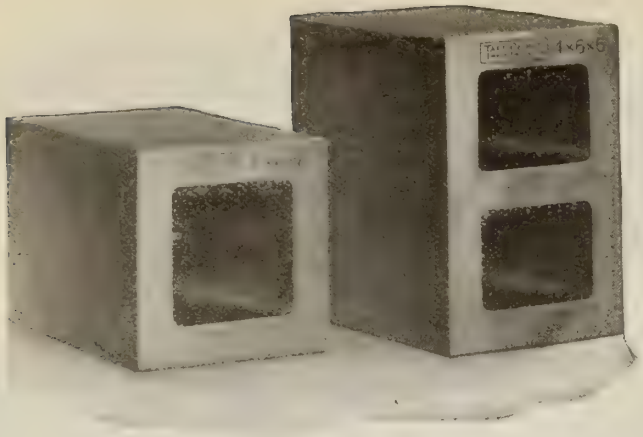


FIG. 11—ILLUSTRATING TWO STYLES OF BOX PARALLELS.

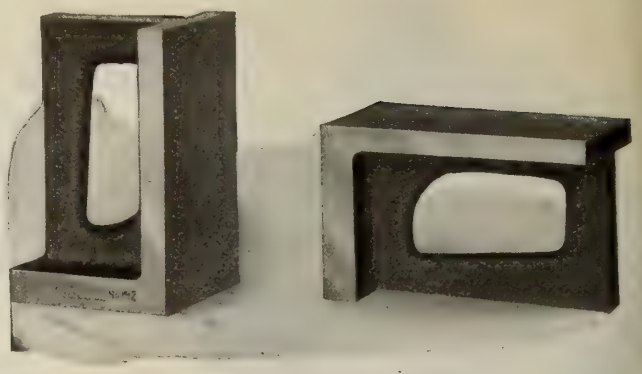


FIG. 13—SEPARATE VIEW OF A UNIVERSAL ANGLE IRON.

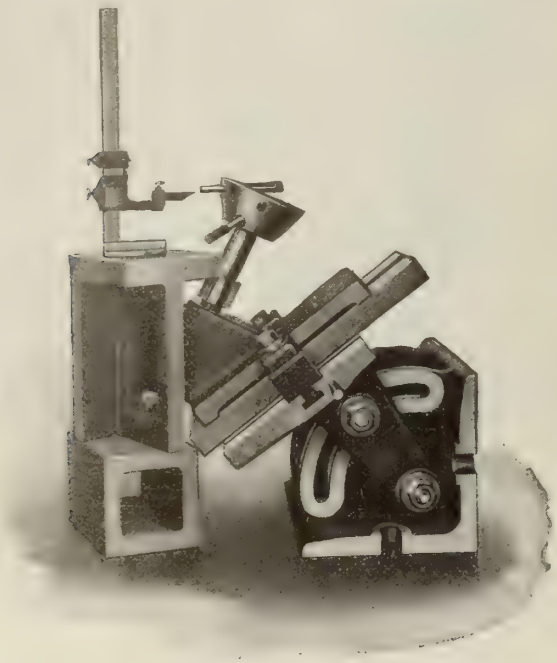


FIG. 14—HERE IS AN INTERESTING COMBINATION. A UNIVERSAL RIGHT ANGLE IRON, IN COMBINATION WITH A BOX PARALLEL, AND TOOL MAKER'S ADJUSTABLE KNEE.

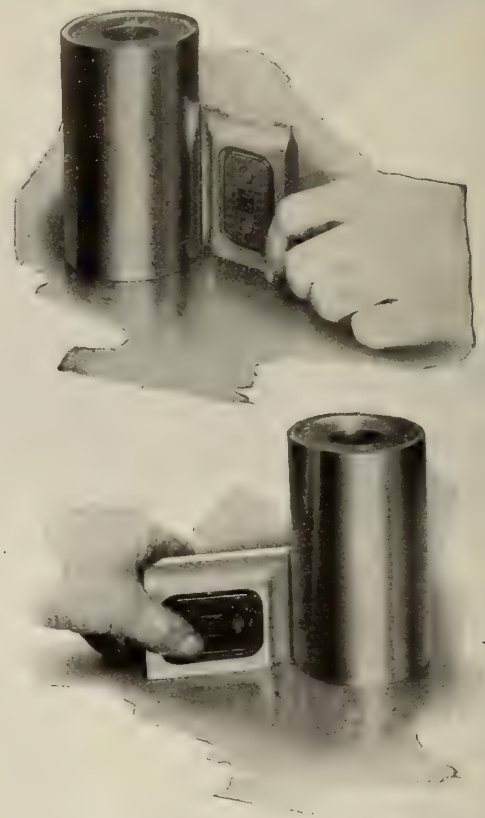


FIG. 15 — ILLUSTRATING HOW BOTH THE LONG AND SHORT SIDES OF THESE UNIVERSAL SQUARES ARE TESTED.

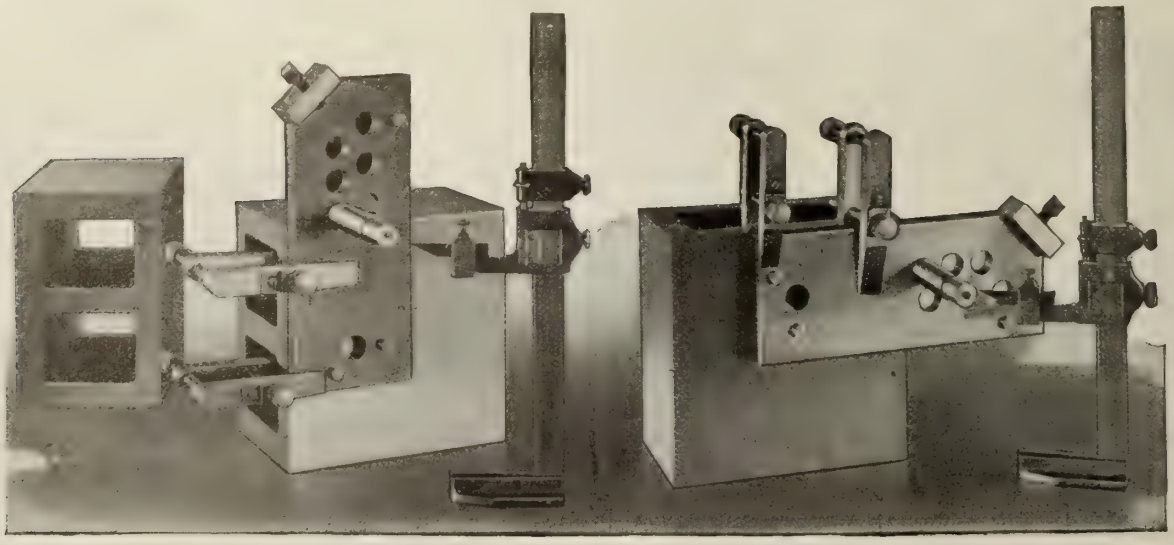


FIG. 12—SHOWING HOW BOX PARALLELS ARE USED.

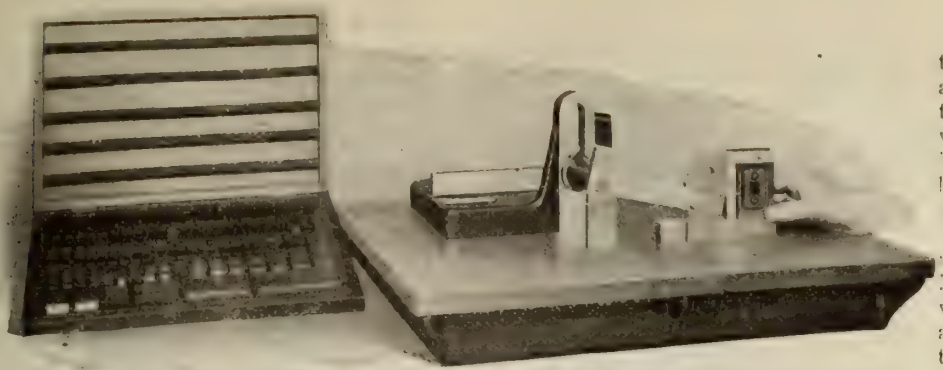


FIG. 16—USING THE UNIVERSAL SQUARE TO SET THE SINE BAR FIXTURE, FOR A SPECIAL MEASUREMENT.

our intention, for our idea is to point out the advantage of using a V-block, in conjunction with the lathe, whenever practical.

The Use of Equalizing Jaws

It often happens that equalizing jaws can be used to good advantage throughout the tool room. This is especially true if the piece to be gripped is of peculiar shape. At Fig. 9 we illustrate a pair of these jaws.

Jaws of such nature are often found equally useful for the general machine shop as well as the tool room, but in this particular case we will confine ourselves to the tool room. Time in set-ups is saved by the use of such a tool, not to speak of the secure grip which you are able to obtain by such a method. The circular fulcrum shown at the centre of the jaws holds them in position while the work is being clamped, and at the same time allows for adjustment to the angle of the work. A set of these jaws in use is shown at Fig. 10.

It will be noted that in this case the work being gripped is a taper shank, an object difficult to grip by any other method, but by means of an ordinary miller vise and a pair of these jaws the trouble is solved at once.

Parallel Blocks

The uses of parallel blocks are many. They are used on almost every machine tool for blocking up purposes, for set-up work, and so on. The ordinary solid type are used extensively on planer work, for raising the work on the bed, while the box type as illustrated at Fig. 11 are used more for gauge and inspection work. Of course some concerns adopt this type for blocking up purposes also, but for our purpose we will illustrate only their use for inspection purposes.

At Fig. 12 we illustrate by two separate views how the box parallel can be used to advantage. As these blocks are finished accurately all over they can be turned to any desired position, giving quite a large range to work on. The only reason they are cored is to facilitate clamping, at the same time reducing their weight.

Angle Irons

As in the case of the parallel blocks there are innumerable styles and sizes of angle irons, but we will confine ourselves to one style only, that being the universal right angle iron. This type of iron is shown at Fig. 13, while a combination of three production tools is illustrated at Fig. 14.

In this case we see a parallel block, an adjustable knee, and a right angle iron, all combined. This is one example which brings forcibly home the fact that accurate measurements can only be obtained with accurate tools.

Universal Squares

An inspection tool, not used as often as it might be, is illustrated at Fig. 15. This tool, known as a universal square, is accurately made so that it will test squares, even when held at an angle to the surface being inspected for squareness. The knife edge and straight sides are finished to a high degree of accuracy. Every square is tested on both sides as shown at Fig. 15, and as can be noted, the centre of the square is of web construction covered with a hard rubber insulation, which provides an excellent grip. These squares are especially useful in setting dimensions which must be extremely accurate.

Take for example Fig. 16. Again we have an illustration of a combination of inspection tools, for here we see the universal square being used to set the sine bar fixture to a special measurement.

Fig. 17 depicts what is known as a measuring iron. This tool is so designed that it may be clamped to the table of a machine or surface plate, and to provide a fixed surface from which measurements can be conveniently taken. It is particularly adapted for use in connec-

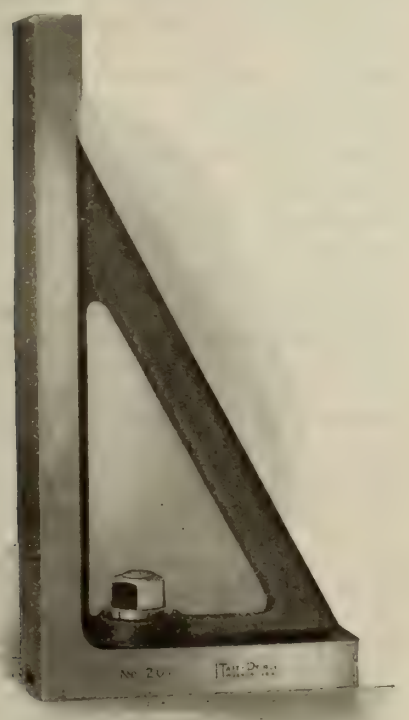


FIG. 17—A DETAIL VIEW OF ONE STYLE OF MEASURING IRON.

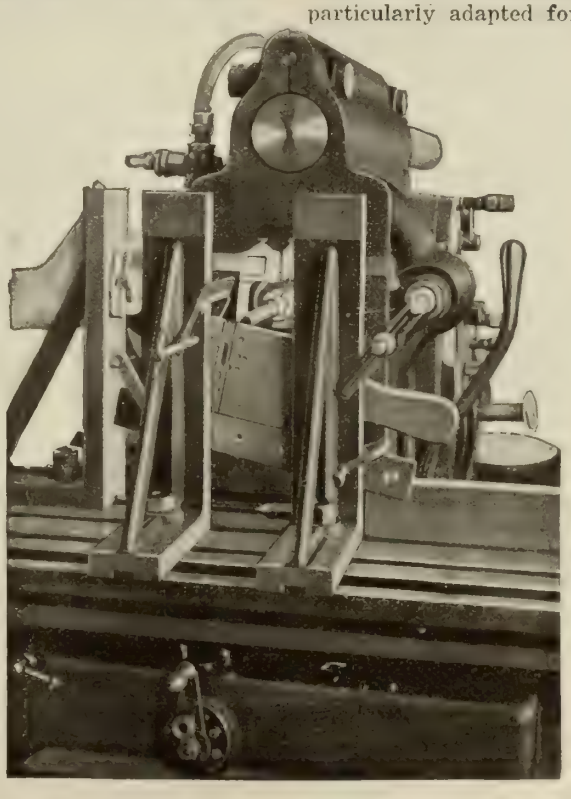


FIG. 18—A SET OF MEASURING IRONS USED FOR A BORING SET UP ON A MILLING MACHINE.

tion with accurate boring operations. As they are narrow, and occupy a small amount of table room, they provide a convenient means of clamping work while it is being machined.

At Fig. 18 we illustrate three of these measuring irons used in a boring set-up on a milling machine. Although shown on a milling machine these irons can be used equally as well on many other types of machine tools. Wherever a fixed surface is required, from which to take dimensions, the use of these irons will be found of great advantage.

Of course there are numerous inspection and production tools which we have not illustrated or described, including bench plates, indicators of all kinds, work centres, test plugs, etc., etc., but we have, however, pointed out the use of some of the more important tools with their attendant advantages.

To turn out accurate work, you must have accurate tools, handled by men who realize the necessity of care and accuracy. This condition makes for an ideal tool room, which in turn means accurate jigs and fixtures. Continuing the train of thought, we find that accurate fixtures mean an accurate product turned out at maximum speed, which, lastly, ensures an interchangeable product. From this we can safely conclude that all the aforementioned conditions are necessary in these modern days of keen competition and speed.

We would like to acknowledge our appreciation to the Taft, Pierce Co., of Woonsocket, R.I., who allowed us the use of the various illustrations throughout this article.

Two Interesting Styles of Boring Heads

By ROBERT MAWSON

A problem recently came up in our Mechanical Engineering Department to machine a large hole of 9 inches diameter.

This hole had to be concentric with a smaller one, accurate as regards size, and also parallel. The tool we designed for boring the large hole is shown in Fig. 1, and is known in the machine shop as a "Cat Head."

There are some features about the tool that are worth noting, especially regarding its construction. Most boring heads of this type are made too light and not sufficiently rugged. This is particularly the case with the boring or cutting tool proper.

Referring to the illustration: The body or holder "A" is made of a machine steel forging, accurately bored to suit the boring bar (which it might be added was supported on both ends in the head and tail members of a horizontal boring machine).

A flat was filed on the bar, and by screwing down a 7/16 inch set-screw in the tapped hole shown the boring head was held rigidly in position. The cutter "B" is made from a stock bar of high speed steel, suitably hardened.

To adjust the cutter for the correct diameter the screw "C" is first slackened and the square-head set-screw "D" tightened, which action forces out the cutter. After the correct size has been obtained the screw "C" is tightened and the cutter held rigidly in position for the machining operation. A pin was also driven through, and extended on each side of the boring bar. This pin fitted into the slot "E" and thus acted as a positive driving medium.

The boring head was a success as far as it went, but it can readily be seen that it has its limitations. For example, it is impossible to machine a hole to a square shoulder, in other words, it can only be used to machine a hole which goes entirely through the piece.

To meet these conditions (especially as one of the holes called for had a sharp corner as illustrated by the section, Fig. 2), the improved design of tool was made as shown at Fig. 3.

The head was made of a similar machine steel forging, the only difference being that the cutter was placed with the angle away from the vertical centre line instead of towards it as shown at Fig. 1. With this latter construction the cutting edge projects beyond the body of the tool and a sharp corner may thus be obtained.

A further advantage of the improved design is that by placing a bar or plug gauge in the 1.500 hole and using a pair of micrometers the actual size which the boring head will machine can be readily determined, namely, 4.500 + .750 = 5.250 inches will be the reading on the micrometer.

Both boring heads have given the best of satisfaction, producing holes mechanically correct in every detail.

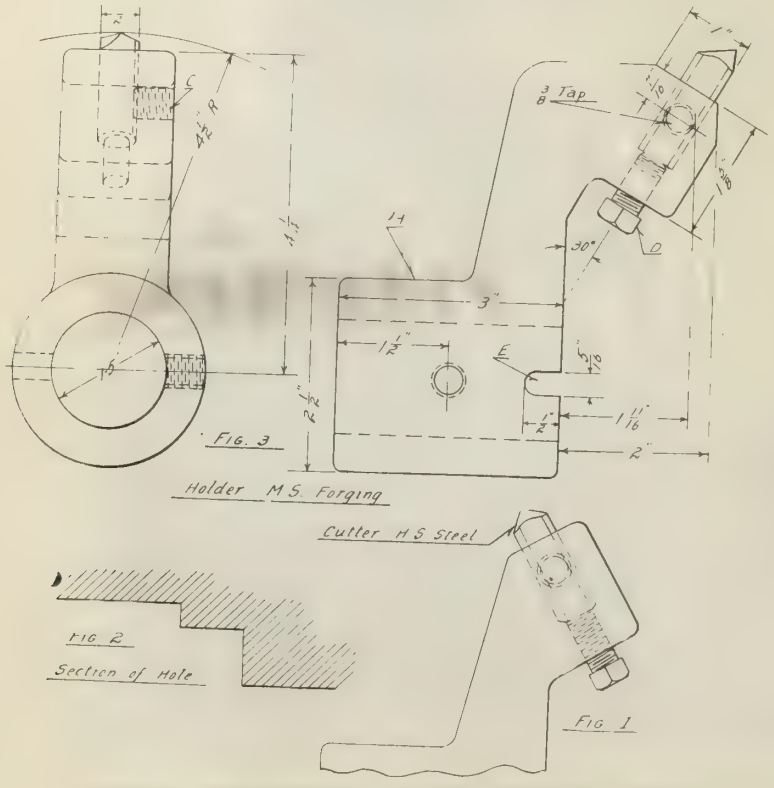


FIG. 3 FIG. 2 FIG. 1

GENERAL VIEW SHOWING THE TWO STYLES OF HEADS.

Copper pipe coils that require tinning may be coated with pure block tin without dipping into a tin bath. The coil should be suspended between two supports on an iron bar or pipe so that it can be freely turned around as the tinning proceeds. The copper coil is heated, section by section, with a preheating blowtorch, and the surface is fluxed with chloride of zinc. The tin is applied from time to time from the end of the bar, and is wiped with a swab made of white cotton waste soaked in the chloride of zinc solution. A clean wooden tray should be placed beneath the coil to catch the tin that runs off. With a little practice a welder can tin copper pipe coils and similar parts smoothly and quickly.

Spare no pains to make a good job when fitting up welding and cutting hose. Spread shellac on the nipples before forcing them into the hose. The shellac quickly hardens and makes not only a tight joint but a cemented joint uniting rubber to the metal.

Various Causes of Grinding Wheel Breakage

There Are Nine Important Reasons Why Grinding Wheels Break, According to the Author of This Article, Which Appeared in "Machine Tool Review." A Perusual Will Prove Worth While

By HAROLD E. JENKS

THE subject of grinding wheel breakage is one which directly concerns every wheel consumer as well as the manufacturer of the product.

Breakage of the wheel affects the consumer as well as the manufacturer of the product.

Breakage of the wheel affects the consumer, since it means danger to the operator and possibly to others in the shop. It also involves considerable expense due to the loss of the wheel itself and loss of time in procuring and mounting another one.

It affects the wheel manufacturer, since it is obviously for his interest to have as few breakages as possible charged up against his wheels, and since, if the cause of breakage is clearly due to manufacturing defects, he will be expected to replace the broken wheel at his own expense.

It is important, then, that wheel breakages should be reduced to a minimum. To do this, its underlying causes should be clearly understood, and it is with the purpose of making these causes clear that this article has been written.

Breakage of a grinding wheel while in operation may be due to any one of the following causes, or to a combination of two or more of them:

1. Centrifugal force due to rotation of the wheel.
2. Direct pressure exerted by the work on the wheel.
3. Heating of the wheel or spindle.
4. Grinding on the side of the wheel (side pressure).
5. Improper mounting.
6. Impact on the side of face of the wheel.
7. Cracks or flaws in the wheel structure.
8. Lack of balance.
9. Initial stresses.

It is unavoidable that these causes should overlap to some extent; for instance, heating of the wheel is a result of direct pressure by the work. It is thought, however, that the list has been condensed as much as possible to still retain the desirable property of clearness.

By "stress," as used here, is meant force acting betwen the particles of wheel material per unit of area let us say in pounds per square inch. Wheel material is much weaker under tensile stress than under compressive stress—that is, a much smaller force will break it if tending to pull its particles apart than if tending to push them together. For this reason, stresses are herein specified as tensile or compressive, it being understood that compressive stresses are not important as sources of breakage. Mathematical proof of statements made regarding the amount and position of stresses in wheels is beyond the scope of this article, and is therefore omitted.

Much importance should be attached to the fact that although not one of the existing stresses in a wheel may be excessive, the combination or resultant of two or more of them may be sufficient to cause breakage.

Centrifugal Force Due to Rotation of the Wheel

In any body which rotates about an axis, stresses are induced at every point due to centrifugal force, which is the force tending to make the body fly apart. In a grinding wheel these stresses are of two kinds: a radial stress acting in the direction of the radius of the wheel; and a tangential stress acting in a direction perpendicular to the radius. Both these stresses are tensile. The tangential stress is much the larger of the two, and reaches its greatest value at the inside of the wheel—that is, around the circumference of the hole.

The radial stress has its maximum at a point from one-third to three-fourths the distance from the face of the wheel to the hole. The amounts of both stresses vary as the square of the wheel speed, which means that if the speed is doubled the stresses are quadrupled. For a given peripheral speed and diameter of wheel, the maximum tangential stress increases slightly as the diameter of the hole is made larger, and in cylinder wheels becomes about 20 per cwt. greater than in disc wheels with ordinary sized holes.

Since a grinding wheel in operation is always revolving, stresses due to centrifugal force always exist; and although it is probable that comparatively few wheels in operation break from these stresses alone, others may easily combine with them and produce breakage.

Reliable grinding wheel manufacturers test all wheels before they leave the factory by running them at such speeds that the minimum safety factor is 2½ and the maximum in some cases as high as 5. As a result of this precaution, practically all breakages that occur from centrifugal force alone can be traced to such causes as shifting thoughtlessly from large to small pulleys, placing large wheels on spindles running at speeds intended for small ones, or substituting for a wheel running at the correct speed one of different grain and grade and lower recommended wheel speed. In other words, these breakages are nearly all due to carelessnes or ignorance on the part of the operator.

Direct Pressure Exerted by the Work on the Wheel

By "direct pressure" is meant pressure on the face of a wheel directed toward its centre. Stresses produced by this pressure are of two kinds—radial and tangential, or frictional.

The radial stress is the same as would be produced by direct pressure, if the wheel were not revolving, and is compressive. It is usually small in amount and is unimportant as a cause of breakage.

Contact between the particles of the revolving wheel and the work produces a frictional force whose amount is proportional to the direct pressure and which is in the direction of a tangent to the wheel face. This force causes bending stresses along a diametral section of the wheel which are tensile on one side of the centre and compressive on the other. These stresses reach their largest value at the face of the wheel, and are usually small and unimportant.

Heating of the Wheel or Spindle

Considerable heat is developed at the point of contact of wheel and work, and in cases where grinding is done dry the wheel may become very hot. The stresses produced by unequal expansion of different parts of the wheel may in this case reach a large value, and many breakages are probably due to this cause. These stresses are similar to those resulting from centrifugal force, and are (as in that case) of two kinds—radial and tangential. THEY MAY VARY GREATLY IN AMOUNT ACCORDING TO VARIATIONS IN TEMPERATURE OF THE WHEEL, AND AN EXACT DETERMINATION OF THEIR AMOUNT IS DIFFICULT, IF NOT IMPOSSIBLE. The greatest tensile stress occurs around the circumference of the hole and hence combines with the greatest stress due to centrifugal force.

Heating of the spindle may be produced by tight bearings on the machine; and if the wheel bushing fits the spindle tightly, expansion of the latter will cause tensile stresses of considerable magnitude in the wheel, which, adding to the maximum stress due to centrifugal force, may cause breakage.

Grinding on the Side of the Wheel (Side Pressure)

Many breakages are directly caused by side pressure, which occurs to a limited extent when work is being traversed across the face of the wheel, but principally when grinding is done on its

side. Also, particularly in snagging operations, large side pressure may be produced by grinding on or "working" the corners of the wheel face. The effect of side pressure is to produce a bending stress whose maximum reaches all points of the wheel as it revolves, and which is tensile on the side of the wheel which sustains the pressure and compressive on the other.

Properly designed flanges used on wheels of sufficient thickness are the best protection against breakage due to side pressure. They not only greatly reduce the maximum stress due to this pressure, but prevent its attaining its maximum at the circumference of the hole, where it would otherwise combine with the maximum due to centrifugal force.

Improper Mounting

This subject is of such importance to all grinding wheel users that it is thought advisable to first give the following brief statement of the essentials of correct mounting:

Care should be taken that the sides of the wheel and the sides of the flanges in contact with the wheel are plane surfaces, in order that an even bearing may be secured.

The hole should be of a diameter approximately .005 in. larger than the spindle or arbor on which the wheel is to be mounted, and must be at right angles to the sides of the wheel, concentric with the circumference. No portion of the bushing should project beyond the sides of the wheel.

The spindle should be perfectly straight and threaded in a direction such that any tendency for the wheel and nut to turn will tighten the nut.

Flanges are used primarily to transmit power from the shaft to the wheel, and for this reason the inside flange must be keyed to the shaft. Both flanges must have plane faces at right angles to the shaft, and should be properly relieved —that is, they should be countersunk so as to bear on the wheel only on the part of the side of the flange nearest the rim.

Blotters or some other form of compressible washers should be used between flange and wheel to insure an even bearing. Their diameter should be at least as large as that of the flanges.

The nut should be tightened only enough to properly hold the wheel. Further tightening is unnecessary and undesirable.

Stresses in the wheel due to improper mounting are particularly important because they all combine directly with the maximum due to centrifugal force.

Forcing a wheel on a spindle for which its hole is too small is extremely likely to result in breakage, as large tensile stresses are induced around the circumference of the hole. If the hole is too small, it should be carefully enlarged by scraping until a perfect fit is obtained.

Side pressure producing large tensile stresses may result from any defect in mounting which tends to produce uneven bearing between flanges and wheel, such as bent or broken flanges; projecting bushings; high spots on bearing surfaces of flanges or wheel; flanges not properly relieved; failure to use proper compressible washers; flanges of different diameters, or excessive tightening of the spindle nut.

Impact on the Side or Face of the Wheel

Probably most breakages due to impact are the result of carelessness or ignorance on the part of the operator. It should be borne in mind that stresses in a wheel produced by a suddenly applied force are very much larger than those produced by the same force if applied gradually.

The impact of the particles of the wheel on the work in any form of grinding produces certain stresses in the wheel, but these are carried more by the particles in direct contact with the work than by the wheel as a whole, and are not important as a cause of breakage. Cases have been known, however, where ignorant operators, in order to increase the speed of cutting, have hacked the face of the wheel in such manner as to cause breakage due to this form of impact.

Breakages are sometimes caused by bringing heavy pieces of work into too sudden contact with either the face or side of the wheel. Carelessness in snagging castings suspended from chain hoists, for example, might easily produce breakage of this kind.

In work requiring a table traverse, the headstock of footstock may be run into the wheel, which will cause wheel breakages unless something else gives way first. This is not true impact, but approaches it on account of the suddenness of application of the force, and results in larger stresses due to side pressure.

Catching of the work between the wheel and the rest in free hand operations is very likely to cause wheel breakage. Such an accident may be due to improper adjustment of the rest or to lack of attention or ignorance on the part of the operator, and may have very serious consequences. This is a case of true impact, the speed of application of the force being practically the speed of the periphery of the wheel.

Cracks or Flaws in the Wheel Structure

Wheel breakage sometimes occurs because of cracks or flaws which are in the wheel before it is put in operation. Such defects may be entirely under the surface of the wheel and therefore not visible. Flaws are manufacturing defects, while cracks may be due to faulty manufacture or to various other causes, such as carelessness in transportation, handling, unpacking, or storage.

Due to the fact that the Norton Company uses such extreme care in testing wheels for flaws and cracks, it is practically impossible for a wheel with such defects to pass inspection and be shipped outside the factory.

The "ring" of a wheel, or sound produced by its vibration when tapped lightly with some solid object, is used as one indication of interior cracks or flaws. A wheel with a clear "ring" is fairly certain to be free from such defects, although it has been shown that a poor "ring" does not necessarily mean a defective wheel. Norton Company, however, in order to be on the safe side, rejects all wheels which do not ring clear.

After the test by "ringing" the wheel, all wheels of over 5-in. in diameter are given a speed test at about double the recommended operating speed, as stated previously. This is a very severe test and is practically certain to eliminate defective wheels.

Rigid inspection follows this speed test and the wheels are very carefully packed for shipping in strong boxes made especially for the purpose.

Breakages due to cracks are therefore beyond the control of the Norton Company, since these cracks must occur subsequent to the time the wheels are shipped.

Lack of Balance

A wheel that is out of balance has developed in it stresses of rather complex character. In cases where the lack of balance is very great, breakage may result, either from these stresses or from impact, as will appear below. Lack of balance may be due to several causes, the description of which follows:

Variations in density in a wheel may cause imperfect balance. However, this can hardly prove serious in the case of wheels furnished by any reliable grinding wheel manufacturer, as the homogeneity of structure of such wheels precludes the possibility of a dangerous amount of lack of balance.

If a wheel goes out of true for any reason, it will also go out of balance, since its centre of rotation will no longer be at its centre of gravity. Wheels may go out of true from such causes as a bent spindle, loose bearings, loose frame, improper use, or from the hacking of the wheel face previously mentioned. If a wheel is seriously out of true, it will deliver a series of blows to work thrust against it, thus producing large impact stresses. The stresses due to the centrifugal force of the out of balance portions of the wheel may also become large in this case, and will combine with the maximum due to centrifugal force.

A wheel should not be allowed to stand partially submerged in water or other liquid, for when it is started in motion the wet portion is much heavier than any other and hence the wheel is greatly out of balance. Several cases of breakage from this cause are known.

During the process of manufacture of any solid body, initial stresses are sometimes set up in the material of which the body is composed. Unless great care is used in its manufacture, a grinding wheel may have such stresses existing in it. These may be regarded as incipient flaws or cracks, and may combine with other stresses to increase the maximum stress in the wheel. No method has yet been devised for determining the existence of initial stresses in wheels.

However, Norton Company by the speed test mentioned above eliminates from its finished product all wheels with large initial stresses. By running all wheels at double the recommended operating speed and thus quadrupling the stress due to centrifugal force, any wheels having extraordinary initial stresses are broken.

On account of the number and variety of the possible causes of wheel breakage given above, it is easily seen that the actual determination of the real cause of breakage of a single wheel may be difficult or impossible. In cases, however, where breakages occur consistently with a certain operator or on a certain machine or operation, it may be reasonably assumed that there are one or two principal causes involved which can by a study of the situation be detected and removed.

A conservative statement, based on experiments, investigation, and long experience with wheel breakages, is that practically all breakages are due to causes beyond the control of the grinding wheel manufacturer and may in no way be attributed to weakness in wheel structure.

Boring Jig for Valve Covers on Air Pump

By ANGUS McALPINE

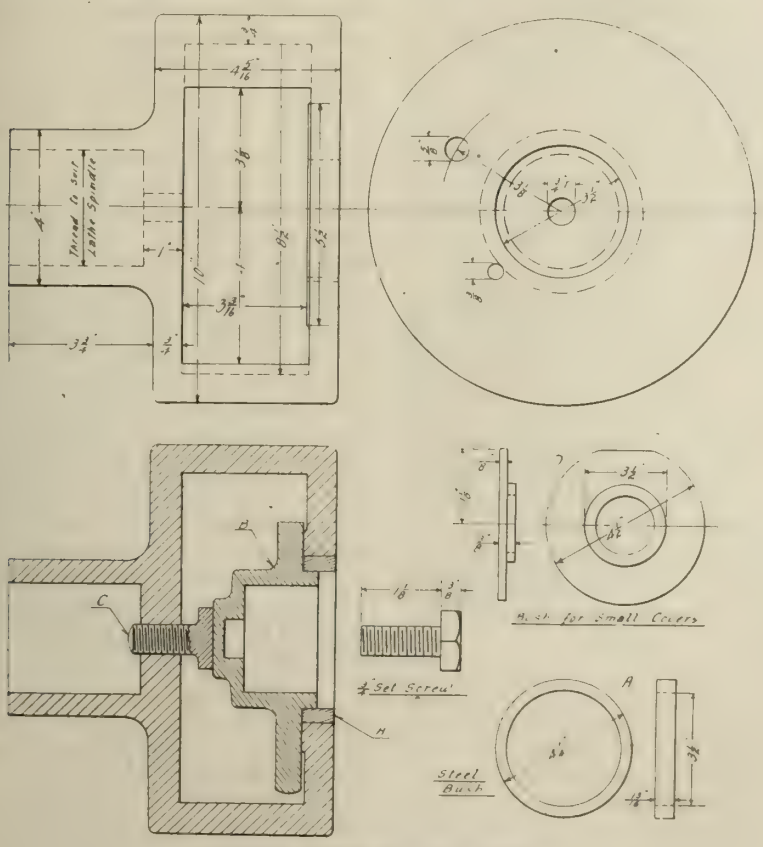
THE accompanying sketch shows a jig for boring the main valve covers of Westinghouse air pump. After being on the road a while, these covers show wear, and have either to be trued up or bushed. The ordinary method is to put the cover in an ordinary dog chuck, catching them by the outside edge of flange.

This is a very important operation, and the work has to be accurately performed, consequently a great deal of time has to be spent setting up. The time spent setting up has become a bugbear, and when the covers come singly they are generally scrapped and a new one applied.

Of course, when twenty or thirty come in from the line, they have to be repaired, and it was to meet such requirements that this jig was designed. The jig itself is just a circular box chuck which is applied to the lathe spindle.

The front is bored out 4¼ inches and hardened mild steel, bush A pressed in. A machining strip is left on the back of the front face for flange of bush to be applied to. Cover is slipped into chuck and the lip on same fits into the mild steel bush. Set-screw C is then brought to bear on cover, forcing flange against the inside face of chuck, automatically trueing the job.

If the set-screw pressure is not sufficient, a driving bolt can be applied through hole in chuck and bolt hole in flange of cover. The sketch is for 11 in. pump, but when the 9½ in. size is to be machined, the bush D is applied.



VARIOUS VIEWS OF THE FIXTURE.

LETTERING ON METAL SURFACES

By Donald A. Hampson

Once in a while there comes up a job of lettering out in the shop to which a draftsman falls heir because of his experience on similar (?) work on the drawing board. Two instances of this kind will be related, for they may help someone else who suddenly finds that lettering on metal is quite different from paper.

It was desired to bring the cast letters of the maker's name into greater prominence by gilding them. The 35 cent packages of gilt put up for household use are all that is needed for the work, but the brush supplied with them is too large and a striping brush must be selected; this will make a line from one-sixteenth to an eighth of an inch in width. The gilt must be mixed quite thin, and only enough carried on the brush for a single line. The flexibility of a brush is in marked contrast to the firmness of a pencil, and some practice will be necessary to get used to making a line by drawing the brush along on its side instead of using the point. Too much gilt will cause horizontal lines to break and run; it will cause vertical ones to bulge at the bottom. Where there is no good support for the hand, a light stick, held in the left hand and resting upon another part of the face, bridges the gap and steadies the marking hand.

Another instance was that of a metal cabinet having about three hundred sizes stamped on the front with ¼-inch figures. Against the green background these did not stand out as they should, and it was decided to make the sizes white. White enamel was used for this, and as it was an impossibility to trace the shape of the figures with a brush, an eighth-inch brush was used to fill the depressions in rough approximation of the stamped shape. The worst of the excess was wiped off with a linen cloth wrapped around the finger. Then a piece of soft rubber, trimmed square and straight, was drawn over the surface, removing effectually any blur remaining from the previous operation and leaving the letters standing out sharp and white.

An alloy of zinc and copper, the composition of which, it is stated, metallurgists have made every effort to determine without success, has made its appearance in Italy, where it has quickly demonstrated its usefulness. It is called Biakametal and United States Trade Commissioner H. C. MacLean, at Rome, has sent a report on it to the Department of Commerce at Washington. A new company having a capital of $2,316,000 has been formed to carry on its manufacture. It is said to have a high limit of elasticity and high resistance to thermic and to chemical action. It can be cast, turned, drawn, forged, rolled and stamped and has proved useful in aeronautic and marine construction on account of its relatively light weight and unusual strength and anti-corrosive qualities.



WELDING AND CUTTING



Fusion Welding Applied to Drop Forgings*

By S. W. MILLER

IT has been found that in such steels, particularly where the piece welded is of considerable size, the quenching effect of the cold metal produces a zone of sorbitic character next the weld, which may start a detail fracture under alternating stress. The work referred to is of the nature of adding material to worn shafts in order to turn them up again to the proper size. While the welding is successful, the alteration of the structure is dangerous. This difficulty can be readily overcome by preheating the shafts to a high enough temperature to prevent the formation of the brittle zone. This temperature would depend on the size of the shaft, being less for a large shaft than for a small one. The slow cooling, due to the preheating, prevents the formation of sorbite and no trouble is experienced.

With oxy-acetylene welding, this defect does not exist, as the piece being welded must be brought to a high temperature before any welding is done, and this is sufficient to anneal the material near the weld.

Breaking Welded Pieces by Test

In making tests of welded pieces, it is essential to know the qualities of the material being welded if fair comparisons are to be made; for instance, in very soft material, having a tensile strength of about 50,000 lb. per sq. in., where the weld is of the same section as the rest of the piece, the chances are that a sound weld made by either process will be strong enough to break the original material, so that the figures obtained are those of the original material and not those of the weld. On the other hand, if the original material is of 60,000 lb. tensile strength the chances are that even with the weld somewhat reinforced the break will take place in the weld. The writer feels it necessary, therefore, to measure the elongation, not only in the total gauge length, but in each inch between the gauge marks in order to be sure of what the figures do represent. In the net results given above for oxy-acetylene welds, the yield points are those of the welds, while in the tests given below for electric welds the yield points are those of the original material.

	T.S.	Y.P.	Elongation in centre 2 in.	Broke
Electric ..	51,200	.....	...	Outside Weld
	51,600	31,300	...	Outside Weld
Welds ...	51,300	33,300	7.5%	Inside Weld
	50,500	32,200	7.0%	Inside Weld

As stated before, the elongation of electric weld material itself is very low, and the yield point, therefore, is very close to the ultimate strength. It will be noticed that the elongation is very small and an examination of the test pieces will show that most of it is in the original material.

While it is not always of great importance in the repair of drop forgings to consider the character of welds with regard to their soundness, because usually welds are not made in parts which require great care in order to get the best results. It may be of interest to know that in the writer's experience the quickest and easiest way of determining a welder's ability is to have him weld together two pieces of ½ x 2 in. ordinary bar steel in the case of gas welding, or two pieces of ½ x 3 in. bar steel in the case of electric welding. The reason for using the wider piece in electric welding is that both the beginning and end of an electric weld are liable to be bad for ½ in. from the edge. The beginning is bad because the temperature has not been raised to the proper point and the end is bad because the temperature was too high. With oxy-acetylene welding the temperature at the beginning and end can be regulated by the operator. The electric weld should be machined off for ½ in. on each side, leaving the piece about 2 in. wide. If such pieces are then clamped on an anvil or heavy block, so that the bottom of the V is on a line with the face of the anvil, and the projecting part of the piece is struck with a sledge, a very good and rapid test can be made of its quality.

It will be found that electric welds are very brittle and will not give much bending, while gas welds will bend down flat and will even stand further bending before cracking on the outside of the weld if they are properly made. An examination of the fracture will indicate the mechanical soundness of the weld. Beyond this the welder cannot go, as he has but little to do with the metallurgical character of the weld.

Welding Heat Changes Structure

The physical structures of welds are of great interest and importance. In most cases they are what would naturally be expected from the high temperatures involved in the welding operation, but in the oxy-acetylene welds made with ordinary material, the weld is coarse-grained, and, on account of the distribution of heat, the grains are approximately equi-axed. Most of the carbon has been burned out by the heat so that what is left exists as isolated particles of cementite at the grain boundaries, as in very low carbon steel. There is always present more or less oxide, which is readily seen in an unetched section as small, round, dark dots. There are frequently minute holes, probably caused by the escape of occluded gases during cooling. Especially in the tops of welds made with a heavier tip than necessary, there are plates and needles of what is probably nitride of iron, due to the combining of the nitrogen of the air with some of the iron. The material next the weld is coarsened by the heat and somewhat decarbonized for some distance below the original surface. Between the body of the weld and the original material there is a zone of gradually changing carbon content as would be naturally expected. In this zone, unless proper fusion has occurred, there are liable to be films of oxide of great thinness, which are not visible in the polished section but which etching shows up distinctly. These films are of the order of a 1/50,000 in. thick, and have the effect of causing the weld to break along the line of the V; greatly decreasing its tensile strength and elongation; they are also fatal under alternating stress. Similar defects are liable also to be in the body of the weld where it has been poorly made; but they do not exist in any place in a properly made weld. The burning out of carbon and the presence of oxide dots cannot be avoided, and they are the only defects which should exist in a good oxy-acetylene weld. The nitride of iron is probably of little importance as far as ultimate strength is concerned, although it may have some effect on the elongation, and, as it should not exist in a good weld, its effect can usually be neglected.

Electric welds have the same general characteristics as oxy-acetylene welds, the difference being in degree only. The grains are frequently columnar, their log

*Continuation of a paper presented before the Sixth Annual Convention of the American Forge Association, Pittsburgh, June 14th. The author is proprietor of the Rochester Welding Works, Rochester, N.Y.

axes being perpendicular to the surfaces of the Vs in the original material. The layers of metal applied later refine the grain of the first layer, changing the columnar structure to an equi-axed one, so that some discretion must be used in interpreting this and other features of such welds. The reason for the columnar structure is the very rapid cooling due to the great localness of the heat. The same result is produced in ordinary steel ingots by the old walls of the moulds. The coarsening of the grain in the original material occurs in electric welds as well as in oxy-acetylene ones, but to a less extent because of shorter time of application of the heat. In all fusion welds there is a zone at some distance from the weld line in which the grain is much finer than in the original material. This zone is further away from the weld with the oxy-acetylene than with the electric process. Its distance varies with the thickness of the piece, being greater with thicker pieces, and is about 1½ in. in the case of a gas weld made in ¾ in. steel plate. Electric welds contain larger amounts of oxide than do oxy-acetylene welds, and they are also much more subject to defects in the form of oxide films and slag pockets for reasons already explained.

Nitride of Iron in Arc Welds

The special difference between electric and oxy-acetylene welds, however, is in the presence of large amounts of nitride or iron, which, as explained before, is caused by the nitrogen of the air combining with the iron at the very high temperature of the arc. Although this material has not been isolated as yet, a comparison with material that is known to be nitride of iron leaves little doubt of its identity. Nitride of iron resembles cementite very strongly with ordinary etching, although it does not blacken with sodium picrate etching, as does cementite. Nitride of iron, when present in sufficient quantities, apparently forms a eutecoid with iron which very much resembles pearlite. All steels contain some nitrogen, but because there are many difficulties in the way of making analyses, not only for nitrogen, but for other gases or their compounds, and in view of the newness of the subject it is not to be wondered at that there are no accurate data as to the amounts of nitrogen in welds. Reasoning from analogy, however, it is probable that the average electric weld contains something in the neighbourhood of 0.2 per cent. nitrogen, which, if the formula of iron nitride be Fe N, would give 1.8 per cent. iron nitride. The appearance of an electric weld would lead one to believe that there is at least this amount of iron nitride present. The appearance of iron nitride varies from that of exceedingly thin plates of brilliant white material to masses of some size, and still further to the eutecoid referred to above. The plates are exceedingly thin, being probably at times of the order of 1/10,000 in. thick, and in many cases they appear in an etched section as dark lines of some thickness, but this is doubtless due to the acid eating off the corners of the metal next to the plates and making a groove which of course shows dark in the microscope. These plates lie along the same planes in the grains as do Neumann lines and do not lie along the slip planes. It is doubtless for this reason that they have but little effect on the strength or distortion of an electric weld. As the amount of nitride increases it collects in large masses, which finally appear as eutecoid. In the writer's opinion these masses of iron nitride contain some iron carbide, because parts of the spots darken with sodium picrate etching or with heat tinting, while in pure iron nitride there appears to be no such effect.

Reference has been made to the path of rupture in welds. As a comparison it may be stated that in sound iron or steel this path is always through the grains along the slip planes. In sound oxy-acetylene welds made with usual welding materials, the same path is followed, while in electric welds the path is, within the writer's experience, always along the grain boundaries.

PROCESS FOR REMOVING RIVETS AND CUTTING METALS

A recent invention by the Societe Anonyme d'Acetylene Dissous relates to a process for removing rivets and cutting metals by means of the electric arc.

Certain work in boiler construction and particularly in the repairing of ships in consequence of stranding, collision and the like, necessitates the removal of a large number of rivets. Formerly this removal was effected by cutting off one head of the rivet with a hand or machine tool and then punching the rivet out, but of late, use has been made of the oxygen process of metal cutting. The head of the rivet is first heated by the flame of the blowpipe cutter, and on reaching a suitable temperature is burnt off by a supplementary oxygen jet.

Also electricity has been used for separating or fusing the members of metallic structures by bringing a carbon electrode connected to one pole of any source of electricity into contact with the metalic material which is to be separated, the latter being connected with the other pole of the source of electricity. As is well known in all fusing operations in which an electric arc is used, the metal, as soon as it melts, is liable to oxidize and the oxide formed interferes with the heat transmitted by the electric arc and considerable time is lots in the operation.

The object of the present invention is a process which effects the removal of rivets or cutting of metals by means of the electric arc without any loss of time.

The process consists essentially in fusing the head of the rivet by an electric arc of suitable intensity, and at the same time enabling the metal of the rivet head to combine with substanaces adapted to form therewith compounds which are sufficiently fusible and liquid at the working temperature to flow readily, or be blown away by the wind of the arc. To this end the metal piece of which the rivet forms part is connected to one pole of a source of electricity, whilst the second pole is connected to an electrode consisting of an iron or steel rod, the diameter of which may vary between 1-16 inch and ⅜ inch, and which is covered by a coating containing the substance which is to enter into combination with the metal of the rivet head. As soon as the electrode is placed in contact with the rivet head the arc develops and the metal and the rivet run away in the form of liquid slag, without loss of time. The most suitable substances for making the coating of the electrode are oxidising substances, fluxes such as borax, and silicates, and substances such as carbon, which form fusible alloys with iron. Particularly interesting result are obtained with a coating essentially composed of hydrated silicates to which a small amount of carbon in powder form may be advantageously added. With an electrode about 3-16 inch diameter coater with such a covering 1-16 inch thick, and with a continuous current of 250 to 300 amperes, the head of a counter-sunk rivet 1 inch diameter can be destroyed in about 20 seconds.

It should be understood that without departing from the scope or the invention other means than the above described may be used for the purpose of bringing into contact with the heated metal, substances adapted to enter into combination with same and form fusible products, for instance the fusible substances may be arranged in the form of a rod or the like along the electrode.

It should be remarked that the metal of the rivet head is not necessarily entirely converted into slag or fusible alloy. Part of this metal can be carried away, as is the case in the process with blowpipe cutters, in the slag or fusible alloy without having entered into combination.

The diameter of the electrode and the intensity of the current may vary within fairly wide limits. Nevertheless a current intensity of 250 to 300 amperes (continuous current) should not be exceeded when it is desired to remove rivets without deteriorating the plate in which they are fixed.

This process can be employed with alternating current and for piercing and cutting plates and beams, but it is of more particular interest for the removal of rivets.—"Acetylene & Welding Journal."

A new heat insulating material is being produced in Sweden which is stated to be very promising, says the "Electrician." The chief constituent in this new material is a kind of clay found on the island of Mors. This "molera," as it is termed, is very porous, and each grain appears to be hollow. This fact is no doubt largely responsible for the good heat insulating properties. After it has been burnt the molera becomes extremely light. Before it is burnt it is mixed with cork. The new insulator is said to be primarily suitable for the lagging of steam pipes and boilers, but may also have uses for the production of soundproof chambers, and as a medium to check the transmission of vibration.



DEVELOPMENTS IN SHOP EQUIPMENT



THE OLIVER NO. 1 UNIVERSAL PATTERNMAKER'S VISE

The Oliver Machinery Company, of Grand Rapids, Mich., have just placed on the market a new and improved patternmakers' and general woodworkers' vise, known as the Victor patent, which has many features worthy of notice. A few views of the vise and its capabilities are shown in the accompanying illustrations.

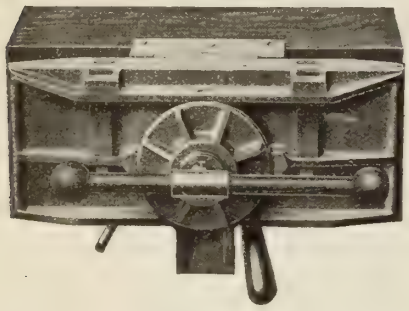


FIG. 1.

Fig. 1 illustrating the Oliver No. 1 universal vise in natural position, flush with the bench top. One is at once impressed by its sturdy and finished appearance—it is the last word in vise construction. Yet only fifteen parts are used and every part is interchangeable. Although the jaws appear lighter, yet, because of the deep web construction they are actually stronger, and under

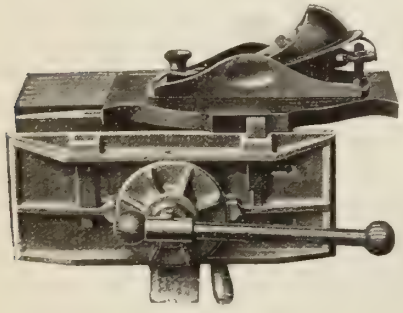


FIG. 2.

test have shown ability to withstand at least 300 pounds more pressure than jaws of other vises.

Fig. 2 shows that there is no limit to the work that can be done with this vise. It will securely hold all classes of work that any patternmaker or woodworker will need it for. This illustration shows the holding dogs for use in surface working on thin wood. Their use is also of great advantage in panel and framing work. Their utility can be further augmented by arranging additional dogs (hardwood) in the top of the work bench directly opposite those in the vise for holding forms or cases.

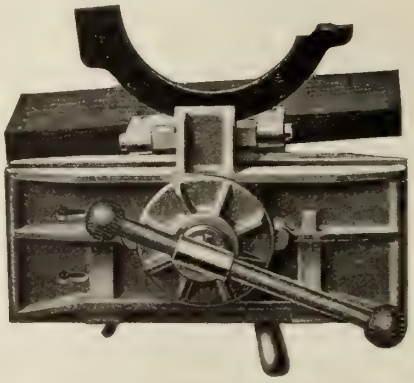


FIG. 3.

Fig. 3 shows the vise swung around and the pair of jaws provided for the holding of metal parts thrown into position to hold the metal parts to be worked upon. The sturdy construction of every part of the vise and its adaptability for every purpose is here plainly shown. The screws of the vise are double thread 4-pitch Acme, cold-rolled steel of ⅞-inch diameter. The weight of the vise is only 75 pounds.

Fig. 4 shows the vise in one of the many convenient positions in which it can be set, to easily handle irregular-shaped work. Because the jaws turn on the beam when set to revolve they may be located and clamped at any desired angle (not at particular set angles as on

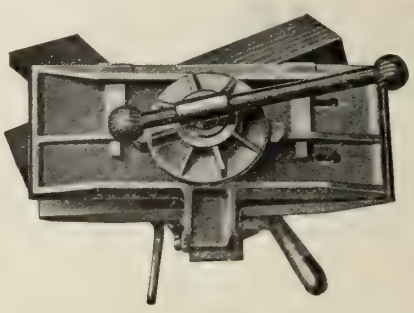


FIG. 4.

the obsolete types). The hand-operated, adjustable collar makes the adjustment for odd shapes and wedges a simple and speedy matter.

Fig. 5 shows the vise holding wedge-shaped work. The jaws are made to swing, being pivoted in the centre, so wedge-shaped work will fit either end of the jaws. The hand-operated adjustable collar makes the adjustment simple and easy. Note also the finished and substantial construction of the hub, which is part of the back jaw; the hand clamp lever used for revolving jaws and the beam, which in most every position



FIG. 5.

protects the screw from foreign matter, being closed side up.

Fig. 6 shows the vise in upright position with tilt or angle jaw in place. Note the rack bar which is used for clamping jaws in any angular position. This bar is flat and holds very rigidly, whereas



FIG. 6.

on other vises this is round and often allows the work to slip from its angular position. The jaws of the Oliver Universal No. 1 are smoothly finished; they are 7 inches by 18 inches in size, and have an opening of 15 inches. Its many special features make this an indispensable tool for the patternmaker's bench.

BECKER DIE-SINKING MACHINE

The Becker Milling Machine Co., Hyde Park, Boston, Mass., have recently added to their line of milling machines. This new addition is known as a Model D-1 die sinker, and is said to have an exceptionally wide range and capacity. The machine was designed primarily for die-sinking, where an ample range is required owing to the size of the largest dies which run up to 10 tons in weight, and at the same time is capable of performing accurate die-sinking operations. The light spindle allows great ease of manipulation, which is necessary to get the delicate adjustment required to "follow the line" with convenience to the operator. This machine incorporates most of the improved features of the later types of milling machines manufactured by this company, together with many new and valuable improvements. It is rigidly constructed, and the knee, saddle, and table have been made exceptionally rugged. The knee, which is of great width, is elevated and lowered through two telescopic screws that are connected by gearing to move simultaneously, and being perfectly co-ordinated they are controlled by a single lever. In order to correct the alignment of the table, due to wear of the mechanism, an adjustment is provided on each screw. These screws also provide a double support for the knee, each screw being well out from the centre of the machine to prevent undue deflection in the table caused by the numerous stresses incident to the large overhang when the table is moved to its extreme limit on either side. The knee is also supported by the frame or column of the machine by means of the Becker patented knee gibbing.

The knee is reinforced by heavy ribs running in both directions, which are cast on the inside, and the spaces between the ribs on the top surface are closed by hand hole covers which prevent the accumulation of dirt and chips. The saddle is the same length as the table, namely, 96 inches, and slides on a tapered gib at the centre of the knee, having in addition a wide flat way at each end, thus providing five generous bearing surfaces. The table is attached to the saddle by a straight gib and has a bearing the full length of the working surface, and it is provided with power rapid traverse in either direction, also a fine hand adjustment which is controlled from the front of the knee or at either end of the table. There are three ¾-inch T-slots in the table, oil-grooves on the side, and an oil-pan at each end for collecting the cutting lubricant, which is returned to a tank cast in the base of the column by means of a flexible metallic tube.

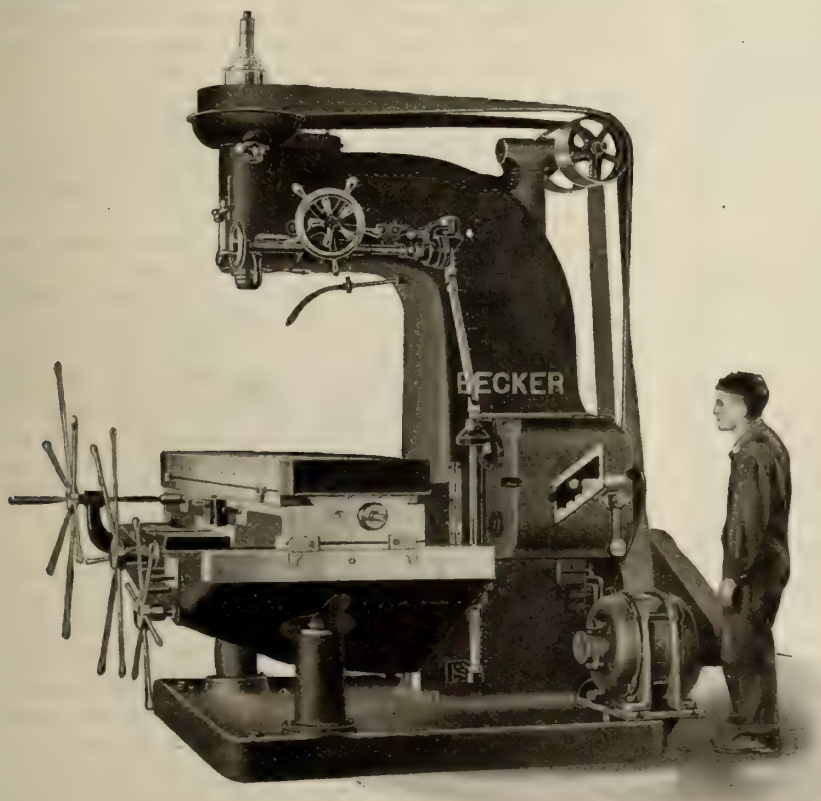
A particular feature of this machine is the centralized control, which allows the operator, standing in his position at the front of the machine, to operate all hand and power feeds conveniently. Adjustable stops are provided for all of the various movements. The spindle is back-geared and driven by a 5-inch double waterproof belt, which transmits power to the spindle quite uniformly and gives to the work the smooth finish so much desired in die-sinking and similar work. The spindle is of the "barrel type" of construction and is provided with an adjustable automatic stop, a micrometer stop gauge, fine hand adjustment, and a quick-return mechanism. The spindle is made of crucible steel and it is carried in a conical sleeve bushed with hard bronze bearings. Collars are provided for adjusting to compensate for wear in the bearings. The end thrust is carried upon ball thrust bearings supported on the end of the conical sleeve. This construction prevents the possible seizure of the spindle due to unequal expansion of the bronze and iron. The micrometer stop is located directly on the front of the spindle, this position having been found very convenient for setting operations. The stop and the slot in which it runs can be seen on the front of the spindle head. In working out the design of this machine the back gears are located on the upper part of the head directly under the spindle-driving pulley, and they are operated by a small lever projecting from the bottom of the bowl-shaped casting just beneath the spindle pulley. The feed-box is of the positive gear type. The feed is obtained from the lower drive shaft by a gear train to the feed-box. Eight feeds are obtained for each motor speed in geometrical progression, making it convenient to obtain any feed that may be most suitable for the particular job that is being done.

There are thirty-two feeds obtainable with a multi-speed motor and fifty-six feeds with the constant-speed motor, as follows: With an open belt, varying from 0.0024 to 0.0621 inch per spindle revolution, and with back-gears from 0.0126 to 0.3260 inch per spindle revolution.

There are fourteen spindle speeds obtainable when the power is supplied from lineshafting through the speed-box or from a constant-speed motor direct connected to the speed-box, varying from 73 to 438 revolutions per minute with open belt, and 14 to 83 revolutions per minute with back-gears. Eight spindle speeds are obtainable when the power is supplied by a multi-speed motor varying from 149 to 447 revolutions per minute with the open belt, and from 28 to 84 revolutions per minute with the back-gears.

The spindle is provided with a draw-bar and is stopped and started by a treadle at the left of the base, when constant speed is provided. The moving member of the clutches for engaging the power rapid traverse to the table is so made that it is impossible for both to be engaged at the same time. When motor drive is desired, the motor is placed on an extension of the base of the machine at the right side at the rear. A 7½-horsepower constant-speed motor running at 1,200 revolutions per minute, or a 7½-horsepower multi-speed motor with speeds of 600, 900, 1,200 and 1,800 revolutions per minute, or a 7½-horsepower variable-speed motor having a ratio of 3 to 1, is recommended. When either a multi-speed or a variable-speed motor is used, the speed-box is not necessary.

Extras, such as arbor supports, an oil-pump with connections, a rotary table with a circular top graduated to 360 degrees, having a working surface 30 inches in diameter and a draw-in chuck for holding cutters, can be furnished. Another important device is the cherrying attachment for die-sinking.



GENERAL VIEW OF THE MACHINE.

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As We Were Saying

DURING the dying days of the year the daily newspapers devoted a large amount of space and a goodly number of scare heads to what they called a revolutionary discovery in the steel trade. This outbreak was based on cables received from correspondents in England, where the discovery was supposed to have been made, and nothing was left out that would tend to the embellishment of the reports. Briefly, they stated that Professor Arnold, of Sheffield, had discovered a new steel, called molybdenum, which would displace every other steel in the market. The British Government had placed an embargo on the patent, and were going to keep it for themselves alone, though according to the hopeful press writers, other nations were falling over themselves to get it.

In our issue of December 25th, under the heading "The Use of Molybdenum," we pointed out that molybdenum was not new, and its use in the manufacture of steel was not new. We gave a brief summary of the various alloys used in steel making, and their effects on the finished product, and pointed out that molybdenum possessed practically the same properties as tungsten, but less molybdenum was required for the same effect than would be necessary if tungsten were used. We suggested that Prof. Arnold's discovery lay in the direction of making molybdenum more amenable of application commercially than had been the case in the past. With the information we had at the time we could not say very much about the reliability of the claims set forth. Our experience is that the enthusiasm of the daily press on engineering matters is about equalled by their inaccuracy.

In the issue of "The Engineer" published on Jan. 2nd in London, we find confirmation of our views on the matter. Being on the spot, and in close touch with British steel activities, "The Engineer" is in a position to speak with authority on the subject. After remarking that if engineering were entrusted to the daily press it would increase in excitement if not in accuracy, they characterize the report as a wild story. The fact was that Prof. Arnold had during the war patented a tool steel that contained 6 per cent. molybdenum in place of the 15 to 18 per cent. tungsten generally used. Publication of the patent was suppressed precisely as all others were suppressed in war time, prevent the enemy obtaining particulars of it. When the news was released, the Sheffield steel trade didn't bat an eye. It is admitted that molybdenum has some slight advantages over tungsten, but as it costs three times as much as the latter, its superiority is not overwhelming. "The Engineer" thinks that in course of time molybdenum steel may win an important position in the market, but at present interest in it is chiefly from the scientific and not the practical point of view.

The steel trade seems to present many pitfalls for the unwary front page writer. It is not very long since that a Toronto daily published some wonderfully inaccurate descriptions of an electric furnace installation. We appreciate the fact that the front page has to be filled, but why not stick to the comparatively safe and indisputable stories of the sea serpent and dinosauria that were once so popular?

A Triumph in Projectiles

NEW developments have been made in bringing out a hard shell in Britain for the use of the navy. Sir Robert Hadfield makes the announcement: "The feat has been accomplished of getting the largest calibre of armor-piercing shell unbroken through the thickest of modern hard-faced armor plates."

Heretofore, the heaviest projectiles have been those used on the British monitors. The gun in which these were used probably weighs 150 tons, and when elevated to 45 degrees carries its projectiles 50,000 yards, or, say, thirty miles.

A writer in a British paper gives some idea of the penetrating power of these shells as follows:—

The shell, when capped and fired, and striking normally is capable of perforating armor of the following thicknesses, the shell itself emerging unbroken on the other side of the plate: (a) At point-blank range, no less than 41 in. of hard-faced armor. This is equivalent to a wall of unhardened steel of about 54 in.; (b) At 10 miles and 20 miles respectively, 22 in. and 12½ in. of hard-faced armor of the latest and best type. (c) Finally, at the extreme range of no less than 30 miles, armor of ordinary steel having a thickness of close upon 1 ft.

As a matter of fact, the shell in actual trials perforated a hard-faced plate of a thickness nearly equal to its calibre at a velocity equivalent to a range of about 14 miles. Thus the heaviest armor afloat, when attacked by it, would not be much better than a piece of cardboard.

The difficulty of hardening an armor-piercing shell of these dimensions will be readily understood, for suddenly "in the twinkling of an eye" a volume of something like 10,000 cubic inches of steel by quenching has to be converted from material of a Brinell ball hardness of only about 200 to one of between 600 and 700. To deal with the strains set up by the sudden change from what is almost material of plastic nature to one of extreme rigidity is indeed a difficult problem, as can be well imagined when it is stated that material of this high rigidity readily scratches glass. In addition, it must be borne in mind that the rupture strains which are set up by the sudden cooling mentioned may continue, not for hours, but for day, weeks or even months afterwards.

The following figures in regard to marine disasters are useful for reference:—The largest recorded loss of life in a marine disaster occurred when the Titanic was sunk, after colliding with an iceberg, south of Newfoundland on April 14, 1912, the list of deaths showing 1,503 names. The Lusitania, sunk by a German submarine, May 7, 1915, carried with her more than 1,200 of her passengers and crew. When the Empress of Ireland was sent to the bottom in the Gulf of St. Lawrence on May 30, 1914, the loss of life was 1,027. One thousand died when the Japanese steamer Kicker Maru sank in Australian waters on September 28, 1912.

Selling Steel Eight Months Ago and Now

By A. R. K.

SAY, it wasn't more than six or eight months ago that folks in the steel trade were coaxing their should-be customers to come into the ring and roll up a mill tonnage.

They had a good yarn to tell them, too, and they had it off word for word. The whole business of selling was being learned all over again. You know, during the war steel salesmen got soft. Their chests dropped down into their laps, and they got into the habit of wearing spats, morning coats and putting perfume on their handkerchiefs.

When it became known that a steel salesman was in town all he had to do was pick out the best invitation from the assortment of free dinners offered to him. He could have anything from "ham and—" to taking every known hurdle between soup and nuts.

But the end of the war knocked out his props and the steel salesman had to get out on the turf. There were double chins to be talked off—there were rotund figures to be machined, and there was, worst of all, a right-about from the days when the chief job was head liar and apologist for the firm.

Yes, Angus, these stall-fed, crate-stuffed tribe had to get out with a rail, a plate, a T-beam, a bundle of sheets, an assortment of bars, and sell the stuff. The open door policy was canned everywhere. They had to send in their little cardboard tickets once more and decorate the little bench where superintendents and purchasing agents make folks sit for awhile in order to justify their pay cheque. You know a superintendent or any other official who lets folks come right in and see him is going to fail. He ought to make 'em sit on that bench outside while he cleans his nails, reads the sporting page and does most everything except manicure his teeth and take a bath. Then the benchers are sure to murmur, "Busy guy," and sooner or later the office hears it—"Busy guy." Next thing you know that sup. has a raise in pay, a pretty stenographer with those grey suede hip boots, and he's sent off to souse in sulphur baths for an acute case of overwork.



He Had To Get Out and Sell.

We enjoyed them days when steel salesmen were out again pawing the turf and spoiling the pasture. We got on speakin' terms with quite a heap of them. Not a bad sort, either, but they don't love each other, no more than a man loves to own up that he's wearin' a wig.

They used to be grateful for information then. To tell a man where to sell a ten-foot beam was regular Damon and Pythias stuff. Then it was that we was all smokin' the same good five-cent cigars together.

But things has changed again. Steel salesmen have simply to go to the front door of a place and holler, "I told you so." You can't talk back. If you take his "Told you so" chant in good part the chances are that he'll shove your order up toward the top of the heap and slip you a couple of sheets or fifty pounds of plate on toward the end of the year.

The way steel men's swaggerin' round now sniffs of boiled shirt fronts, clean socks and diamond studs.

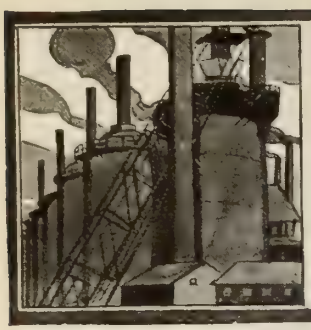


"Gentlemen, it's like this . . ."

There's a nice fat job open in one office where they spend time now wondering when production is going to be tripping on the heels of orders. That job is for some good, fat, juicy person, who owns a claw-hammer coat, a corduroy vest and who don't object to wearin' a sweet-scented geranium leaf in his buttonhole in working hours. He's got to be head prevaricator for the office, smooth as oil and as convincing as Lydia Pinkham in her palmiest days. His chief job is to wave his hand and speak thusly: "Now, gentlemen, it's just like this. It's perfectly true that that we booked your business, but one of the ingots that was to be rolled into your order got misplaced before it reached the rolls. Investigation shows that the head office boy got out a tracer for that ingot. He located the man who was on the heat the day it left the open-hearth. That man's number is 1628 in the south building. Evidence as to who witnessed the ingot that 1628 saw leave the open-hearth being stripped and soaked is missing. Our last report, No. 678,356, from the cost department, says this ingot must be some place between the open-hearth and the soaking pit. As soon as we receive a further report on report No. 678,356 we shall be pleased to take the matter up further with you." Here the head explainer is supposed to have one hand on the shoulder of the customer and with the other is presenting a perfectly good 1920 six-cylinder smoke.

If the customer shows signs of restlessness, or looks as though he might cancel the order, Claw-hammer is supposed to recite a couple of verses of Browning, discuss the farmers in politics, the nebular hypothesis, the brotherhood of man, the setting of slide valves, what to do with the surplus of smallpox scabs. If all these things fail, Claw-hammer is likely to lose his job.

If you've got a friend in the steel business now, cultivate him, especially if he has any shipments pointed his way. Ask him out to your house and have your wife take a snap-shot of you and the steel man lookin' at each other with a sort of "You know me, Al" atmosphere on your face. It's a quicker way to get popular in the community than havin' a booze shipment from Montreal delivered at your house in broad daylight.



MARKET DEVELOPMENTS



Mills Refusing to Take Further Business

Offices Here Report That Business is Now Being Turned Back on Them—Big Order of Small Tools Went at a Price to Old Country Firm—Sheets Head the Shortage List

NO good purpose can possibly be served by minimizing the seriousness of the situation that has come to pass in the iron and steel markets in Canada. Some of the largest offices are having their business turned back on them now by their mills in the States. Their deliveries are already extended away to the end of the year, and they reckon that further bookings would simply complicate matters to no good purpose.

The situation in blue annealed sheets is particularly serious. One report has it that a large maker of automobiles three or four months ago sent his representatives all through the country, and cleaned up on this stock, some of the stove-makers letting go to him, as they could make more money than by making their sheets up into stoves and selling them in the usual way. Whatever there may be to the story, it sounds reasonable, and it is a fact that the country is barren of these sheets now, and a number of concerns are pinched and cramped for material.

New base prices are reported for plate, bars, hoop steel, etc. In a number of cases many warehouses might as well quote any fantastic figure that appeals to them. They have not the material in their stocks, and they have no way of getting it.

The machinery market continues firm, with nothing to show that prices are going to be more reasonable. The sale of small tools and supplies is also reported as quite satisfactory. One order for 400 dozen high speed drills was placed in Toronto by one firm a few days ago. The bulk of the business was secured by an Old Country firm, which was able to put in a price that the Canadian firms would not come down to.

MONTREAL STEEL PRICES CERTAIN TO BE MOVED TO HIGHER LEVELS

Special to CANADIAN MACHINERY.

MONTREAL, January 29.—Combinations of circumstances are reaching the point where prices on steel commodities will require to be still further advanced. The reluctance on the part of producers to depart from the policy of avoiding radical price changes will readily be understood, as any drastic steps in this direction would probably mean a cycle of upward price quotations and labor demands, a condition that would not assist in settling the abnormal unrest that prevails throughout many industries at the present time. Dealers in this district report a steady and continued demand for all lines of steel products, but emphasize the acute situation that exists as regards the supplying of this demand. Despite the fact that the United States steel strike has been declared at an end, the production of the mills is apparently inadequate to meet the present trade requirements.

The cause of this falling off of mill output, it is claimed, is the inability to get sufficient raw materials in the shape of ores, fuel, etc., and inexperienced and efficient help to operate at the capacity which business on the books demand. The car shortage is one of the serious factors that influences mill production as shipments of material are very irregular. In addition to the present increasing demands for steel products it is thought that many developments in trade activity are being deferred on account of the high rate of exchange that must be considered when material is purchased from American mills. The exchange conditions have had the effect of increasing the demand on the Canadian mills, and additional activity in this direction is quite pronounced. The continued cold weather is taxing the railroads in the matter of traffic, and no small amount of the delays in transportation must be laid to this condition. While the market shows no immediate change in price quotations, the apparent perplexity of the entire situation will probably result in higher prices on many commodities. Local warehouses are practically bare of such material as is in general demand.

Steady Tone in Metals

The metal market has quieted down a little from the activity that prevailed last week, and the present tone is one of steadiness, with prices firm. The tin situation is still abnormal and is governed by conditions in London. Quotations may be shaded a little but the nominal price of 70 cents per pound is a fair basis of the prices asked by dealers.

Improvement in Tool Demand

The general belief is prevalent among dealers here that a steady improvement in the demand for machine tools will continue from now on. While there appears to be no pronounced buying from any one quarter, the disposal of equipment, both for tools and supplies, is spread over a wide area, not being confined to localized requirements. Many small machine shops throughout the country have been purchasers of single tools to augment their former equipment. There is little to indicate that the purchaser of a machine tool will be able to obtain the same at a lower cost than now effective for many months to come. As stated last week, some American manufacturers are showing their willingness to shoulder the extra exchange rate to stimulate the placing of orders, although in many instances early delivery is out of the question. Considerable activity is still reported in used equipment, and at good prices.

Steady but Quiet Demand

Little can be said of the old material situation other than that the market is decidedly firm on a quiet demand. There is a light but steady movement in all materials, with a slightly heavier demand for machine cast iron. The nominal prices quoted are subject to revision to suit individual sales.

NEW BASE PRICES ARE SHOWING ADVANCE

Shortage of Material is Cramping Industries—No Relief in Sight at Present

TORONTO.—One of the Toronto jobbers had before him a new price list for U. S. mills this morning. Summarized as to leading items they ran about like this:

Plate, base	3.50
Bars	3.25
Structurals	3.00
Cold Roll Strips	7.25

Roughly, that is an advance of about 90 cents per ton over prices that have been quoted since March 21 last. For some time past the premium business has asked almost any price that good delivery would warrant, but now it is an accepted thing, according to the reports this dealer had received, that these prices are current, and recognized as such.

As a matter of fact, if a person could place business now for plate at 3.50, and be certain of deliveries, he would not be taking much chance. He could make money on the business. Only today one dealer stated that if he could get 200 tons of plate at once he would be willing to pay 75 per cent. above market prices, and moreover he would thank the person who could lead him to the goods.

No Improvement in Sight

It is quite right to state that the steel market is growing worse instead of showing signs of improvement. It may be all right for steel companies to show figures of production, to the effect that they are improving in their output, but the fact of the matter is that the man in Canada who wants to buy steel fails to see where these figures are helping him. His one chance to size up the whole situation is when he goes out to buy. If he can get deliveries he will believe that conditions are improving. If he cannot, it is hard to show him where the improvement comes in, and a good many people are in the latter class at the present moment.

There is some structural material to be had yet, perhaps more of this than anything else, and there is a certain tonnage of heavy plate that can be picked up. But blue and box annealed sheets are the worst off, and there are several shops in Ontario where the scarcity is being felt in a decided way.

Blames the Auto Industry

Here is the explanation that one dealer has to make of the blue annealed material: 'The automobile business is the direct cause of the shortage in blue annealed material. Some months ago they saw there was going to be a shortage in this line, and they knew it was necessary to their business that they should have a supply of this much in advance of what was to be secured in the open market. So they sent out their buyers and cleaned up everything in sight. Why, I know of cases where they went to makers of stoves and paid them a price for their stocks of blue annealed material that would represent a better turnover than if they had made the material into stoves and sold them out to the trade in the usual way. It was a short-sighted piece of business for the stove makers who sold out at that time, for they find now that they cannot get anything more of this line."

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that the anxiety of buyers to be protected for nearly all lines of steel and iron is becoming more pronounced each week.

—

Advices this week give 3.50 as the current base price on plate at Pittsburgh and other points. The war price was 3.25.

—

Local dealers state that principals are turning down nearly all the business they are forwarding to them now in lines of steel.

—

Dealers in small tools report business as being good and coming from a well-distributed lot of sources.

—

One order for small tools in the Toronto field was for 400 dozen drills. It went to an English company by reason of a close price.

—

Belief is expressed that there may be a runaway market in steel if the companies do not get together. The anti-combine law makes it hard for them to come to any agreement.

Machinery Markets

Although there has not been any very great buying going on, inquiries continue to come in from a well-distributed area. Deliveries are not making any improvement, but there are some firms that are doing better than they promise when the business is placed. It is a matter of satisfaction to the dealer who holds such agencies, as a betterment in a delivery date is a much better factor in securing business than the making of apologies for falling down in the matter.

One Toronto buyer recently returned from making the rounds of the U. S. shops. He reports that production of machines is not as good as before the war. There is a complaint in the shops that the per-man production is down and against that they are paying a much higher wage. The prediction was freely made in several places that the top of the price list had not yet been reached.

The Small Tool Section

Prices remain firm in the small tool and supply market. Reference was made a few issues ago to a large order that was likely to be placed in this district. The business went to an English firm, and was for 400 dozen drills of various sizes. Canadian dealers quoted on the deal, but they refused to give the concessions that were necessary to meet the competition of the Old Country firm, and it is understood that the bulk of the order was placed at a price about ten per cent. below the prevailing market quotations.

Canadian dealers are being called upon now for the first time in some years to meet Old Country competition.

Business in the small tool section is reported as brisk by all the dealers. There is no tendency to shade prices now, and this condition seems to be working out in a very satisfactory way all around.

Prices May Move Up

There are indications that pig iron prices may move beyond their present levels for the last half of 1920. Present quotations in Toronto are about as follows from Canadian stocks:

No. 1 Foundry (silicon 2.25 to 2.75 per cent.)	$47.30
No. 2 Foundry (silicon 1.75 to 2.25 per cent.)	45.95
Standard malleable	47.30

By basing on present Buffalo prices and prices for last half deliveries, it would not be surprising were prices for this district to be:

No. 1 Foundry	$49.45
No. 2 Foundry	48.10
Standard malleable	41.25

LACK OF STABILIZING INFLUENCE MAY BRING RUNAWAY STEEL MARKET

Special to CANADIAN MACHINERY.

PITTSBURGH, Jan. 27.—There is a contrast between the increased anxiety of buyers of pig iron and steel to cover their requirements with price a secondary consideration, and the growing fears of financiers that fundamental conditions are unsound and will grow worse until what they consider a wave of extravagance is checked, either by intelligent and co-operative action in advance or by the stern mandates of economic laws transgressed.

All the evidences of the pig iron and steel markets are of increased strength. Consumers are anxious to buy, to secure protection on their raw materials farther ahead. They are not only willing to pay advanced prices if asked, but are actually bidding prices to producers in hopes of inducing them to loosen up in their sales policies. The producers claim to be conservative and to be desirous of avoiding a runaway market, but it seems rather clear that their refraining so largely from selling is stimulating buyers to put the market up on themselves.

Steel Price Situation

Briefly reviewed, the situation as to

sales of finished steel products is that the United States Steel Corporation has sold at the March 21 or Industrial Board prices for about six months ahead, while few of the independents have sold much tonnage beyond the present quarter. A part of this tonnage sold has been at stiff premiums over the March 21 schedule, but another and considerable part has been at those prices. Thus while the independents do not have nearly as much tonnage on their books at the March 21 prices as has the Steel Corporation, still they do have a considerable tonnage. Some of the independents that have sold only at March 21 prices have made promises to regular customers that they will take care of their tonnages for second quarter, but at prices to be named later, on one date or another in March.

In view of the great pressure for steel products on the part of manufacturing consumers, who see excellent trade ahead of them not only for second quarter, but for a longer time, the steel ought to have been sold to them before this. The reason it has not been sold, except in the case of the Steel Corporation, is that the trade has virtually been without its old time Steel Corporation leadership. The independents used to follow that leadership, but of late they have been, with few exceptions, and now probably with none, unwilling to follow that leadership because it means March 21 steel prices and the independents want more. The independents, however, are unable, on account of the laws, to get together and decide what they do want, hence they have drifted along and buyers become more nervous each day.

A prediction, which seems a pretty fair one in the circumstances, now made is that the independents without any particular collusion will advance to the prices ruling before the March 21 or Industrial Board reductions, which would put the market on the basis obtaining after the first reductions were made from the war control prices. These reductions became effective December 12, 1918, ranging from $4 a net ton on structural shapes and merchant bars to $8 on tin plate, but with no reduction on wire products. The March 21, 1919, reductions were $5 a net ton on wire and wire products and on grooved steel skelp, with $7 on practically all other finished steel products.

Another prediction is that the market will go up to the war control level, passing over both reductions instead of only one. This prediction is not as popular as the other. In each case, however, the talk is that the large independents would stick to the advanced level, once attained, so as to avoid a runaway. A third prediction is that there will be a general runaway, in which case the Steel Corporation would either abandon its policy and follow the runaway or would be in the position of furnishing its steel to regular customers, as far as the production would stretch, at much less prices than the customers could buy at elsewhere.

The case of the smaller independents is not included in the first two predictions. The smaller mills have a way at all times of not selling far ahead, cutting the general market when it is weak, and securing delivery premiums when it is strong and the large mills are sold up several months ahead. Thus there might conceivably be three markets, one on the part of the Steel Corporation at March 21 prices, another on the part of the larger independents at January, 1919, or war-control prices, and still another at a wide range of premium prices for particularly early deliveries.

Demand Prospects

The common view is that there will be an unlimited demand for steel for several quarters to come, i.e., a demand clearly in excess of the supply, whatever that may be. Unquestionably this conclusion is premature, and the fact that it is so almost universally held does not confirm the view but rather makes it the part of wisdom not to accept it as a finality. Those who hold the view, when questioned, are found to hold it either because they find everybody else holds it, for no better reason than they themselves, or hold it because they find buyers so importunate in seeking to buy. As to this phase, the condition may be due to the extreme reserve of the independents in selling, due to their having renounced Steel Corporation leadership and thus being without leadership, and the necessary reserve of the Steel Corporation because it will not sell more than it can produce and must apportion that tonnage to regular customers.

If the prospective demand for steel be scrutinized from the viewpoint of prospective consumption operations rather than from the viewpoint of the importunities of buyers—which may be only a sort of "hearsay" evidence—the prospects for large consumption are found to be not necessarily so clear. Much is being said about large purchases the railroad companies are going to make after their lines are returned to them March 1, but railroad officials do not talk that way. They express concern as to where they are to get money, and money first for refunding maturing obligations, not for making additional expenditures. As to new construction, of buildings, factories, bridges, etc., into which normally a large proportion of the steel output flows, there is complaint everywhere of labor being very scarce and of construction costs being extremely high. There will undoubtedly be altogether as much building of one sort or another as there is labor supply but there is no distinct outlook of there being a great volume of building of the character that consumes large quantities of steel. For illustration, offices are extremely scarce in Pittsburgh and a few days ago B. F. Jones, Jr., bought the Monongahela House, a large brick building erected 80 years ago and for several decades the leading hostelry in Pittsburgh. There is no thought of rebuilding, however, the intention being simply to convert the old hotel into office rooms. Again, it is just announced that the Mellon Bank, which years ago acquired the various parcels of real estate making up what is one of the very best sites in Pittsburgh, facing three good streets, is about to go ahead with its building project, but it is understood it will erect simply a three-storey bank building, not a sky-scraper, even though space in office buildings is renting at 50 to 100 per cent. above the rates of five years ago.

The common view may be right, but this is a time when the majority may be wrong, and the individual will do well to consult also his own judgment.

U.S. SCRAP METAL

There has been a strong market for scrap material, heavy melting steel selling particularly well. Total sales of this grade were over 50,000 tons. Following are reports from various U. S. centres:

PHILADELPHIA.—Steel scrap sold in large quantities at $25 delivered, the largest buyers being the Bethlehem Steel Co. and the Lukens Steel Co. There is a good demand for all grades of scrap material, cast scrap being most in demand.

NEW YORK. — There has been an active market here, and prices have advanced. Heavy melting steel has been the most in favor, sales amounting to over 70,000 tons. The price of this material is $20.50 to $21, f.o.b. New York. Heavy cast scrap has advanced about $1.

PITTSBURGH.—Heavy melting steel is being quoted pretty generally at $28, and a small tonnage has been sold at this figure. The market for steel making grades is very strong. A small lot of baled sheet scrap was sold at $24, and bundled sheets have brought $20.

BUFFALO.—There is a strong market here, with good enquiries for all grades of material. Enquiries for heavy melting steel aggregate 25,000 tons. Heavy melting remains around $25 to $26, although $27 has been asked by Youngstown for delivery to this district.

CLEVELAND.—While both cast scrap and heavy melting are strong, cast scrap has taken the lead. Heavy melting has advanced to $26 and $27, while No. 1 cast has sold as high as $38 per gross ton, and heavy cast $26. Other grades are about the same prices as last week.

CHICAGO.—Cast scrap is in strong demand by foundries, and is generally quoted at $42.50 per gross ton. Steel grades have declined somewhat, due to short selling by dealers. There is very little chance of any general reduction.

ST. LOUIS.—Good demand with heavy buying, caused an advance in most grades of scrap material during the week. Railroad wrought is now quoted at $28 to $28.50, iron rails at $30 to $30.50 and care wheels $33.50 to $34. The Lacled Steel Co. bought 10,000 tons of re-rolling rails.

CINCINNATI. — There is a strong market, with plenty of enquiries, but not a great deal of actual business. There is not much material held in stock, and this is not increasing.

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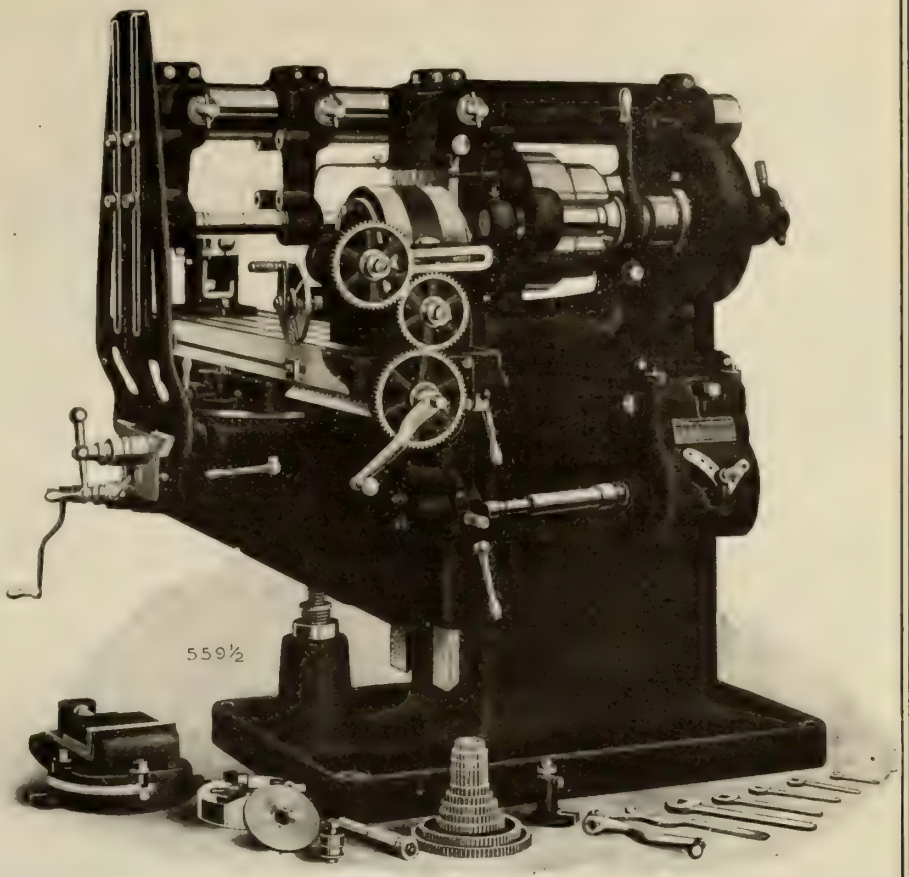
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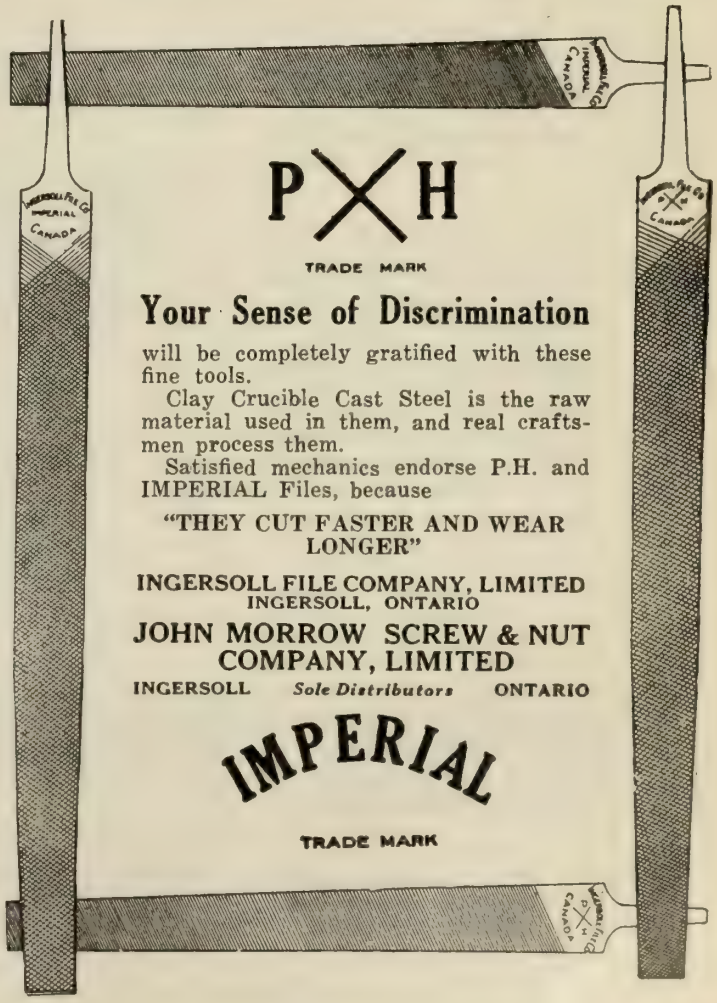
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IMPERIAL
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The Week's Events in Montreal Industry

R. Duguid has resigned from the position of manager of the Tidewater Shipbuilders, Limited. Pending the appointment of a new manager, the duties of the office will be taken over by the president, A. A. Wright.

Everything is in readiness for the big annual business and professional meeting of the Engineer Institute of Canada. Every effort has been made to make this the most successful, both socially and from a business standpoint, in the history of the organization.

Five workmen of the Hall Engineering Company, of Montreal, were slightly injured while repairing a boiler at the Low Level pumping station, when a tube on an adjoining boiler burst, enclouding them in steam. Little damage was done to the plant, but the burns of the men were painful, but not of a serious character.

The reported illness of Graham Drinkwater, vice-president of the Canadian Fairbanks-Morse Company, of Montreal, has caused no little anxiety in business circles in this city. While on a trip to New York, prior to taking an extended holiday tour in the Mediterranean, he contracted a severe cold that developed into pneumonia, from which, however, he has partly recovered. The sea voyage will likely be postponed or deferred, and Mr. Drinkwater and his wife will journey to South Carolina, where they will spend several weeks, to enable Mr. Drinkwater to recuperate after his recent illness.

At a meeting of the Canadian West Indian League, held last week at the Windsor Hotel, Montreal, at which Frank H. Keefer, Parliamentary Under-Secretary of State for External Affairs, was the guest of honor, a resolution was passed by those present, in which the Government would be urged to appoint a commission that would confer with the various Governments of the West Indian colonies with a view of helpful co-operation for the extension of trade between the two countries. Many of the members felt that the time was very opportune for stimulating of production of Canadian goods for export to these colonies. Canada is at present a heavy buyer of West Indian products, but a very large percentage of the total comes to this country through United States channels, and it is the hope of the League that a considerable amount of this trade can be carried on direct.

The Motor Show just closed in Montreal has been the most successful yet held by the Automobile Association. It is estimated that approximately 100,000 people visited the Motordrome during the week the show was in progress. Every available foot of space was occupied on the three floors of the large building, and 128 dealers, many of whom represented four or five different makes of cars or accessories, were kept extremely busy throughout the entire period in telling of the many merits of their various lines. The farmers, in particular, were especially interested in the farm trucks and tractors, and they fully realized the economic value of this class of equipment for general rural purposes. The appreciation of the public for the splendid exhibit and the all-round success of the show has so impressed the officials that the prospects of a better and bigger exposition for next year will induce the management to extend it for a longer period.

George Hadrill, who, for the past 34 years, has been the active secretary of the Montreal Board of Trade, and who has been associated with that body for a total of 43 years, has resigned from the position he has so efficiently filled for so many years. His services will be retained in the capacity of "secretary emeritus," while the active duties of the office will be taken over by J. Stanley Cook, who has acted as assistant secretary for the past 22 years. Mr. Cook has been carrying the bulk of the burden for several years back, and has the full confidence and respect of every member of the Board.

Compensation, to the amount of $2,000,000, has been paid to Sir Charles Ross for the Ross rifle factory. With the settlement of this claim, Sir Charles retires from a position recognized as exclusive purveyor of rifles for Canada's military forces. The amount handed over was paid out of the war appropriation vote of last session. What plans the Government have respecting the disposal of the factory have not been made public, but as the plant is fully equipped with the most modern equipment, it is expected that it will be ultimately utilized as a permanent plant for the manufacture of instruments for national defence.

Announcement has been made by officials of the Canada Steamship Lines, general agents for the Fracanda Line, that a new service will be inaugurated on February 24, between Canada and the port of Bordeaux. Winter sailings will take place from St. John, N.B., but vessels will come up the river to Montreal during the summer season. The success that has been attained by the previously established trade service between Canada and Havre has been an influencing factor in this latest step of the company. In speaking of the new service, Mr. Doherty, general traffic manager of the Fracanda Line, said: "Importers and exporters should benefit greatly by this service, as the port of Bordeaux serves a section of France not conveniently reached through Havre or other northern ports. The establishment of our Havre service was the result of our faith in the future trade relations between Canada and France, which we realized could be developed only through direct steamship connections. Our faith in the service of this venture has been fully justified and the support extended us has encouraged us to extend our field by a direct service to Bordeaux. Early indications point to liberal patronage of the new line from the start and the likelihood of our being justified in the very near future in increasing the sailings to two steamers monthly."

PIG IRON TRADE

There have been heavy sales of pig iron for last half delivery. Basic also has had some big sales and has advanced in price. Following are reports from U. S. points:

CLEVELAND.—Pig iron tonnage for last half delivery has been large, and the prevailing price has been $40 for 1.75 to 2.25 silicon. 2,000 tons of malleable was sold at $40.50, and some sales of this grade have been made at $41.50 furnace. Between 40,000 and 50,000 tons basic has been sold in this district at $40 valley furnace.

PHILADELPHIA.—No. 2 iron for second half is generally quoted at $42 Eastern Pennsylvania furnace, with $43 for 2.25 to 2.75 silicon. However, competition on this business and particularly for third quarter has been keen, and some selling has been done at $1 less than the prevailing price.

NEW YORK.—Good business has been done in this district for second half, and the total will be about 70,000 tons. The grades included both foundry and steelmaking, and some of it was for export. Enquiries are on the market for over 75,000 tons, foundry, malleable and steelmaking grades.

PITTSBURGH. — Business has been comparatively quiet this week. The biggest enquiry has been for 12,000 tons basic for export. Quotations for basic are around $40 valley furnace. 1.75 to 2 25 silicon is also bringing $40 furnace, although some business has been done at $41.

CINCINNATI.—There is not much iron available in this district, and the demand is increasing. There is no iron to be had for less than $40, either for first half or first quarter of second half, and in some cases $41 has been secured.

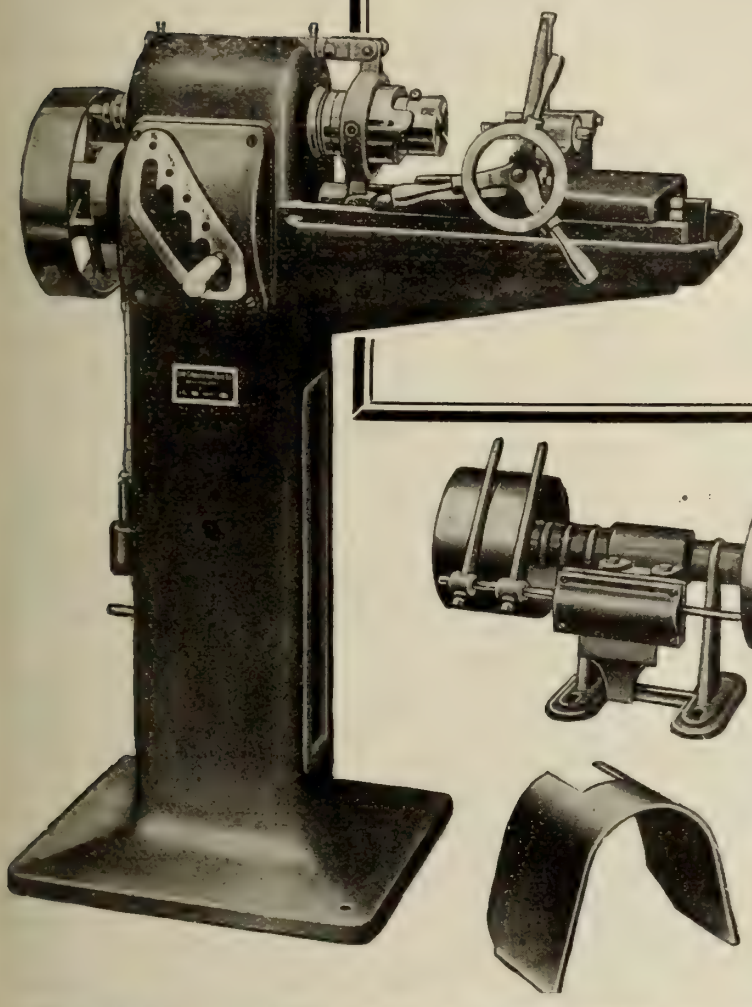
THE GEOMETRIC WAY

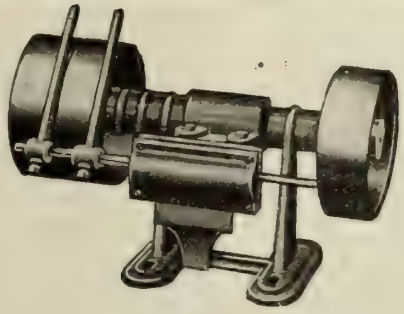
Where quantity and exactness have to be considered, the Geometric Threading Machine is just the way that suits. These machines have been tested and proved over and over again on speed, accuracy and endurance.

Geometric Threading Machines are employed on a large class of small threaded parts that cannot be produced economically on the ordinary screw machine.

Made in three sizes—to cut ⅛ to ½ inch, ¼ to ¾ inch, and ¾ to 1½ inch diameter threads. The carriage is mounted on slides and on the largest size machine is moved back and forth by rack and pinion, and in the smaller sizes by hand.

Spindle speed changes readily made, adapting the machine to the diameter and material of the work. An adjustable stop assures accurate length of thread, and automatically opens the die head, permitting of drawing the work straight back.





A line from you brings full details regarding this machine. Tell us your threading requirements — let us recommend the proper Geometric Collapsing Tap or Self-opening Die.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	**3 62**
Structural shapes	**3 72**
Plates	**3 90**
Small shapes under 3"	**3 62**

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	70 00	60 00
Spelter	11 50	10 75
Lead	10 25	8 75
Antimony	12 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld		
⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74
Standard Lapweld		
2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 80
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

Joseph T. Ryerson & Son

Chicago, Illinois

and

The Conradson Machine Tool Co.

Green Bay, Wisconsin

Take pleasure in announcing an association of interests in the manufacture and sale of the new line of "Ryerson-Conradson" Machine Tools.

Mr. C. M. Conradson, President of the Conradson Machine Tool Co., and of national reputation, is the inventor and designer of the line of Plain and Universal Milling Machines, Selective Head Lathes, Planers and Radial Drills.

Joseph T. Ryerson & Son are enlarging their machinery organization, which now includes plants in Chicago, St. Louis, Detroit, Buffalo and New York, offices in the larger American cities and agents and direct representatives throughout the world.



Home of the Ryerson-Conradson Machine Tools

Canadian Representatives:—

Garlock-Walker Machinery Co., Ltd.

32-34 Front Street West

MONTREAL **TORONTO** WINNIPEG

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 25
Premier, 10¾ oz.	....	9 65
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, ammly	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

The Dawn of Economy and Speed in Tapping



Aikenhead's Wahlstrom Tapping Attachment has the oscillating movement which mechanically imitates hand-tapping, though ten times faster and reduces tap breakage to a minimum.

Takes taps of all sizes from 5-40 to ½ inch standard. Powerful, durable, foolproof, There's nothing to get out of order.

May we send one for 10 days' trial? Return it if not satisfactory.

Has Two Movements

Oscillating for hard material — continuous revolution for soft material. Tap reverses when spindle is raised.

Fits Any Drill Press

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

Aikenhead's VAN DORN ELECTRIC PORTABLE DRILLS

Drill Faster

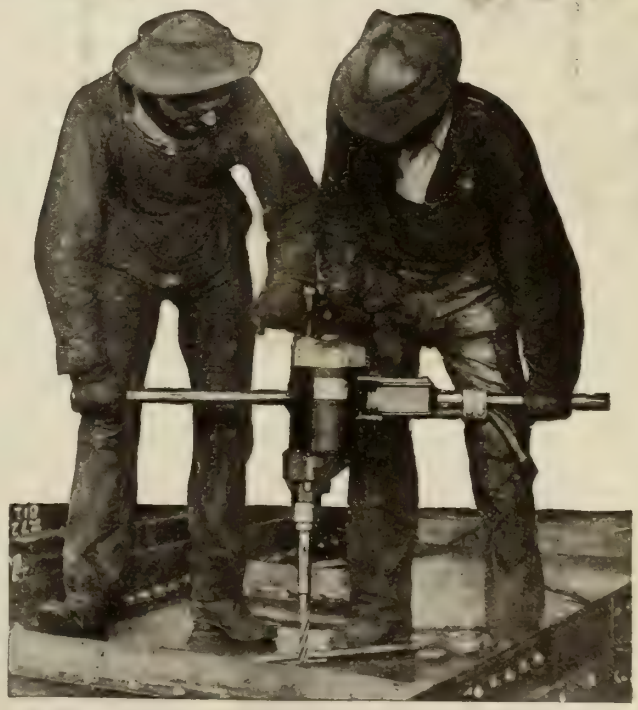
Van Dorn Electric Drills make neat, clean holes 50% faster than the best pneumatic drills.

Drill Cleaner

If you have holes to drill in wood, steel, any metal — Van Dorn Electric Drills can drill them for you at lessened cost.

Van Dorn Drills are both fool-proof and trouble-proof. ASK THE USER.

May we send catalogue?



Aikenhead Hardware, Limited

17 Temperance Street, Toronto

If interested tear out this page and place with letters to be answered.

Big Business Chances in Japanese Market

Canadians Who Have Anything to Sell Should Look Into This Market—Should Send Best Men Who Thoroughly Understand the Lines They Are Representing

VANCOUVER.—C. D. Strong, Tokyo buyer for the United Paper Products, Vancouver, has great hopes of the amount of business that can be done with Japan. Mr. Strong is intimately acquainted with the Japanese market, having spent about nine months of every year in Japan for the past seven years. Speaking to a representative of CANADIAN MACHINERY, Mr. Strong said:

"I want to tell you," said Mr. Strong, "that it would break a Canadian's heart to see all the business that can be done in that country, and what a poor effort is being made to capture any of it. I only ran across one Canadian business man over there selling goods, for a good many months. That was an elderly gentleman from Hamilton selling steel, and I believe he was doing good business, too. But there's an immense demand right now for hundreds of the things that are being made in Ontario. There's a great market for pulp mill machinery and scores of other kinds of machinery, such as was being made at Brantford, Hamilton, Waterloo and all the other manufacturing centres. There are thousands of tons of nails alone shipped into Japan, and I don't see any one even reminding the Japanese trade that Canada can make such an article.

"If you don't do another thing," he said to your representative, "tell the Canadian manufacturer that he'll never sell many goods in this market until he sends his own man over here to sell the goods. There will never be a success made of merchandising Canadian goods if an agent is left to do it. The ones that are making the greatest success of selling their goods in Japan, from the United States, send a smart, aggressive, well-posted salesman out to Japan; one who knows his goods thoroughly and who can not only sell the line, but operate it, and teach others to do the same (I refer to mechanical lines). Heinz and Libby and Getz Bros., of 'Frisco, are selling immense quantities of canned goods in Japan. They sent over their salesmen to put their goods on the market, and they keep a staff over there to see that they "stay put" on the market. I haven't been able to buy "Quaker" brands of vegetables or fruits, or Clark's Pork and Beans, or any other Canadian line. Why? Japan is very proud of her relations with Great Britain, and Canada means Great Britain over there—there would be a good hearing for a Canadian salesman on canned goods there. Canadian pulp is being shipped in great quantities to Japan, but the mills should have their resident salesman right on the ground all the time. The same is true of lumber. The American typewriter, cash register, and adding machine people get right into the interior of China and Japan and they keep salesmen right in the field.

"If our Canadian manufacturers want to sell machinery in Japan, and there's a market for almost any kind, and lots of money to pay for it, they must send their best informed salesmen, and an expert mechanic to instal and operate the same. The Japanese merchant will pay, and pay well, to have the whole installation in perfect working order, and his staff trained to operate.

"Let me say right here," Mr. Strong continued, "that having the language is a great help to the salesman in Japan; if I were going to send a good man into that territory to sell my goods, I should have him take six months' lessons on the language here before he went; I understand that many of these languages are now taught in connection with the business colleges; and even the rudimentary knowledge of Japanese so gained, would be a great asset on arrival. I don't say that it is absolutely imperative that the salesman speak Japanese, but it is a great advantage; you can get very much closer to your prospect in his own tongue. It is surprising that there are no great American or Canadian export and import houses in Japan. Those who are buying in Japan and have a staff there for that purpose do not sell; nor do those selling there buy; even the largest American company operating in Japan sells only.

"The manufacturing of Japan is mostly done in a small way; it is a small man proposition. There are, of course, big factories but a great many of the articles exported are made in practically what might be called a home factory. A man and his wife will have a little work shop and turn out only one or two little articles; and have made these articles all their lives.

"Most of my purchasing is done from a multitude of these little fellows (else the middleman's profit), and you can readily see that my knowledge of their language is invaluable to me. Often I will sit and chat and drink tea for a couple of hours before I can find out just what that particular chap manufactures. He will never produce samples or urge purchase at casual acquaintance. The language gives you the personal touch which facilitates business and confidence the world over.

"Another thing we need to build up a big business with the Orient is boats; Canadian boats that will always give the Canadian cargo the first consideration. The C. P. R. boats are splendid and have done a great deal to help Canadian trade with the Orient. In understand that they are putting some more and bigger boats on the Pacific run.

"I expect to go back about the twentieth." said Mr. Strong. "I've only had a month home, this time, but business is very big in the Orient just now. I do hope that many Canadian manufacturer will jump into their opportunity now i: that Oriental market. I hope they'll at tend personally to the pushing of thei individual lines there; will study th British way of packing, and make Can ada's export business flourish; that's th way to pay the debts."

NEW LINES PLANNED FOR SHERBROOKE NOW

Ingersoll-Rand Make New Connections—May Have Pulp Mill Erected There

The Canadian Ingersoll-Rand Co., Ltd., 260 St. James Street, Montreal, Canada, have concluded arrangements with the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, and are now manufacturing and selling in Canada W-S-M hydraulic turbines and rubber machinery, which comprises: rubber calenders, tire-applying presses, rimming presses, hydraulic press vulcanizers, washers, crackers, mixing rolls, moulds, cores, etc.

This firm have also been appointed Canadian agents for and manufacturers of the Bird Machine Company's line of pulp and paper mill specialties, which comprises Bird inward flow rotary screens, Walpole screens, continuous beating attachments, save-alls, etc., and the Ryther and Pringle Company's slasher and swing saw systems, kickers, loaders, log haul-ups, conveyors, chip screens, splitters, shredders, and other wood preparing machinery, as well as the Barrienger braking device for skidding large logs or lowering heavily-loaded sleighs or other vehicles down steep grades.

The Sherbrooke plant of the E. & T. Fairbanks Company starts running on an eight-hour basis next week. The office force has been working 7½ hours for some time and the shop is now going on to the eight-hour basis so as to be in line with the practice at the St. Johnsbury plant of this company.

B. C. Howard, of B. C. Howard & Company, plans to erect a pulp mill here providing the necessary electric power can be obtained. It is said that this mill will be located a short distance below the junction of the St. Francis and Magog Rivers and within easy reach of the Grand Trunk tracks.

Using a revolving knife, a new bread slicing machine cuts even the thinnest slices without crushing a loaf.

The government of Denmark and Sweden have been investigating deposits of coal discovered on the Danish island of Bornholm, near the Swedish coast.

JOHN LEE examining a Morrow High Speed Twist Drill that has actually drilled 30% more holes in a Chrome Vanadium Block than other drills—and the cutting edge is still good.





THE JOHN MORROW SCREW & NUT COMPANY, LIMITED

were the first to manufacture Twist Drills in Canada and have maintained their supremacy. The plant has been added to three times to meet the increasing demand and now it is the largest and best equipped for

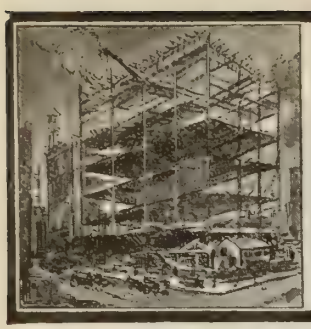
HIGH SPEED DRILLS

that positively give you more holes with less re-grinding. The Company want you to know what high-speed drills will do for *you*. Make your next order *Morrow's*. Every tool warranted.

Works at

INGERSOLL, CANADA

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Credit for Machinery.—The War Finance Corporation, Washington, D C., has announced further credits for machinery. The amount is $10,000,000 and the machinery is to be exported to England, France, Belgium and Italy.

Direct Route to West Africa.—With a view to opening up a direct service from the West Coast of Africa to the Dominion, Mr. A. E. Cook, of the Elder-Dempster Company, Montreal, has sailed for England to take up the question with the head office of the firm in Liverpool.

New Company in Welland.—The Marvel Company of Welland has been incorporated and will carry on the business of manufacturing and dealing in automobiles and accessories of every description. They will manufacture the "Marvel" steering device for Ford cars and deal in light, heat and power.

Busy Brantford Firm.—The John H. Hall & Sons Co., Ltd., Brantford, speaking to CANADIAN MACHINERY this week, stated: "This firm has more pipe-threading machinery on order than at any other time in its history, and the number of inquiries received indicate that the year 1920 will be the best yet."

Machinery for Brantford.—A large amount of machinery is being shipped into Brantford from across the line, regardless of the adverse exchange rate. The newest company, the Bluebird Manufacturing Company, which has taken over the premises of the Motor Truck Co., has already started work in the tool-room.

Toronto's New Industries.—Through the efforts of the Toronto Industrial Department there has been brought to the city since March last twenty-five new industries. Most of these are branches of American factories which are establishing themselves here. The establishing of two of these firms alone will mean the retaining in Canada of from $3,000,000 to $4,000,000 per annum.

Looking for Rolling Stock.—The Belgian Minister of Railways is in London, Eng., negotiating through the Dominion Government representatives there for the purchase of fifty locomotives and three thousand cars from Canadian manufacturers. The contract will be signed as soon as the Minister of Finance consents to an advance of credit. Belgium has an unused balance from last year's credit, of which she only availed herself to the extent of $11,000,000, the total being $25,000,000. She expects to get credit now of $10,000,000.

International Waterway Committee.—A meeting of the Canadian Deep Waterways and Power Association and officials of the Great Lakes, St. Lawrence and Tidewaters Association, took place at the Detroit Board of Commerce recently. Representing the Canadian Association were O. E. Fleming and Major Alex. C. Lewis, while H. P. Gardiner and C. P. Craig represented the United States organization.

Montreal.—Mr. Robert Reford of the company of that name, says that oil burning vessels will soon be on the Montreal route.

HAVE JOINT SHOP COMMITTEE AT ROBB ENGINEERING WORKS, LTD.

The Robb Engineering Works, Limited, Amherst, N.S., have in operation an Industrial Council, which they call the "Joint Shop Committee," and which is working out in a very satisfactory manner.

An official of the firm outlined the project to CANADIAN MACHINERY as follows:

The membership of Robb Engineering Works' Joint Committee shall consist of a number of members appointed by the workmen of the Robb Engineering Works, Ltd., and an equal number of members appointed by the management.

The objects are as follows:

(a) That the workmen in the Robb Engineering Works be given a wider interest in and a greater responsibility for the conditions under which their work is performed.

(b) The settlement of general principles governing the conditions of employment, including the methods of paying and re-adjusting wages, having regard to the need for securing to the workmen a share in the increased prosperity of the industry.

(c) The establishment of regular methods of settling differences between employers and workmen and to their better adjustment when they appear.

(d) Better utilization of the practical knowledge and experience of the workmen.

(e) Improvements of processes, machinery and organization.

(f) Technical education and training.

(g) Consideration of sanitary conditions and the study of comfort for workmen.

(h) The institution of safety committees for the introduction of safety devices and methods.

(i) Robb Engineering Works Relief Society Organization.

TRACTOR COMPANY IN THE MARKET FOR A LONG LIST OF MATERIAL

The Franklin Tractor Company, Greenville, Ohio, announce that they are in the market for the following material for delivery in 1920, commencing March 1: 750 30 h.p. 4-cylinder tractor motors; 750 magnetos; 750 sets of radiator cores; 1,500 rear sprockets (steel castings); 1,500 front sprockets (steel castings); 4,500 track rollers (grey iron castings); 1,500 upper track roller idlers (grey iron castings); 4,000 brackets (grey iron castings); 750 gasoline tanks (Armco iron or equivalent); 750 gasoline tank pedestals (grey iron castings); 750 steering wheels; 750 spring seats or equivalent; 7,000 lineal feet steel angle 4.4 pounds; 7,000 lineal feet steel channel 5 pounds; 2,000 sheets (blue annealed Armco iron or equivalent); 100 tons cold-rolled rounds, 1 in. to 3 in. diameter; 750 complete sets transmission gears; 750 pressed, split steel pulleys, or 750 power take-off systems complete; 750 transmission housings (grey iron castings); 750 clutches; 60,000 steel treads for crawler type tractor; 750 radiator filler caps; 750 radiator cases (grey iron castings; 750 motor fans and belts; 750 liquid steel castings); 155,250 bearings; 750 complete rear systems; 750 front axles (steel castings; 155,250 bearings; 750 carburetors; 750 governors. Miscellaneous castings and forgings.

In addition to the above we shall be in the market for lathes, boring mills, shapers, presses, drill presses, power saws, and other necessary material and equipment.



In analyzing your shop costs have you considered a possible saving in your tool room?

How Many Prices Are You Paying for Making Your Tools?

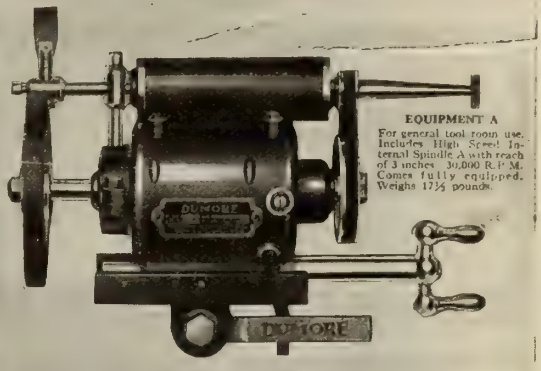
An analysis of the operation of departments from a "dollars and cents" point of view, and particularly those departments directly affecting production, invariably discloses abnormal costs.

One sure means of reducing costs and, at the same time, of obtaining highest quality tools, is found in the **DUMORE** portable grinder. The two chief reasons for this are **balance** and **speed.** The perfect running balance eliminates vibration and chatter—the big range of speeds from 10,000 to 50,000 R. P. M. gives even the small wheels the correct cutting speed, thus insuring work free from taper or bell-mouth. In addition to these reasons, the **DUMORE** is portable, permitting the mechanic to carry it to the many jobs being constantly set up in all parts of the shop.

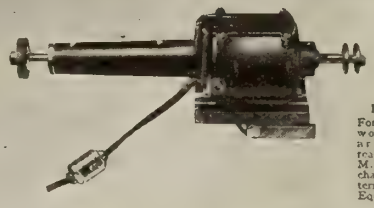
Your dealer sells **DUMORE** grinders. Ask him for a demonstration.

WISCONSIN ELECTRIC CO.

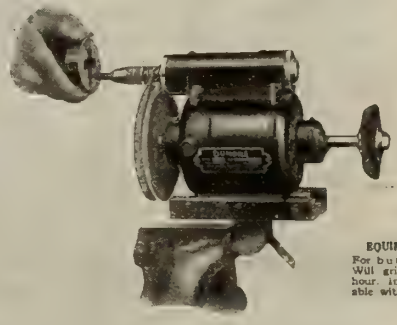
2919 16th Street RACINE, WIS.



EQUIPMENT A
For general tool room use. Includes High Speed Internal Spindle A with reach of 3 inches 30,000 R. P. M. Comes fully equipped. Weighs 17½ pounds.



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P. M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

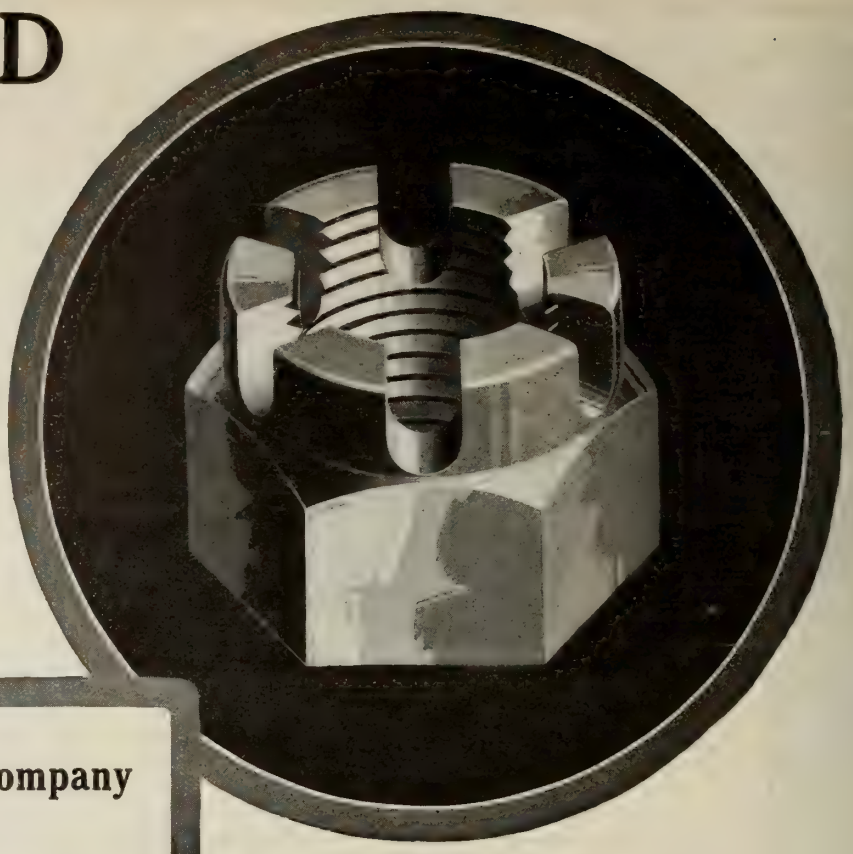
STANDARD

"V," U.S.S., S.A.E. Cap Screws
"V," U.S.S., Set Screws
Plain or Castellated S.A.E. Nuts
Semi-Finished "V" U.S.S. Nuts

SPECIAL

Screw machine product to specifications

Submit your requirements



The National Acme Company
MONTREAL, P.Q.

De Courcelles **G.T.R.**

treal to London service, would be resumed just as soon as the new ships being built became available. There are six of these vessels on the stocks, and it is hoped that some of them at least will be available for next season. They will all be oil burners.

Baldwin's Place Orders.—A large amount of new equipment has been ordered in the United States by the Baldwin Canadian Steel Corporation, who are building their new plant on the land of the Eastern Harbor Terminals in Toronto. This is the site formerly occupied by the British Forgings, Ltd. The material ordered consists of tinning units, conveyors and cleaning machines, and the order has been placed with an Ohio company.

Second Writ Issued.—A second writ has been issued by the United States Government for the recovery of 11,000 tons of steel forgings, and a number of motors, power transformers, machine tools, etc. The goods are situated on a piece of property north of the Buffalo and Lake Huron branch of the Grand Trunk Railway at Brantford. The writ is endorsed with the statement that the United States has sufficient assets to cover the costs of both parties, situated in the Province of Ontario.

Doubling Output.—Jenkins Bros., Montreal, are making an addition to their plant. The new building will be one storey, steel and brick construction, with crane way and monitor; 80 ft. wide by 192 ft. in length. The contract price is approximately $40,000. This building will be used as a machine shop, and taken in conjunction with the addition to prevent foundry building and new core room, which is already completed, will increase Jenkins Bros.' output of valves about 100 per cent.

New Industry in Brantford.—Plant No. 1 of the Motor Trucks, Ltd., has been secured by the Bluebird Manufacturing Co. of St. Louis, and the officials of the company expect to be in a position to secure production in about three months. Considerable capital has been subscribed by Brantford men, and the directorate of the new company will be practically the same as that of Motor Trucks, Ltd. The names of these gentlemen are J. B. Detwiller, R. E. Secord, W. J. Verity, W. C. Boddy, and T. Hendry.

To Survey Western Industries.—G. M. Ponton, assistant secretary and technical adviser of the Canadian Trade Commission, has left for a tour of the Western Provinces. Mr. Ponton will make a survey of the industries now operating and suggest means of increasing their operations. He will also examine the cases of industries which have had a brief existence, and are now shut down, with a view to ascertaining if they have a prospect of success if resuscitated. He will also enquire into the advisability of establishing new industries in the West, depending on natural resources and general conditions of trade.

Ontario Iron Shipments.—The Government report for the output of mines during 1918 is now available. During this year the Ontario mines shipped 198,883 tons of iron ore, 91,069 tons of which were shipped to Ontario smelters, the remainder being shipped to the United States. The chief producers were the Algoma Steel Corporation from their mines in the Michipicoten district, and the Moose Mountain Ltd., at Sellwood, near Sudbury. Three hundred and forty-five tons were shipped by the Pee Mining Co., Frontenac Co., and 80 tons by the Canadian Union Mines Corporation, Drummond. Ontario blast furnaces smelted 100,000 tons of Ontario ore and 1,375,459 tons of U. S. ore during 1918.

MARINE

Liverpool.—Famous names will be perpetuated by the Cunard Company, who will name their new ships after others formerly in the line. They will pursue this policy naming twelve big passenger ships now building. Four vessels of the 600-foot class now under construction will be named Scotia, Franconia, Laconia and Samaria.

St. John, N.B.—The St. John Board of Trade has issued figures covering the year 1919, showing the movement of goods through the port. Exports were

Oil Tempered Steel Springs

—for every purpose and the best for each use.

Special styles of all kinds to order.

THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio
U.S.A.

DOCKER'S

Elastic Steam Jointing Cement
Its elastic properties allow for all expansion and contraction as well as oscillation and vibration.
It is unaffected by pressure 600 lbs. per square inch or temp. of 500° Fahr.
It will not "blow" expansion and contraction being same as iron.
Its bulk is more than double that of red lead.

Iron Cement
For blow holes, cracks and defects in castings.
Also for furnaces, boiler seams, leaks in tanks, etc.

J. N. WARMINTON & CO.
MONTREAL
Agents:
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Engineering Apparatus Supply Co. Winnipeg

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next week's issue.

Canadian Machinery
143-153 University Ave., Toronto

TRADE MARK
"HAWK" BRAND STEEL



REGISTERED U.S. PAT. OFFICE NOS. 50932-61349
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"HAWK VANADIUM" TOOL STEEL

Remarkable in its glass Hardness, Toughness and Cutting Efficiency.

Will give twice the cut of a regular tool steel at one grinding.

Order "Hawk Vanadium" for your End Mills and cutters. Once known—always used.

Large Stock. Prompt Shipment.

Write for full particulars to

Hawkridge Brothers Company

Main Office and Warehouse
303 Congress Street, Boston, Mass
Storehouses Malden Mass.

STEEL
OF EVERY DESCRIPTION
SEND US YOUR ENQUIRIES.

Special Machinery
MADE TO ORDER

Mill Machinery, Engine Work
Grey Iron and Brass Castings

TRY US FOR GENERAL REPAIRS

ALEXANDER FLECK, LIMITED
(Vulcan Iron Works) OTTAWA, ONT.

Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO (MADE IN CANADA)

SANITARY DRINKING FOUNTAIN



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself.

"Puro" saves 35% on water bills, too. You can attach it in a few minutes.

Tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:
McKENZIE BROS.
18 St. Alexis St. Montreal, P.Q.

PLEWES Limited
WINNIPEG
For All
Machinists' Supplies

WIRE SPRINGS OF ALL KINDS

Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.

JAMES STEELE, LIMITED
GUELPH, ONTARIO

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CABLE ADDRESS "BREVET"

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
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MAPLE LEAF
STITCHED COTTON DUCK
BELTING
DOMINION BELTING CO. LTD.
HAMILTON CANADA

ploughs, forty heavy land ploughs, three hundred No. 2 drag scrapers with runners, to weigh approximately 95 pounds each, one hundred No. 2 wheel scrapers, six four-horse graders. Delivery to be made complete on or before May 1st. Particulars can be obtained from W. A. McLean, Deputy Minister of Public Highways, Parliament Bldgs., Toronto.

STAR GAP LATHES

The Seneca Falls Manufacturing Company, Inc., Seneca Falls, N. Y., have just brought out two sizes of Gap Lathes 11 in. x 18 in. swing and 13 in. x 21 in. swing. In designing the "Star" Gap Lathes, the extra capacity feature of the "Gap" has been added to the quality, convenience and efficiency of the well-known "Star" Screw Cutting Lathes.

The bed is of the box section type, thoroughly braced by cross webs and made very heavy through the Gap section to insure usual "Star" Lathe accuracy. A bridge piece is furnished to close up the Gap when the extra swing of the Gap is not needed. Beds are made 5, 6, 7, 8, 10 ft. long.

The carriage has the cross slide placed at left hand for convenience. The cross feed screw is supplied with micrometer collar graduated in thousandths of an inch. The apron has safety device so that longitudinal feed and split nut cannot be engaged at the same time. Has extremely wide range for screw cutting all standard threads from 3 to 72, including 11½ and 27 pipe threads. Can be equipped with transposing gears or metric pitch lead screw for cutting metric threads.

An unusually large line of attachments, including raising block, quick change gears, taper attachment, motor drive, draw-in chuck, milling and gear cutting attachment, turrets, relieving attachment, etc., may be used on the "Star" Gap Lathes.

There is a danger in riveting steam boilers by hydraulic pressure, that the pressure on the cup may be released before the shank of the rivet has had time to cool. In such an event the plates may spring apart to such an extent, that the shrinkage of the rivet in cooling is not sufficient to ensure a tight seam. In a German technical paper a description was recently published of an autographic recorder designed to overcome this possible defect of hydraulic riveting. Pressure upon the warm head of the rivet is transmitted through piping to clockwork and sets a pointer in motion until the required pressure is reached. This pressure is kept constant until a predetermined number of seconds has passed, when a red pointer indicates that the pressure may be released, and the pointer returns to zero. This result is graphically recorded upon a travelling paper band, from which the pressure and the period of compression can easily be read.

\$149,986,167; imports, \$15,702,446; grain exports 1918-1919 were 16,295,373 bushels, valued at \$33,014,536; customs receipts 1918-1919, \$3,244,424. The tonnage of vessels entered in 1919, 1,239,280 register; number of vessels, 2,130; vessels cleared 2,090; register tonnage, 1,204,011.

TENDERS

The Department of Public Highways are calling for tenders, up to February 2nd, for the supply of road building equipment: Two three-quarter yard steam shovels, forty railway breaker

THE WAY TO BRING IT DOWN



—St. Louis "Star."

—And the Board of Commerce might help "Everybody" by telling how to handle the weapon.

NEW USES FOR OLD THINGS



Slicing Cucumbers

We don't guarantee success and would like to know what luck others have before we try it on ours.—"The Exciter," house organ of the Central Marine Power Company.

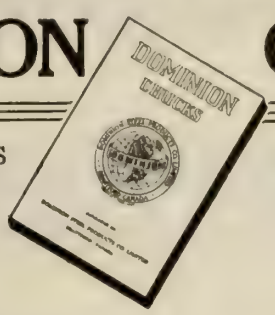
In a paper on the subject of quenching oils for forgings, held by the American Drop Forge Association, Mr. G. W. Pressell said that the water quenching of large forgings was very sharp and severe, and if not properly handled often resulted in the failure of the piece after working. The quenching of forgings in oil was fool-proof, and the expenditure of money required properly to equip the hardening department with tanks and cooling systems was fully warranted. The ideal quenching medium for forgings would be a water soluble material which, when mixed with water, would give a quenching speed through the critical range equivalent to that obtained with water, and from the critical range to the atmospheric temperature equivalent to that with oil. A mixture of oil and water had, nevertheless, proved unsuccessful. Spreading a small quantity of oil on the surface of water used for quenching to reduce the sharp effect of water alone had also been tried, but without success.

A novel use for balloons has been developed in California, where one is being used for hoisting tent-like covers over citrus trees which have to be fumigated. The balloon has a capacity of 3,000 cubic feet and takes the place of a high travelling derrick, which was liable to damage the trees while being moved about the orchards. The balloon and a crew of four men place between twenty-five and thirty tents an hour over large Valencia trees. The derrick outfit with seven men places but fourteen or fifteen tents an hour.

The Swedish state railways are planning to electrify the line between Stockholm and Goteborg at a cost exceeding $16,000,000 and requiring more than three years of work.

Send for this Book

DOMINION CHUCKS



DOMINION CHUCKS ARE GUARANTEED

Steel or Cast Iron Body — *Built for Heavy Duty*

You Want Dependable Chucks

INCREASED cost of production demands that every tool give satisfactory and continuous service and be free from the annoyance of frequent breakage. **Dominion Chucks** were perfected by us for our own use and to fill a specific need for a chuck that would stand up and give a satisfactory service under the strain of heavy and continuous work.

Chuck troubles in our own plant compelled us to design and manufacture for our own use the **Dominion Chuck.** It has proved satisfactory under the test of heavy duty service and the most exacting work. We are manufacturing this chuck either in all-steel or iron bodies—sizes 10 to 24 inches. *Write for our Chuck Book.*

DOMINION STEEL PRODUCTS CO.
LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

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on all branches of Engineering and every conceivable subject. Second-hand at half prices. New at lowest prices. State wants and send for Catalogue No. 23, post free.

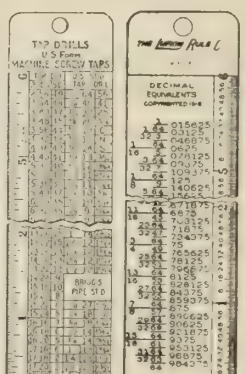
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OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co., Ltd.
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FOR SHIPBUILDERS & IRON & STEEL WORKS
BERTRAMS LIMITED
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BETTS
HEAVY DUTY MACHINE TOOLS
Planers, Engine and Axle Lathes, Slotters, Boring and Turning Mills, Horizontal Boring and Drilling Machines.
BETTS MACHINE CO
406 BLOSSOM ROAD, ROCHESTER, N.Y.



A Handy Machinists RULE

Combining measurements 1/32nds—1/64ths together with tap drill sizes and decimal equivalents.

LUFKIN
TAPES AND RULES
Accurate and Durable
THE LUFKIN RULE CO. OF CANADA, LTD.
WINDSOR, ONT.

MORTON MANUFACTURING CO
PORTABLE PLANERS
DRAW CUT SHAPERS
SPECIAL DRAW CUT R.R. SHAPERS
FINISHED MACHINE KEYS
STATIONARY & PORTABLE KEY WAY CUTTERS
SPECIAL LOCOMOTIVE CYLINDER PLANERS
OFFICE — WORKS MUSKEGON HEIGHTS U.S.A.

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Rates (payable in advance): Two cents per word first insertion; one cent per word subsequent insertions. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

AGENCIES WANTED

MONTREAL SUPPLY HOUSE HAVING SALES organization and good connections with mills and industrial plants in Quebec and Maritime Provinces (branch St. John, N.B.), is open to handle one or two more specialties of merit, chemical or mechanical. Address Box 642, Canadian Machinery. (c25m)

MACHINERY WANTED

WANTED TO PURCHASE

2 BRIDGE JACKS, 25 TON WITH FOOT. Height 24 in. with 13 in. rise, also 20 in. traversing bases. Reply Box No. 651, Canadian Machinery. (c7m)

DRILL WANTED

Four-spindle power feed drill. Must be in first-class condition. Also one light multiple drill.

NINETEEN HUNDRED WASHER COMPANY
357 Yonge Street
TORONTO, ONT.

FOR SALE

FOR SALE—ONE 16" BURKSTONE MILL; one Schutz O'Neil Disintegrator. The above machines are practically new and in good condition. Can be seen at our works. Dalton Spice Co., 11 Front St. East, Toronto, Ont. (c7m)

ONE 16 IN. x 8 FT. BRASS TURRET LATHE, friction geared head, one extra cross slide turret, chasing bar cross slide, spring chuck and friction countershaft, $4.50. One 8 x 8 belt-driven air compressor. One No. 2 pressure blower. One Foote Burt heavy duty vertical drill. Darling Bros., 120 Prince St., Montreal. (c6m)

Foundry For Sale

Tenders for the purchase of the entire plant and equipment of the Alton Foundry Company, Limited, at Alton, Ont., will be received by the undersigned up to the 30th day of January, 1920.

The property consists of a large stone foundry and machine shop, equipped with lathes, drills, milling machines. motors, transformers, etc., details of which, and terms of sale, will be furnished on application.

Alton Foundry Co., Limited
ALTON, ONTARIO

FOR SALE

NEW MITRE BOX PATENT

IF YOU ARE INTERESTED IN BUYING A patent for the latest labor-saving device in mitre boxes, address Box 636, Canadian Machinery.

FOR SALE—BRAND NEW INGERSOLL-RAND After-cooler, never used, for compressor up to 14 x 14". London Mfg. & Machine Co., Ltd., London, Ont. (ctfm)

FOR SALE — AT REASONABLE PRICES. Genuine Swedish iron bars. Full assortment of sizes. Apply Dillon Crucible Alloys, Welland. (c7m)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (cfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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Machinery for Sale

DRILL PRESS

1 24 in. Barnes type sliding head vertical Drill Press with Lever, Hand Wheel, and automatic feed. Rebuilt and in first-class condition.

TURRET LATHES

2 18 in. Libby Lathes with Countershaft complete, as they stand or re-built if required.

AIR COMPRESSOR

1 Bury Air Compressor 12 in. x 14—Class M. Belt driven. Erie unloader, 330 cubic ft. per minute. This is in first-class condition.

These machines can be inspected here in Guelph.

The Lang Manufacturing Co., Ltd.
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Full line of

Honestly Rebuilt Machine Tools at bargain prices.

Special price on 20 inch x 8 ft. C.M.C. Lathe.

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WHEN WRITING TO ADVERTISERS KINDLY MENTION THIS PAPER

WANTED FOUNDRY to make

high-grade Gas Engine Cylinder Castings. Submit full particulars as to experience, capacity, and references to present connections.

Box 649, Canadian Machinery

THE U.S. GOVERNMENT

Has a large quantity of surplus manufacturing

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Canadian Manufacturers are presented with an opportunity to secure at low prices good quality new and used Miscellaneous Machinery, Shop Equipment, Miscellaneous Tools, Electrical Equipment, Testing Equipment, Miscellaneous Hardware, Etc.

For Immediate Disposal

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Accumulators
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Drilling Machines
Forges
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Grinders
Hoists
Lathes
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Motors
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Pulleys
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Reamers
Scales
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Screw Machines
Shapers
Switch Boxes
Taps
Tensile Machines (Storage)
Thermometers
Transformers
Trucks
Vises
Welding Equipment

Toronto District Salvage Board
Ordnance Department U.S. Army
39 Adelaide St. East, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

A REQUEST—

There has been an unprecedented demand for our Annual Review Number, January 8th, and our supply of this issue has been entirely exhausted.

We shall appreciate it very much if manufacturers who subscribe for several copies will let us have any they may be able to spare. Eleven Cents Postage per copy will be required, and this will be forwarded promptly.

CANADIAN MACHINERY
153 University Ave.
TORONTO, - ONTARIO

SURPLUS EQUIPMENT FOR SALE

PRESSES

	Stroke Inches	Width Bed	Approx. Cap. Tons
2—No. 666 Toledo Embossing Presses	2	32	1,200
2—No. 27 Bliss Embossing Presses	2	32	1,000
2—No. 60½ Bliss Rack and Pinion Drawing Presses	60	21	100
7—No. 60½ Bliss Rack and Pinion Drawing Presses	42	21	100
1—No. 857 Toledo Rack and Pinion Drawing Press	48	25	100
1—Robertson Hydraulic Press with pump and extra set of columns	24	27	800

LATHES

6—11" Blount Speed Lathes, 5' bed.
4—No. 2 Warner & Swasey Speed Lathes.
2—20" Stoll Wood Turning Lathes.
35—Bullard Cartridge Case Lathes.

GRINDERS

2—Wells Cutter Grinders.
1—12" x 72" No. 4 Cincinnati Universal Grinder.
1—No. 70 Heald Internal Grinder.
1—No. 75 Heald Internal Grinder.
1—10" x 24" Landis Grinder.
1—No. 1 American Surface Grinder.
1—No. 74 La Salle Surface Grinder.
1—Ford-Smith Double Head Grinder, 3" x 24" wheel.

FURNACES

1—Gas Muffle Furnace, 3¼ x 1½" x 7" long.
1—Gas Temperirg Furnace with oil reservoir.
1 Gas Tempering Furnace with Tray in Reservoir.
1—H.S. Tool Hardening Furnace, 9" x 8" x 9" long.
1—Double Door Gas Furnace, Doors 20½" x 12" high. Fire Space 50" wide, 12" high, 54" long.
5—26 ft. Rockwell Single Chamber Annealing Furnaces, equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

BLOWERS AND FANS

	Size of Outlet	Displacement per rev.
1 Root Positive Blower	8" Vertical	3.3 cu. ft.
1—Connersville Blower	6" "	1.5 " "
1 " " "	6" Horizontal	1.5 " "
1 Boland Positive Blower	4" "	

3—Desk Fans.

MOTORS

	Volt	Phase	R.P.M.	Cycle
1—Type Dumore	115	with buffing		spindle.
1 Garage Pump and Motor	110	1	1400	25
1—10 H.P. Westinghouse	200	2	1245	60
1 20 H.P. Westinghouse	200	3	710	25
1—25 H.P. Westinghouse	200	3	710	25
5—50 H.P. Westinghouse	200	3	715	25
1—75 H.P. Westinghouse	200	3	720	25

MISCELLANEOUS

11—No. 3 Brown-Boggs Trimming Machines.
1—No. 3 Tinius Olsen Testing Machine. 10,000 lbs., capacity hand-operated.
1 Sauveur-Boylston Photo-Micrographic Instrument.
1 Boland Special Sand Blast Machine.
1 Whitton Centering Machine.
3 No. 310 Simplex Lifting Jacks.
4 2½" x 18" Screw Jacks.
1 2¼" x 16" " "
3 1¼" x 4" " "
1—No. 873 Toledo Trimming Machine.
Bristol & Brown Indicating Pyrometers.
" " Recording "
1—Motor-driven addressograph machine with stencil cutting machine and full equipment of special attachments.
2—Adding Machines (Listing)

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HAMILTON, CANADA

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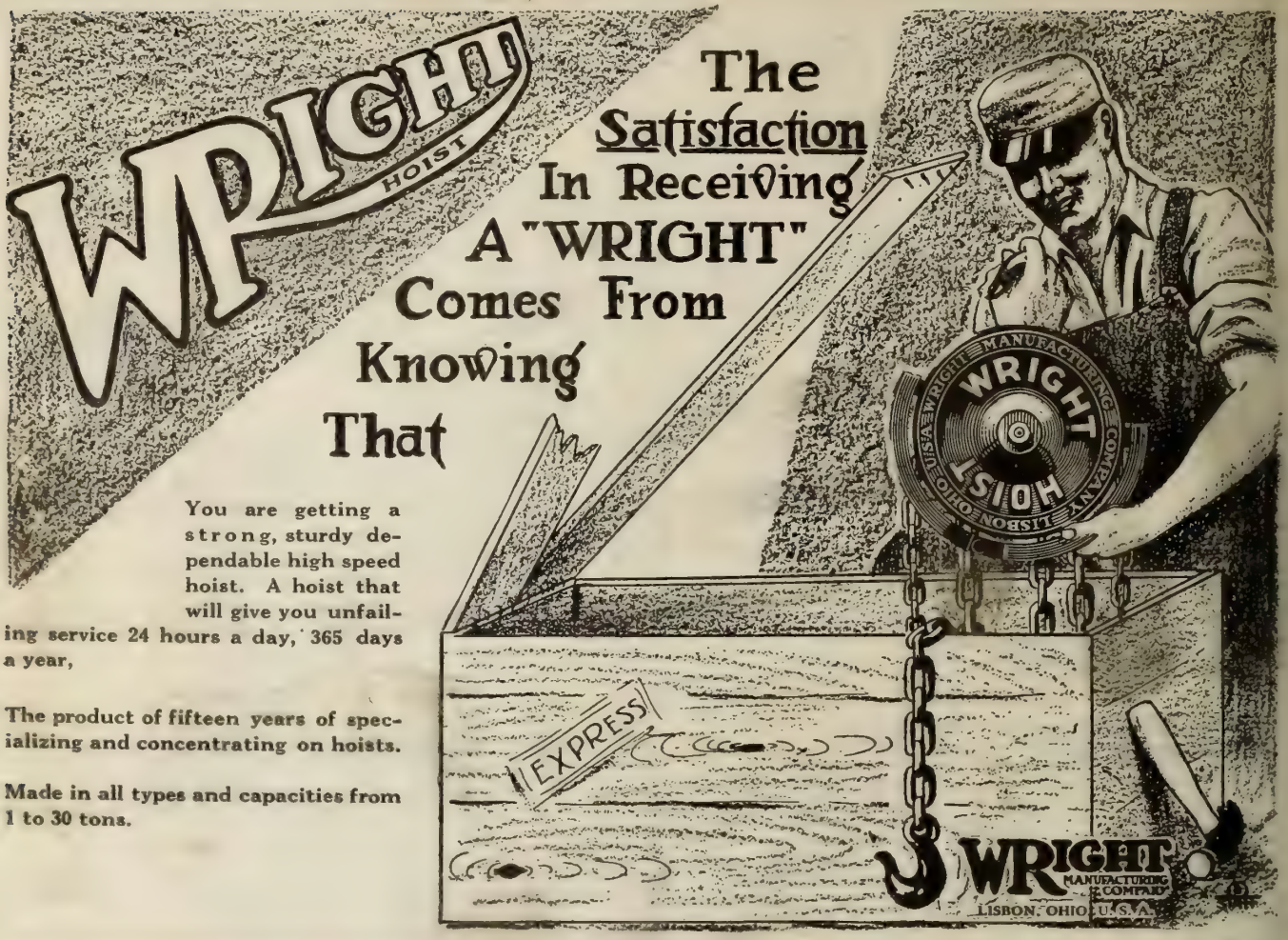
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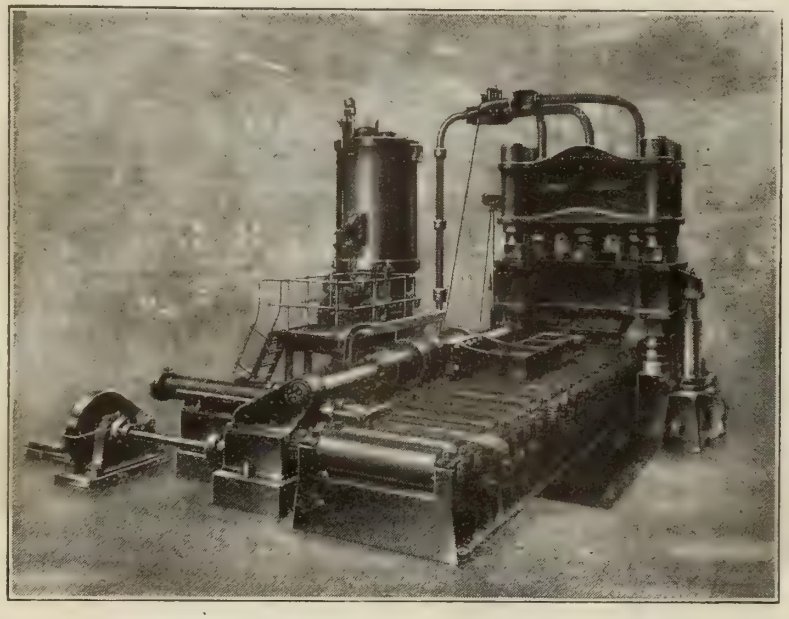


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Telegrams: STEWART, GLASGOW

Established 1864



Set of 54 in. x 16 in. Steam Hydraulic Slab Shears

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ROLLING MILLS.
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BLOOM, SLAB, BILLET and PLATE SHEARS.
PUMPS.
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HOT SAWS.

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The Problem Solved!

Dependable quality in abrasive wheels is next to impossible unless the manufacturer commands his own raw material supply. Inability to do this has always stood against dependability in Canadian wheels.

We have solved the problem by making our own abrasives, and we are now prepared to guarantee that DOMINION WHEELS will give equal service to the best imported wheels.



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Have you any grinding problems? We have had long and varied experience and can give you valuable assistance.

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BRANCHES: Vancouver, Calgary, Winnipeg, Toronto.

The Hughes Owens Co. Ltd.

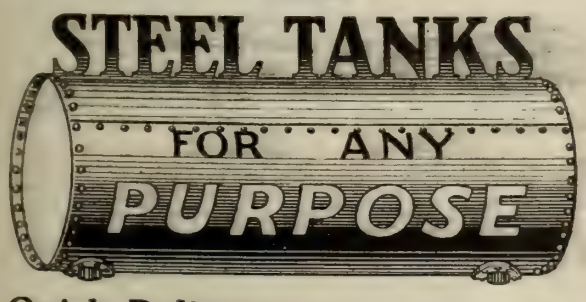
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Clean, *Accurate* Threads —in half the time!

Don't let big production demands make you forget that the threads you turn out must be standard, must be clean, must be within prescribed limits of size.



MURCHEY COLLAPSING TAPS and SELF-OPENING DIE

are tools that give big production without sacrificing accuracy. That's why Murchey production is different. Murchey tools have an unexcelled production record; and they produce accurate work because they clear the thread instantly when opened, with no danger of stripping.
We are prepared to send you a Murchey tool on approval, to try out on your work. Take advantage of this to-day.

Murchey Machine & Tool Company, Detroit, Mich.

THE COATS MACHINE TOOL CO., Caxton House, Westminster, London, England, Glasgow, Newcastle-on-Tyne,
FENWICK FRERES AND CO., 15 Rue Fenelon, Paris, France

Steam and Power Pumps

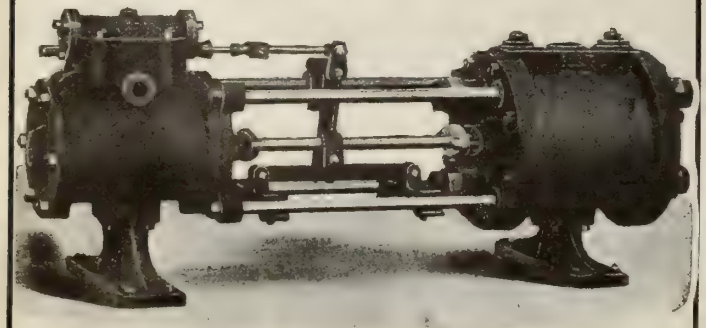
OF ALL KINDS

We are manufacturing improved designs of the well-known Martin pump and are prepared to furnish standard duplex pumps for boiler feed, air, circulation, fire, mines, and general service; low and high pressure pumps for hydraulic presses, lifts, accumulators, etc.

Write for Standard Sizes and Prices

John T. Hepburn, Limited

18-60 Van Horne St., Toronto, Ont.



DUPLEX BOILER FEED PUMPS

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

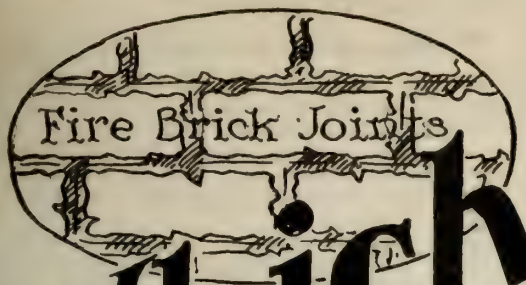
Structural Steel and Steel Plate Work, and a combination of the two lines.

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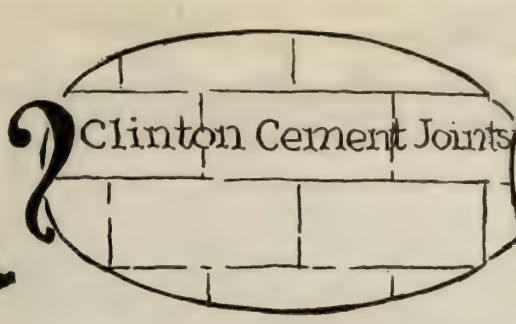
MacKINNON STEEL CO., LIMITED

Sherbrooke, Quebec

Montreal Office: 404 New Birks Building



Which?



CLINTON CEMENT

FIRE clay dries up and sifts out from between the bricks like powder, causing the escape of hot air and interfering with proper combustion by cold air leakage.

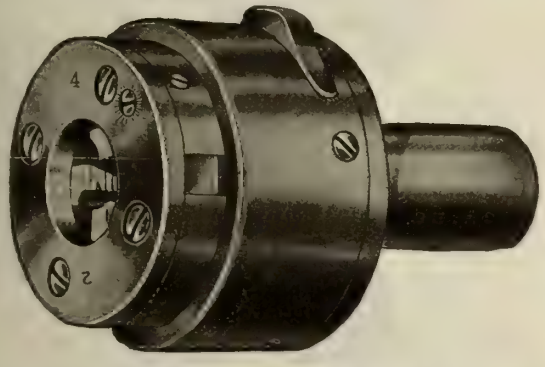
Clinton Cement Saves Fuel and Increases Boiler Furnace Efficiency

It makes joints that stay tight. Sets and makes a surface like glass yet allowing for expansion and contraction. Stands a heat up to 3,000 degrees Fahrenheit.

Try it once and you always want it.

A five-pound tin of **Clinton Super-Heat Cement** will be sent you free and all charges prepaid, if you write the

Standard Machinery & Supplies Limited
261 Notre Dame St. West, Montreal



H & G **Die Heads**

are of small outside diameter compared with the size of work they do.

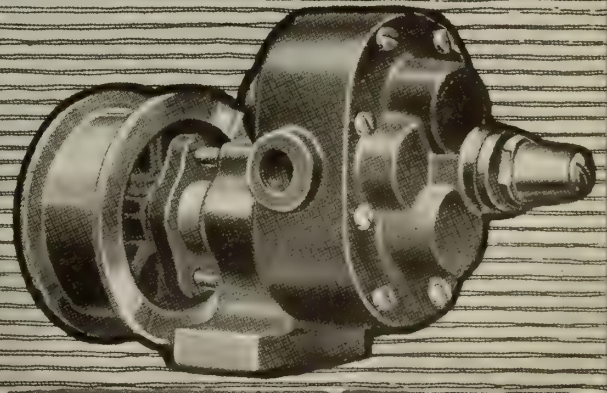
The H. & G. illustrated is an automatic, self-opening Die Head designed especially for use on Gridley and National Acme Multiple Spindle Screw Machines and others that use the die in a revolving position. The four sizes of this Head cut up to 9/16", 1", 1¼" and 1½".

All parts are hardened and ground and interchangeable. In a word—it's an H. & G.

Ask for Catalog

Eastern Machine Screw Corp.
New Haven, Conn., U.S.A.

TRAHERN
Lubricating Pumps

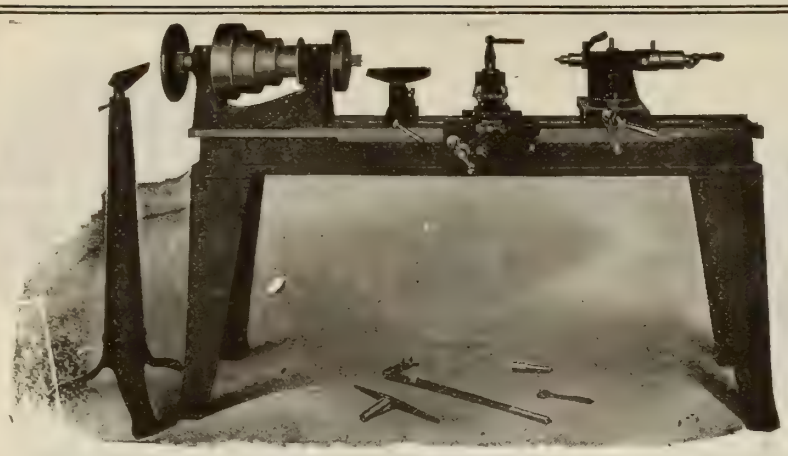


Need no introduction to Machine Tool Manufacturers. They are known the world over as the reliable Rotary Geared types.

Trahern Pumps specialize in delivering a continuous, forceful, non-pulsating stream of oil, against 100 lbs. pressure if necessary. If installed properly will not loose prime, operate at low speed, long life.

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Rockford, ILL., U.S.A. Geo. D. Roper. Corp.

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A Favorite—

Blount Pattern-makers' Lathe

FAST AND ACCURATE—Equipped with set over swivel tailstock and carriage, and outside face plate and tripod. Built in 16" swing with beds 6 or 8 feet in length. Spindle is made of high carbon steel, is hollow and fitted with Morse Taper and runs on self-oiling bronze bearings.

Our catalog gives a full description of this strong and highly efficient machine, also our other quality speed lathes and grinders. Give us your address.

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MARK YOUR PRODUCTS THE "MATTHEWS" WAY



"Matthews-made" steel stamps and lettering dies make easily read and durable marks on all classes of products. Matthews Champion Type Holders—for flat and convex surfaces—with interchangeable Steel Type, save time and lower marking costs. Matthews Inspection Hammers of best Pittsburgh Steel, are fashioned with the "know how" of over 50 years' experience.

Booklet "For Light and Heavy Marking" sent on request. Write for a copy of it.

J. H. MATTHEWS & CO.
3946 Forbes St., Pittsburgh, Pa.
STEEL LETTERING DIES AND STAMPS

MANHATTAN *UNIVERSAL* Grinder



A tool that stands in first rank in machine design and machine utility.

Simple, sturdy and accurate; a machine that you will be proud to have in your shops. If you have a big variety of work to be done there's no better investment.

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CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
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RAWHIDE OR METAL

Do Your Furnaces Waste Oil?

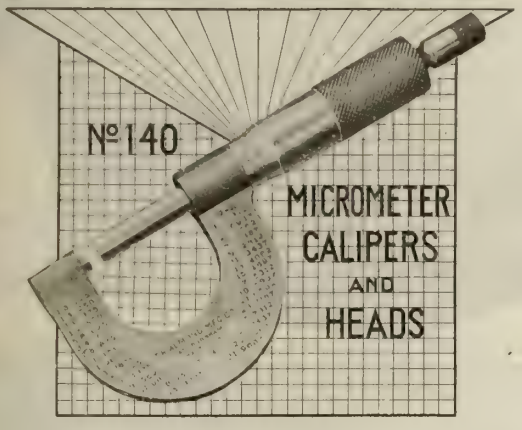
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Will save 50% of the fuel used by ordinary furnaces of the same capacity.
Continuous forge furnaces, and furnaces for heating, melting, reheating, heat treating, annealing, hardening, sherardizing, and welding. Any industrial process requiring heat.
The only distinct advance in furnace practice since Sie men's time.
Are you interested in a description of these furnaces? Bulletin 54 is yours for the asking.

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ALMOND



All Almond Micrometers are inspected and adjusted to Johansson Gages and recognized comparison only with these gages.

Almond Service.—Should the Micrometer need readjusting at any time or defect in material or workmanship develop send to Ashburnham and readjustment or replacement will be made without expense.

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Three HOYT METAL babbitts — "Frost King," "Trojan" and "Nickel Genuine" — ranging from a metal which keeps wheels turning in the coldest weather known, to a hard babbitt which stands up under the extreme heat of foundries and glass works.



Compounded scientifically to be exactly suited to their purpose. Give consistent satisfaction because they are mixed with scrupulous accuracy and care.

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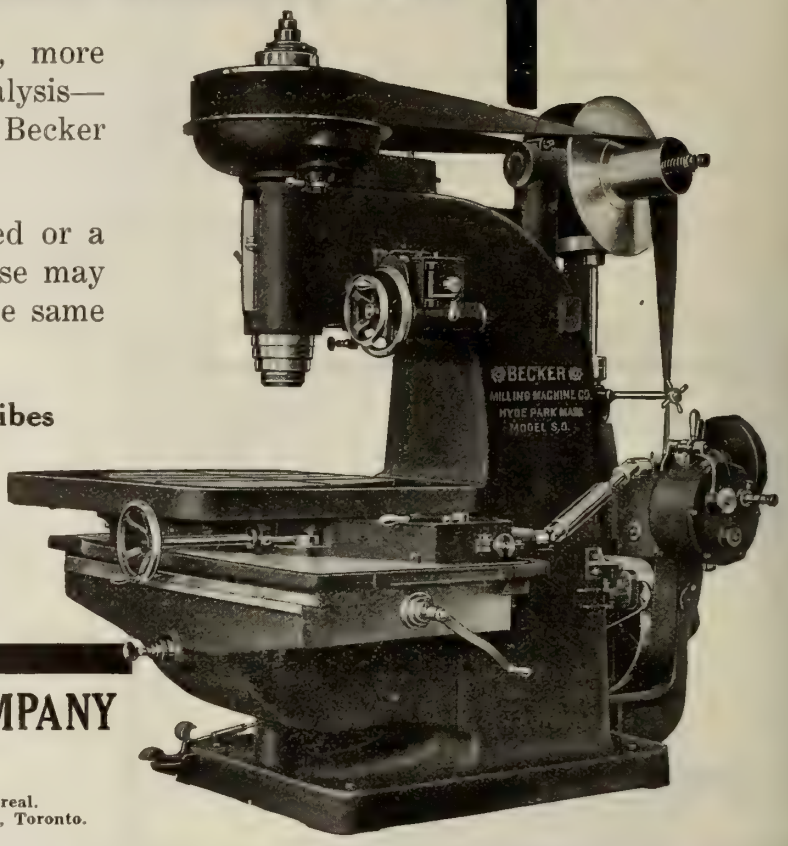
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Increased production, lower costs, more perfect parts—and in the last analysis—efficiency; are attained by the use of Becker Continuous Milling Machines.

One set-up does for fifty, a hundred or a thousand duplicate parts, as the case may be; and each will be finished to the same dimensions.

Write for circular 0-601, it describes

THE MACHINE
THAT GIVES THE
SMOOTH FINISH

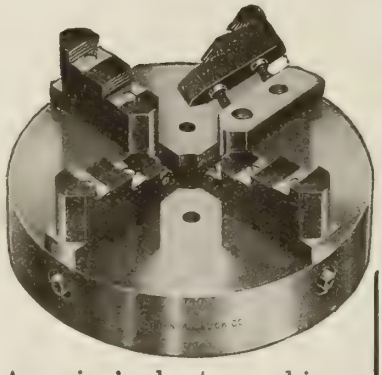


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On many of America's best machine tools—

In many of the better metal working plants of the world—

In the highest esteem of thousands of operators.

If you use chucks, investigate the Skinner line. It will pay you.

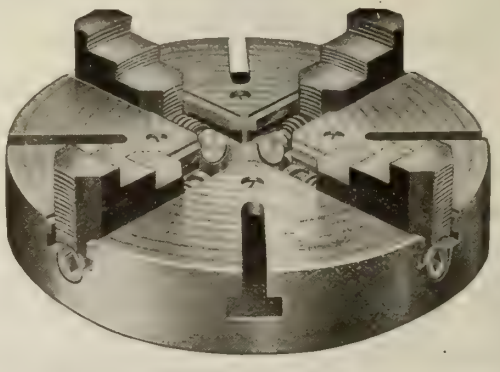
The Skinner Chuck Company
New Britain, Conn.

N. Y. Office: 94 Reade St.
San Francisco Office: Rialto Building
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ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

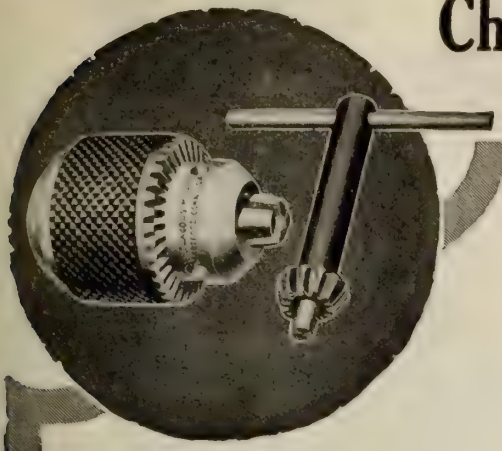
New Britain, Conn.

***New York Office:* 26 Cortlandt Street**

Makers of a complete line of chucks

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Chucks that have won their place



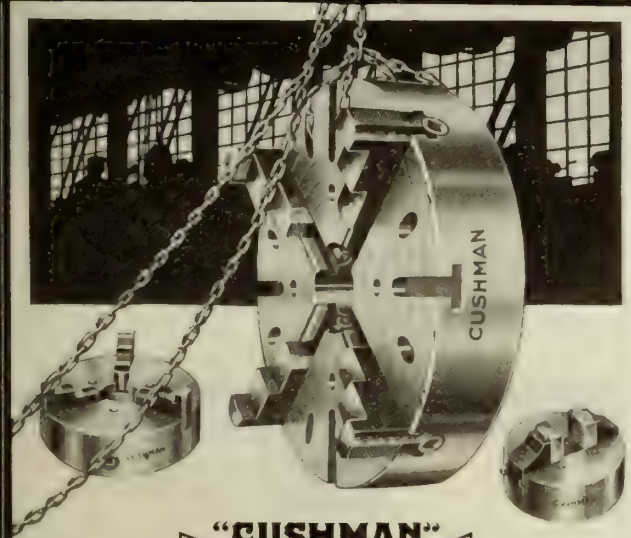
Jacobs Chucks have come to be as much of a necessity in modern industry as the drills they hold so firmly.

They have won their place by their durability, their firm grip, their freedom from drill breakage, and the ease with which they permit the changing of drills.

If you would know the value of Jacobs Chucks, ask any mechanic who has used them.

DEPT. C. M,

THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.



"CUSHMAN" CHUCKS 1862

THE STANDARD FOR EXCELLENCE

WHEN THE BEST IS NONE TOO GOOD
SPECIFY CUSHMAN CHUCKS
THEIR USE IS WORLD WIDE

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Quality Cutting Dies

For All Purposes



Our experience is varied in this line of work and we are completely equipped to handle any kind of Cutting Die Works.

The picture shows you a few of the many kinds and styles, such as Envelopes, Labels, Lithographs and Advertising Novelties, Boxes, Wrappers, Gaskets, Paper Napkins, Drinking Cups, etc., Cutting Dies which we manufacture.

We solicit your inquiries

The Hoggson & Pettis Mfg. Co.
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Sold by Geo. F. Foss Machinery & Supply Company, Limited, 305 St. James St., Montreal.

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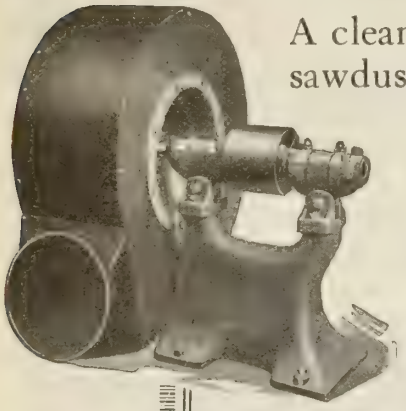
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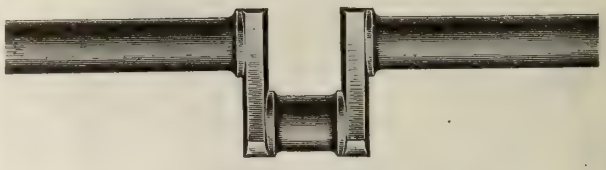


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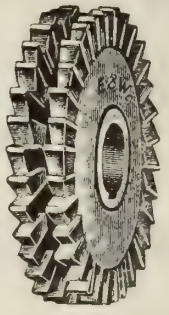
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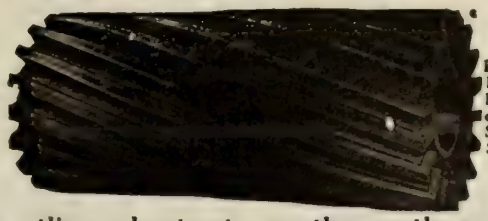


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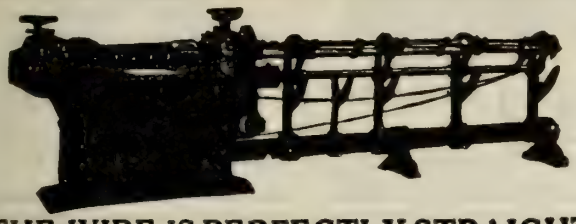
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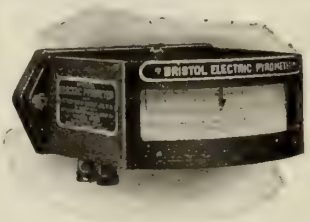
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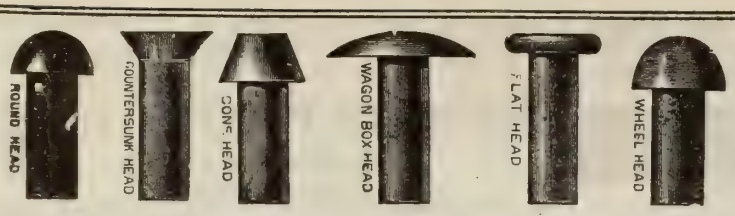


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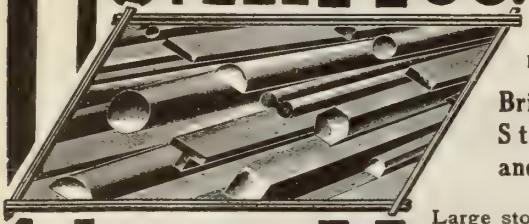
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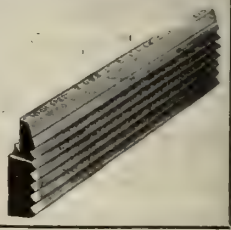
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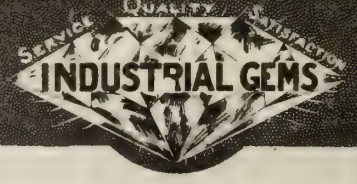


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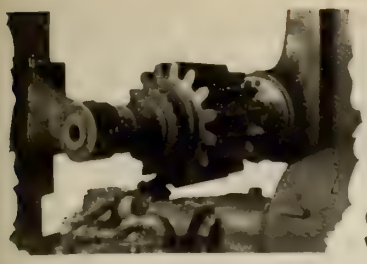
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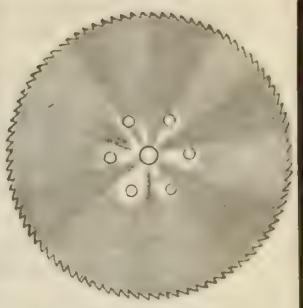
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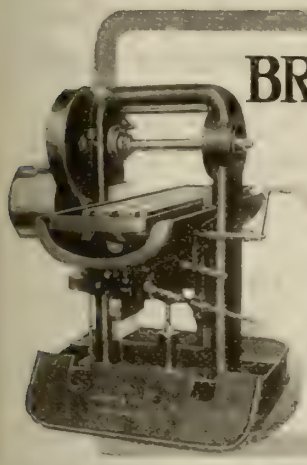
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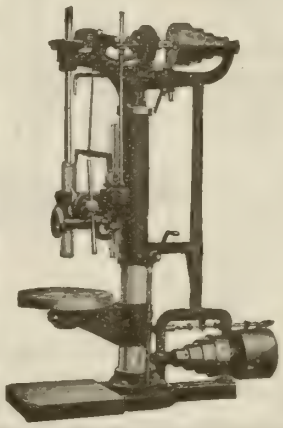
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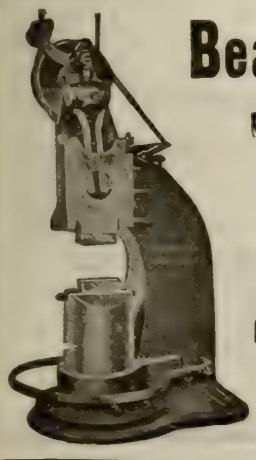
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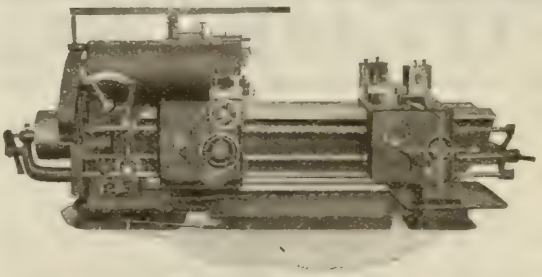
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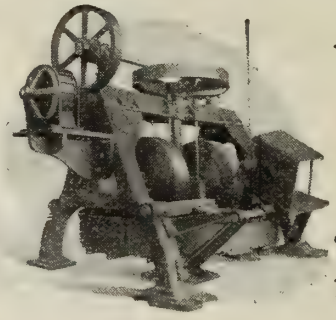
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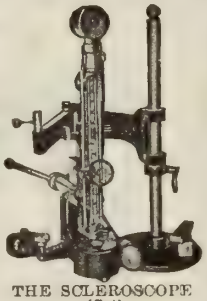
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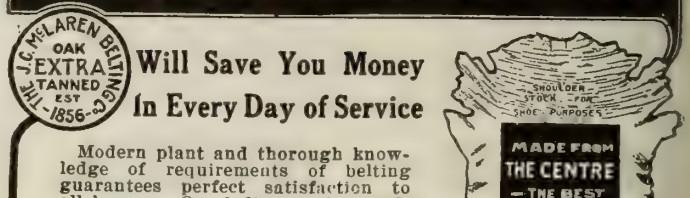


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Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Burniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
U. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co. Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St Lawrence Welding Co, Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co, Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., W nesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE & TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Petrie, Ltd., H. W., Toronto.

BRICKS, FIRE
Elk Fire Brick Co. Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
D. S. Ordnance, Toronto, Ont.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroocke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

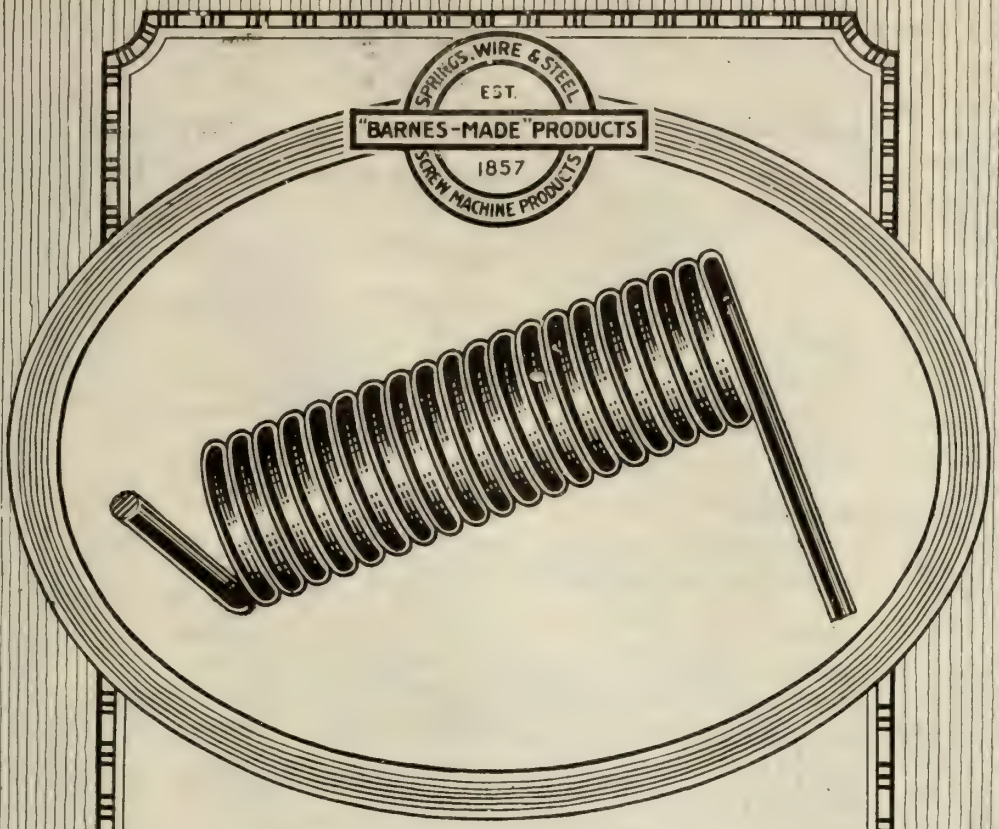
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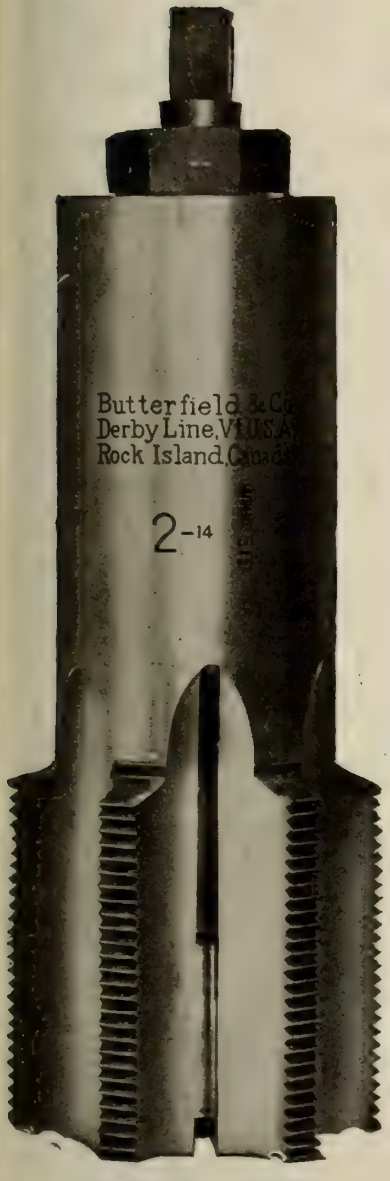
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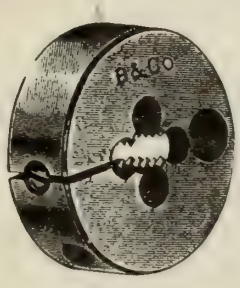
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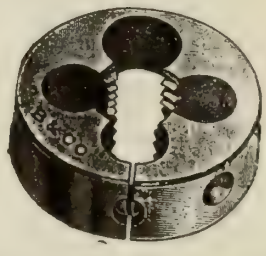
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Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE. CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
H. H. Barton & Son Co. Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Brantford Emery Wheel Co., Brantford, Canada
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Truing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford.

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamilton

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Northern Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX
British Smelting & Refining Co., Ltd., Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

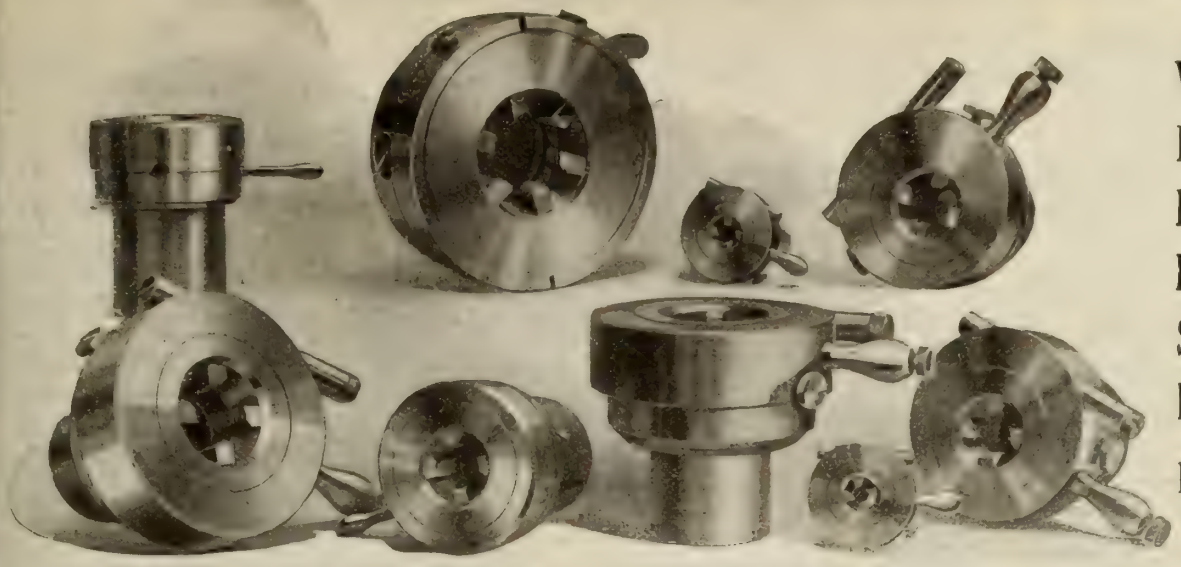
GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS.
LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont
Wilton Tool & Mfg. Co., Boston, Mass.

GAUGES, SNAP. THREAD AND CYLINDRICAL
C. E. Johansen, Inc., Toronto, Ont.
Wilton Tool & Mfg. Co., Boston, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. Co., Boston, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.



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The No. 1 Hartness die will thread from 3-32 inch to 9/16 inch diameter, all pitches.

The entire range from ¼ inch to 2¾ inch for standard threads, and to 3 inches for 8 pitch or finer, is covered by three sizes of dies, whose ranges overlap.

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JONES & LAMSON MACHINE COMPANY

American Agents for Dies and Chasers:

Boyer, Campbell Company, Detroit.
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E. L. Essley Mchy. Co., Chicago, Milwaukee and Moline.
Fairbanks Company, Albany, N.Y.; Buffalo, N.Y.; Bridgeport, Conn.; Hartford, Conn.; Providence, R.I.; Boston, Mass.; New York, N.Y.; Newark, N.J.; Scranton, Pa.; St. Louis, Mo.; Birmingham, Ala., and New Orleans, La.
E. A. Kinsey Co., Cincinnati, O.; Indianapolis, Ind.; Columbus, O.
Machinists Supply Co., Pittsburgh, Pa.
D. Nast Mchy. Co., Bourse Bldg., Philadelphia, Pa.
Robinson, Cary & Sands Co., St. Paul & Duluth.
A. V. Wiggins & Co., Syracuse, New York.

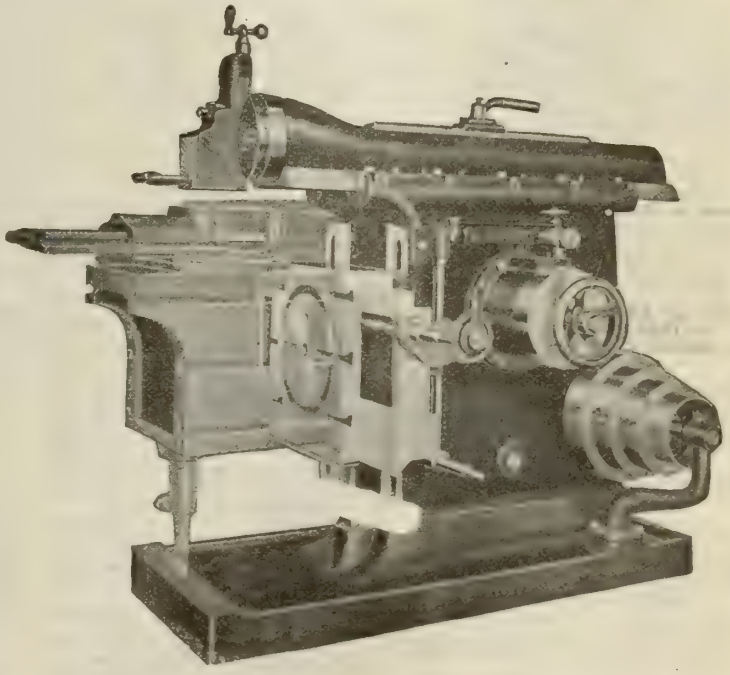
Foreign Agents:

France, Spain, Belgium, F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland, Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia, McPherson's Pty., Ltd., Melbourne, Australia.
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A PRODUCT of specialists in machine tool design. Distinctive in its simplicity and ruggedness, absence of unnecessary moving parts and ease of control—features which result in rapid, economical operation.

The quality of workmanship on this machine is on the same high level as the refinement of its design—perfect to the last detail. Capable of meeting the most exacting duties of modern industry.



Milwaukee Shaper Co.

Milwaukee, Wis.

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FOREIGN: Manning, Maxwell & Moore, Belgium; R. L. Bobroff, Russia, Poland; Alfred Herbert, Ltd., Italy, India, China, Japan, Korea, Burmah, Ceylon.

Our literature, which goes into details of design, is yours for the asking.

If interested tear out this page and place with letters to be answered.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. C., Boston, Mass.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES ,REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York,
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND F AND DEEP HOLE
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
E. C. Atkins & Co., Inc., Indianapolis.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
E. C. Atkins & Co., Inc., Indianapils.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
E. C. Atkins & Co., Inc., Indianapils.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q.

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada Galt, Ont.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

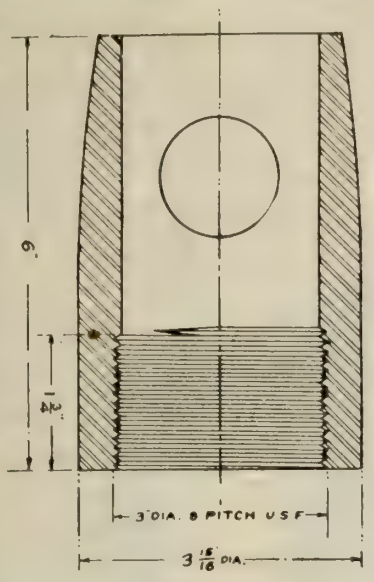
HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
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Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

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HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland.

If this piece resembles something you are making, a Smalley-General Thread Miller will save you money



MATERIAL—Steel Forging.
LATHE TIME 35 minutes approx.
THREAD MILLER TIME—2½ minutes, floor to floor.
Note—If desird to face end true with thread add 45 seconds.

In any case, you are almost certain to be making internal threads, fine pitch, standard or Acme—somewhere in your shop—and you're probably doing it on a lathe.

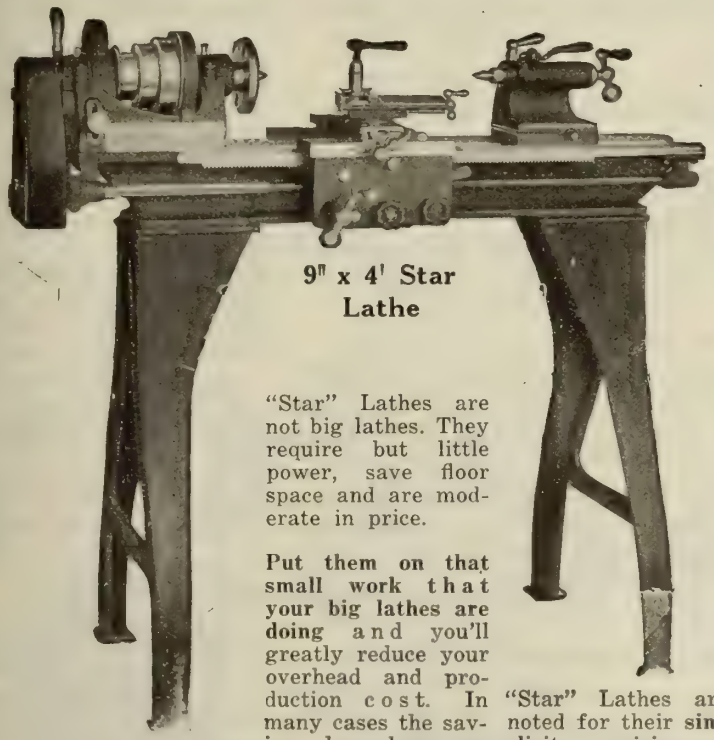
That's why we're publishing these figures. Startling, aren't they? Just multiply the present production of your lathe by 14 and you get an idea of what is possible with the **Smalley-General Thread Miller** on jobs like this.

Speed is one thing, but accuracy and finish are usually important factors. **The Smalley-General Thread Miller** with ordinary labor produces work with a quality and accuracy superior to that turned out by a skilled man on a lathe.

Let us give you a guaranteed production estimate on your work.

Smalley-General Co. Inc., Bay City, Mich.

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9" x 4' Star Lathe

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Suitable for all kinds of fine, accurate work from experimental to tool room and including production work.

"Star" Lathes are not big lathes. They require but little power, save floor space and are moderate in price.

Put them on that small work that your big lathes are doing and you'll greatly reduce your overhead and production cost. In many cases the saving has been as much as 40 per cent.

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William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

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Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

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Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Dangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Sturtevant Co., B. F., Galt, Ont.

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HYDRAULIC MACHINERY
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Dom. Steel Products Co., Ltd., Brantford
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

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Taylor Instrument Co., Rochester, N.Y.

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Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

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Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

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City of St. Johns, Quebec.

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Thomas Moore & Son, Montreal.

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Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

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Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

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Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Globe Engineering Co.
Morris Crane & Hoist Co., Herbert.
Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
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Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
E. C. Atkins & Co., Inc., Indianapolis, Ind.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)
LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)
LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
dendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Codge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
John Bertram & Sons Co, Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Cisco Machine & Tool Co., Cincinnati, O
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

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Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
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Swan & Finch, Inc., New York.

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Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trahern Pump Co., Rockford, Ill.

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Thos. Pink Co., Ltd., Pembroke, Ont.

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Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox Southington, Conn.

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)
MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS
Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
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Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Bogge Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland

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Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

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MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

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See Chemists.

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Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Lyman Tube & Supply Co., Montreal, Que.

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See Saws.

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Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.

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Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
E. C. Atkins & Co., Inc., Indianapolis, Ind.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.

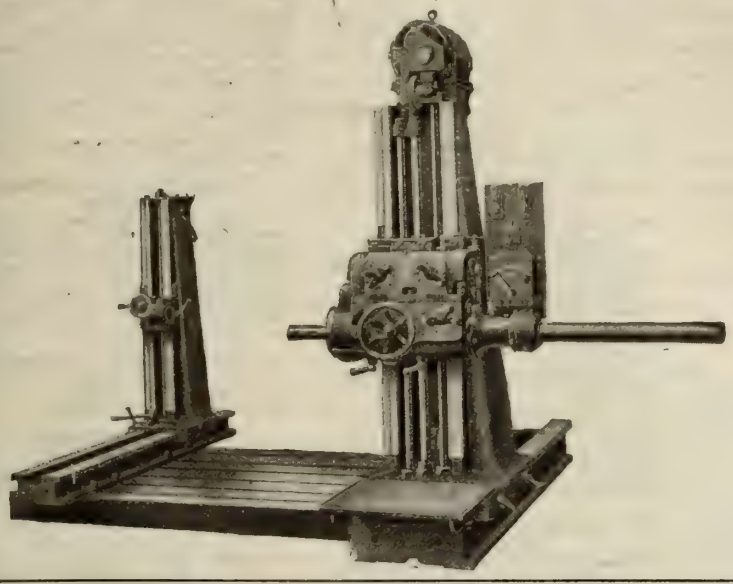
MILLING ATTACHMENTS
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.

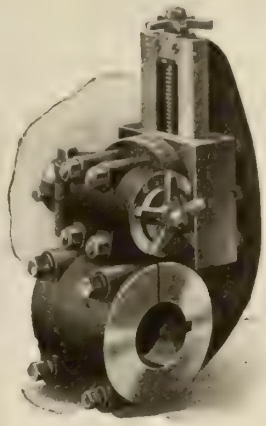
A LANDIS FEATURE

Landis Engineers are always adding that "little bit better" factor to Landis Boring Machines.

For facing surfaces beyond the capacity of standard facing tools, special facing heads are made. They are designed to be clamped to the spindle, but on special order can be supplied with flange for attaching to face plate for special work.

Write for our new bulletin on *Boring* Machines.





20-inch Swiveling Facing Head

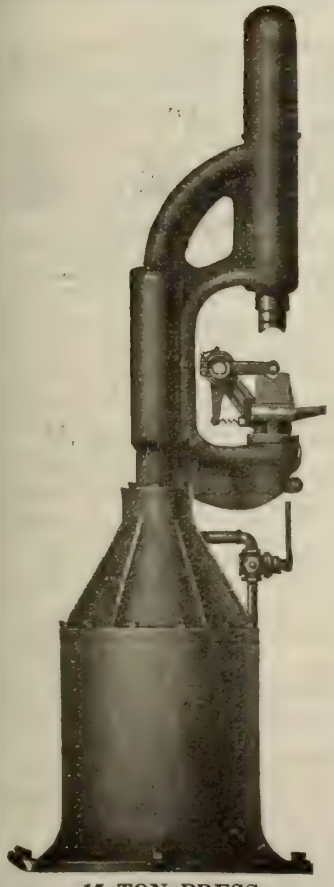
The "Boring Machine With a Powerful Spindle"

LANDIS TOOL CO.

Waynesboro, Pa.

New York Office: 50 Church St.

Canadian Agents:
A. R. Williams Machinery Co.
Toronto Winnipeg and Vancouver
Williams & Wilson, Montreal



15 TON PRESS

A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

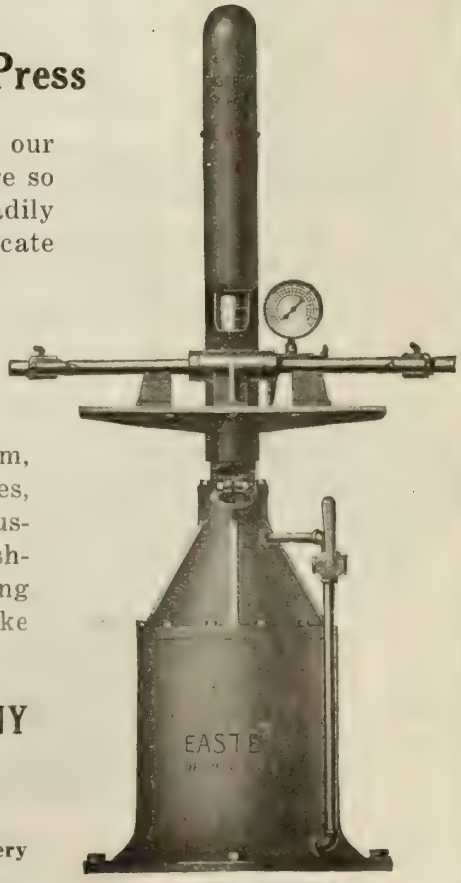
Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

EASTERN PRODUCTION COMPANY

137 LEIB ST., DETROIT, MICH.

Branch: 120 Wisconsin St., Milwaukee, Wis.

Canadian Representative: F. F. Barber Machinery Co., Limited, Foy Building, Toronto



15 TON PRESS

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Becker Milling Machine Co., Boston, Mass
Barber Mchy. Co., Ltd., Toronto, Ont.
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Becker Milling Machine Co, Boston, Mass.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, PROFILE
Brown & Sharpe Mfg. Co., Providence.
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordinance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Gruton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tuffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co. Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
St Lawrence Welding Co, Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford.

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford.

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Budden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS
Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Walcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlass Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CAM, TOGGLE, EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

Milwaukee Milling Machines

Increase Production on a Low Upkeep

BECAUSE of the numerous meritorious features that Milwaukee Milling Machines embody, increased production on a low upkeep is obtained. They accomplish most accurate results and are easily operated, due to the convenient location of all levers and handles.

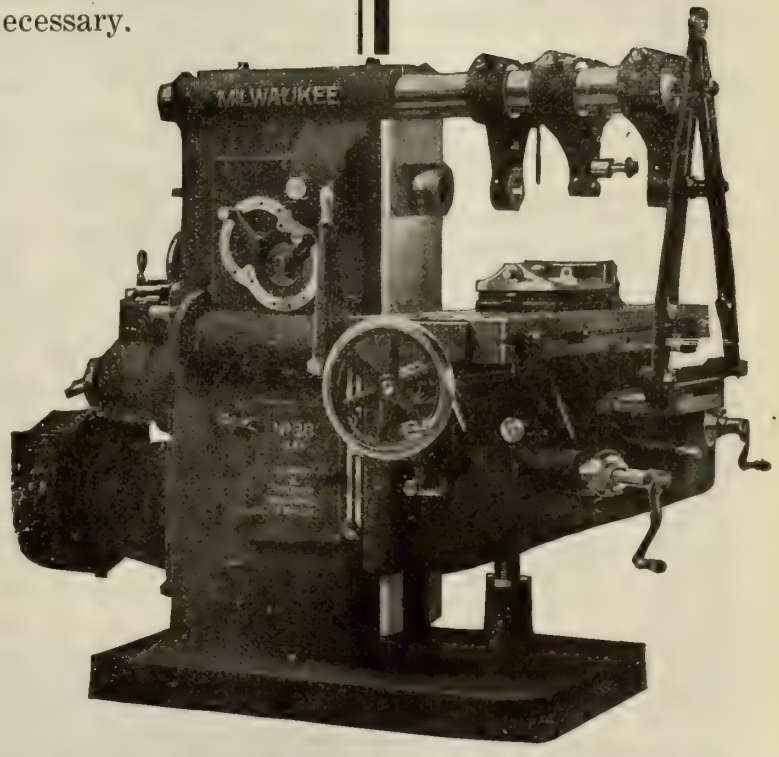
The column is a one-piece, box section casting with few and small openings, reinforced with heavy vertical and horizontal internal walls. The base is made pan-shaped to catch splashing oil and chips.

The double overarm provides for positive alignment of the arbor and prevents it from being pounded out of line when using large, coarse pitch cutters on rough, heavy work. This makes it possible to use cutters at a greater distance from the face of the column.

The spindle has a large flange forged on the end. This flange carries keys for driving large face milling cutters, that are attached directly to the flanged end by means of four bolts, and also for driving the hardened steel arbor drive collar. The arbor drive collar protects the end of the spindle from injury, so that when face milling cutters are attached they run true. The reverse for the spindle is self-contained within the machine, no overhead apparatus is necessary.

All gears and bearings in the column, feed box and pulley bracket are automatically flooded with lubricant that is pumped to the top of the machine and distributed by a perforated pipe. This pump operates whenever the drive pulley rotates.

Every Milwaukee Milling Machine is equipped with a cutter lubricating system which is an integral part of the machine and is not added as a separate item. The cutter lubricating system operates only when the spindle is running.



Complete facts, regarding Milwaukee Milling Machines, will be found in our catalogue. Write for a copy, TO-DAY.

KEARNEY & TRECKER CO., MILWAUKEE, WIS., U.S.A.

If interested tear out this page and place with letters to be answered.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

PRESSES, HYDRAULIC
Bertram & Sons Co., John, Dundas.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
[illegible] Ingersoll-Rand Co., Montreal, Que.
[illegible]ing Bros., Ltd., Montreal, Que.
[illegible]t & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H., Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Moore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 115 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Wells Bros. of Can., Galt, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland.

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Dom. Steel Products Co., Ltd., Brantford

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md
Lawrence Welding Co, Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS, CIRCULAR METAL
E. C. Atkins & Co., Inc., Indianapolis.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
E. C. Atkins & Co., Inc., Indianapolis.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
E. C. Atkins & Co., Inc., Indianapolis.

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SCANDINAVIA BELTING is a general purpose belt for the machine shop, and it will pay you to use it for the following reasons:

It will not come apart, as there are no plies—it is solid woven.

It will give good service in hot places and is not affected by foundry gases.

It works well on belt shifters.

Its tensile strength is so great that it has been found to make the strongest harness trace known.

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172 John St., Toronto

If interested tear out this page and place with letters to be answered.

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Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co. Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co. Worcester, Mass.
Rice Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler Ont
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEETS, NICKEL, RESIST, ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

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Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Niagara Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mche. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

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The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

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Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

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Katie Foundry, Galt, Ont.

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Peck, Stow & Wilcox Co., Southington, Conn.

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Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
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Matthews, Jas. H & Co., Hartford, Conn.

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Oliver Mach. Co., Grand Rapids, Mich.

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STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
Stuntevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng
Marshall, Son & Bunney, Toronto.

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Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Jonsite Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
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Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B. Agent, Montreal.
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Baines & David, Toronto.
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H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
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Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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STEEL, OPEN HEARTH
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Kayser-Ellison & Co., Ltd., Montreal.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

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Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

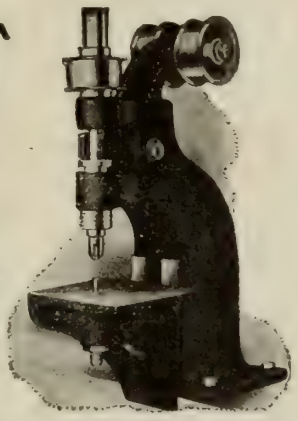
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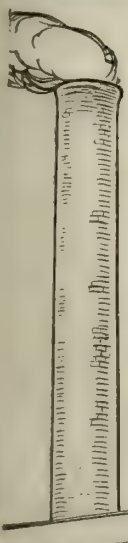
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Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
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Vanadium-Alloys Steel Co., Pittsburgh.

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Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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St. Lawrence Welding Co., Montreal, Que.
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Toronto Iron Works, Ltd., Toronto.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke
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MacKinnon Steel Co., Sherbrooke, Que.
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A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
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L. S. Starrett Co., Athol, Mass.
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Lufkin Rule Co. of Can., Windsor, Ont.

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Ingersoll Mach. Co., Ingersoll, Ont.
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Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield, Mass.
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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
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Wells Bros. of Can., Galt, Ont.

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Greenfield Tap & Die Corp., Greenfield.
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Foss Mchy & Sply. Co. G. F., Montreal.
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Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
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THERMOMETERS, RECORDING AND INDEX
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Taylor Instrument Co., Rochester, N.Y.
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TESTING INSTRUMENTS, METALLURGICAL
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Pratt & Whitney Co., Dundas, Ont.
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Garlock-Walker Machinery Co., Toronto.
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Sturtevant Co., B. F., Galt, Ont.
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Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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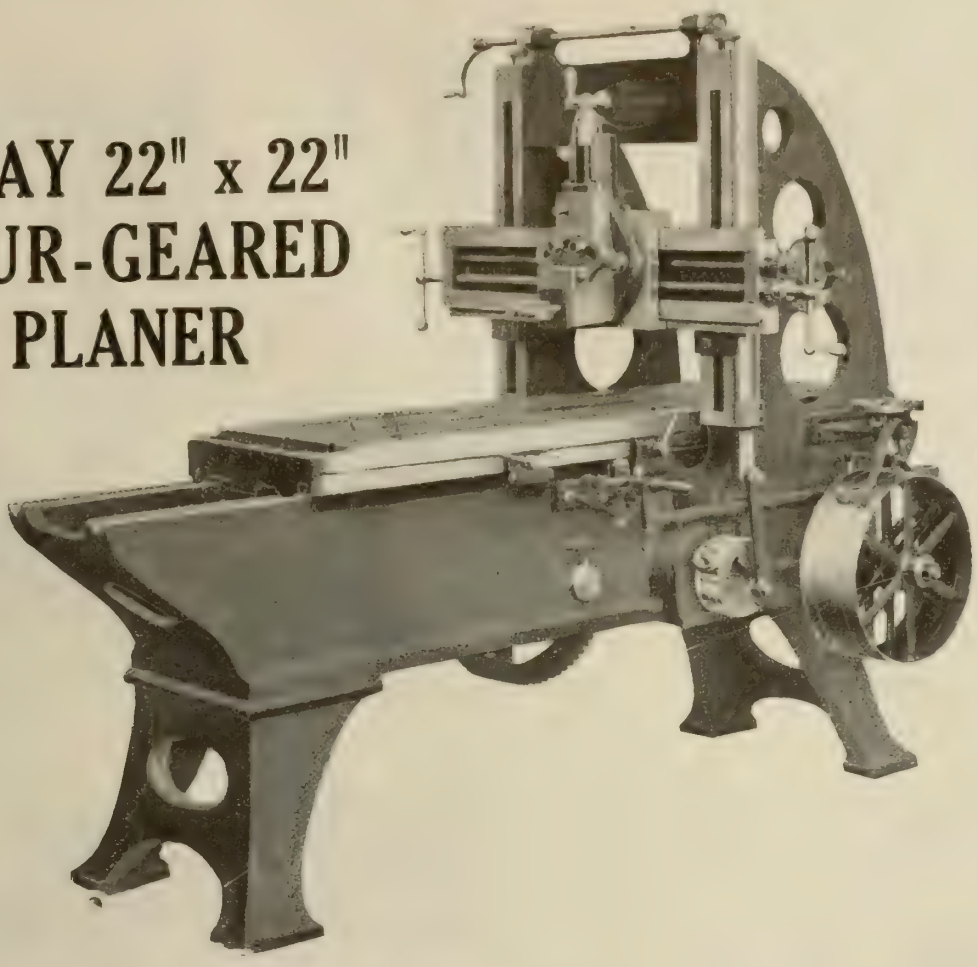
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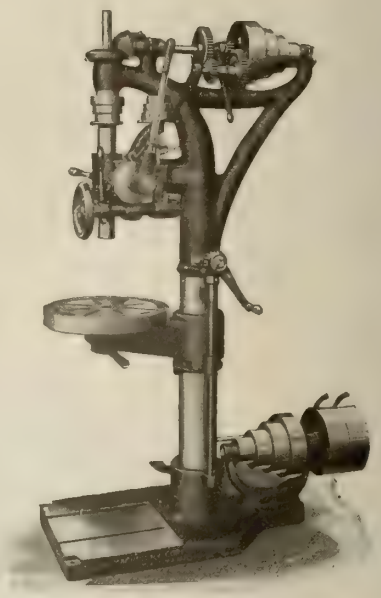
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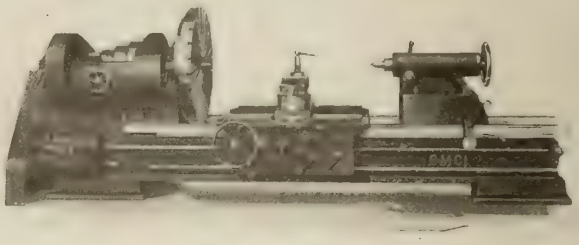
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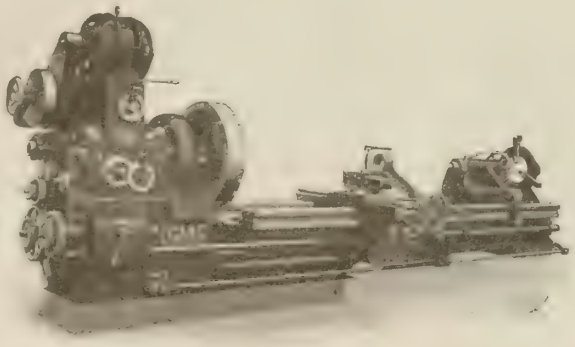


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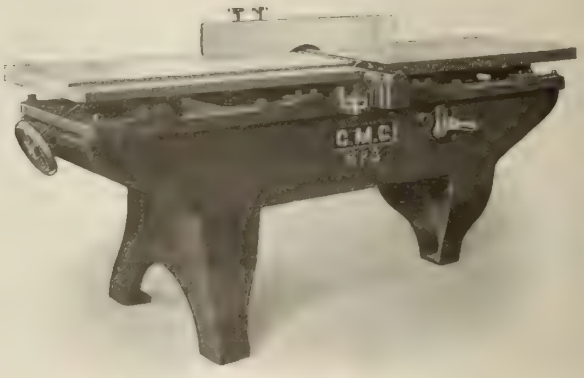
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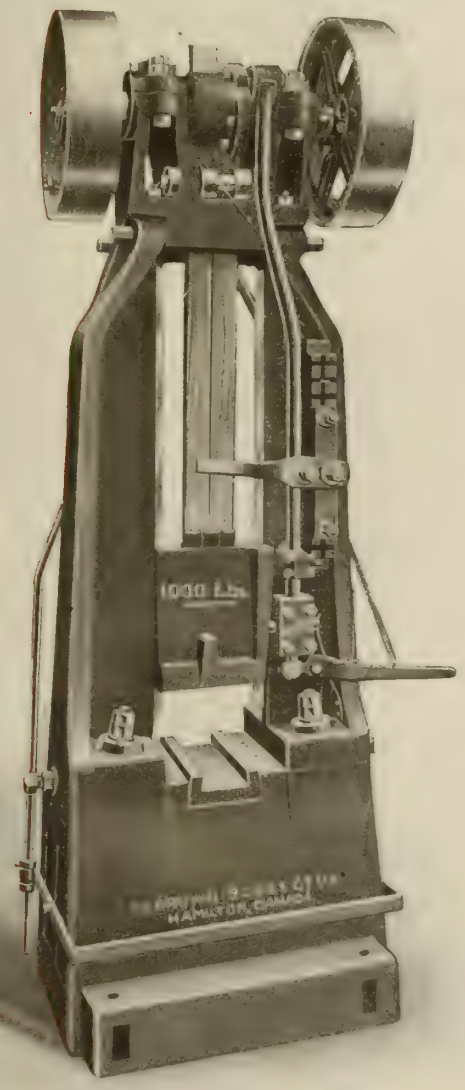
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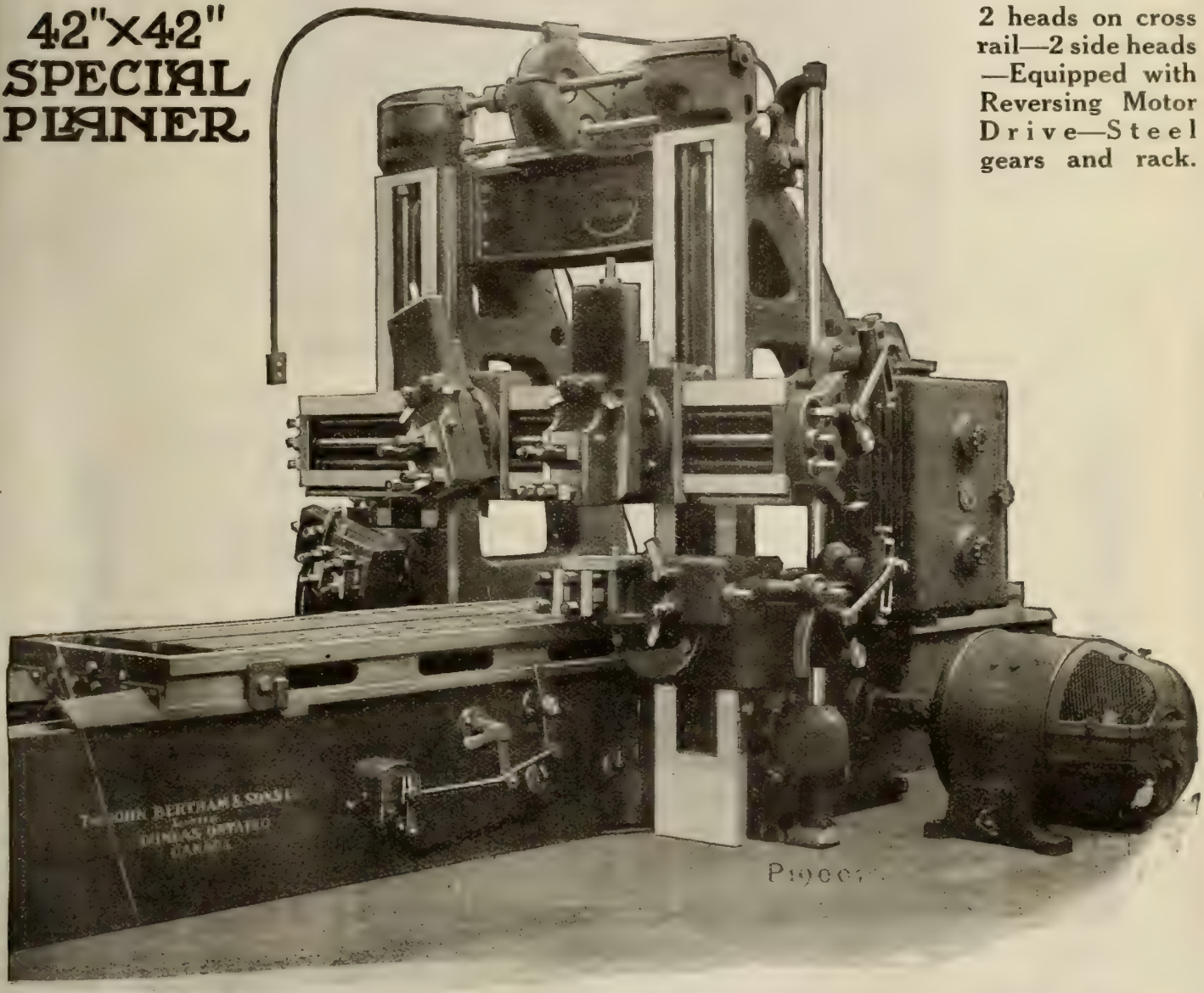
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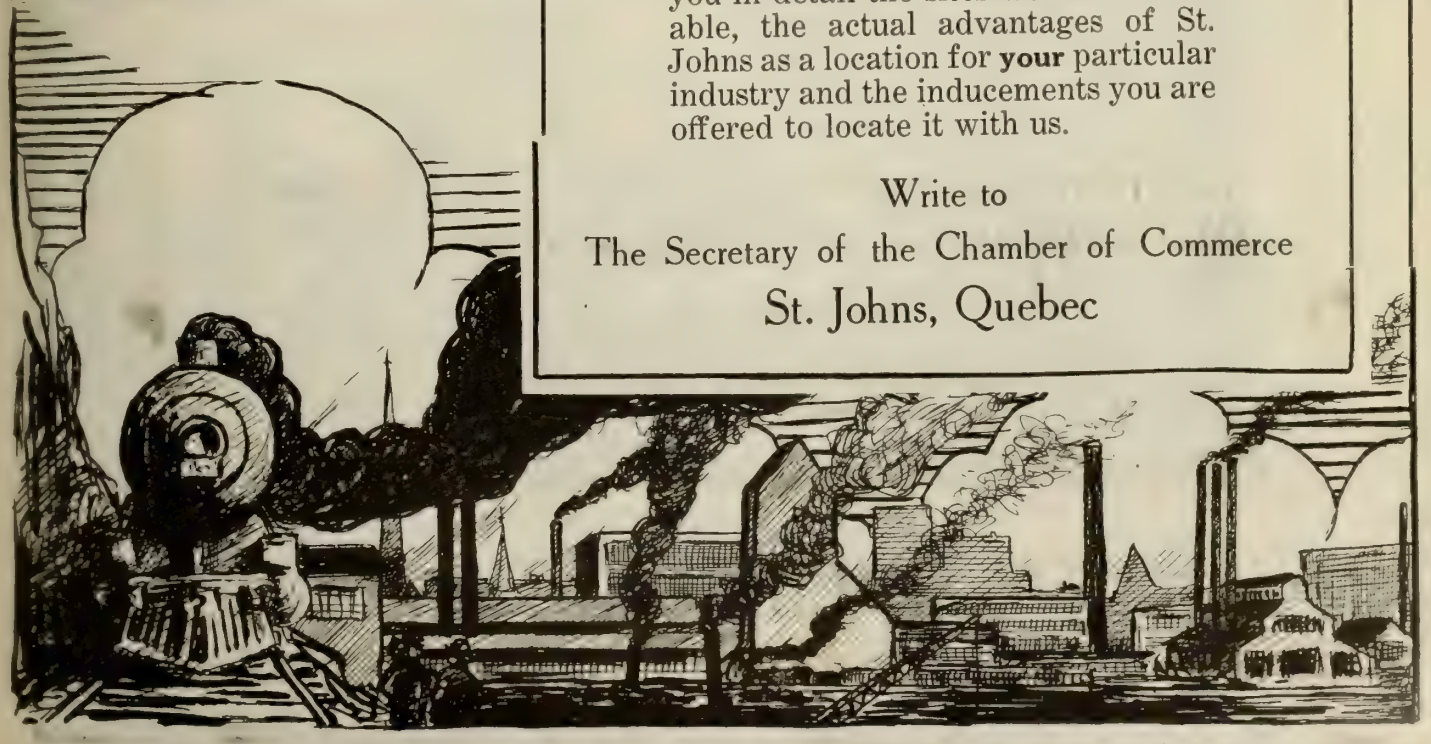
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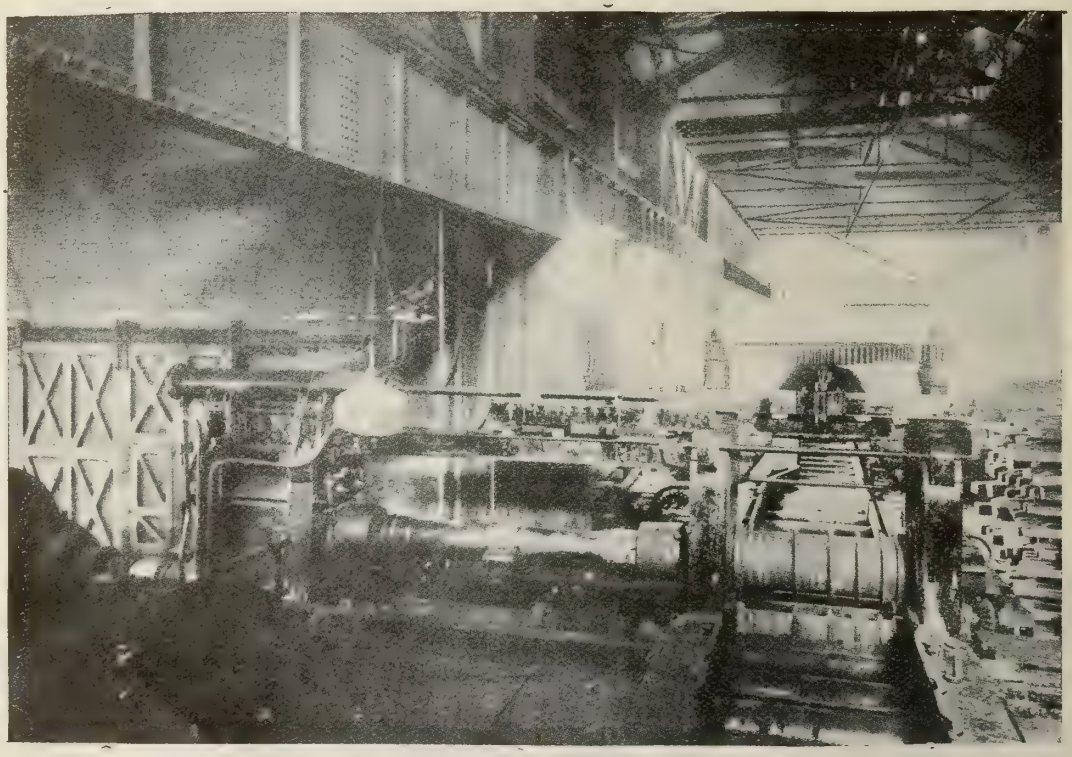
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London Office Wilt Twist Drill Agency,
Moorgate Hall, Finsbury Pavement,
London, E.C. 2, England.



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Building Pumps
With the aid of Air Tools



The part played by pneumatic tools in the manufacture of modern pumping equipment is an important one. From the ramming of molds, grinding and chipping of castings in the foundry to the machining and final assembly of parts they are almost indispensable to economical and rapid production.

Perhaps you do not make pumps, but, if your product is made of metal, it will pay you to investigate the merits of "Little David" Air Tools as a means of speeding up your output and lowering your overhead expenses.

Our nearest branch will be glad to help you with your problems. Ask them for a copy of Bulletin 8000 describing the "Little David" line.

Canadian Ingersoll-Rand Company
Limited

Sydney Sherbrooke Montreal Toronto Cobalt
Winnipeg Nelson Vancouver

Little David AIR TOOLS



The Cleaning of Metal Parts in Process of Manufacture—

The Problem—

In a certain plant, small brass parts were washed with soda ash to remove rubber compound. Soda ash left a sediment, so five girls were employed to scrub the parts with soap to remove the sediment. This operation was slow, tedious, costly.

The Solution—

An Oakite representative was consulted. The use of 30 pounds Oakite weekly to replace 444 pounds soda ash was recommended. Oakite was adopted, The parts now come from the tank absolutely clean. No sediment. No scrubbing.

The Result—

Oakite has saved this plant $83.52 weekly on one cleaning operation.

This Advertisement is one of a series based on actual occurrences.

A lar. e Automobile plant now uses Oakite and saves $67 on each car produced—with an output of several thousand cars a week.

And a small concern making metal parts for computing scales saves $11.25 monthly by using Oakite—one-half former cleaning cost.

Between these extremes there are countless recorded instances where Oakite has saved time, money, labor

May We Serve YOU Too?

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK

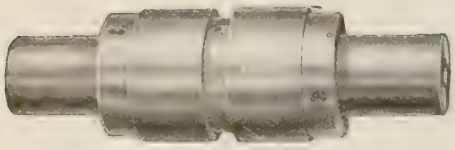
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THE JOHNSON FRICTION CLUTCH

The Clutch for Your Machine Made to Order



Single Clutch—Interior—Clutch Disengaged



Double Clutch

Where space is limited and conditions are exacting, the clutch problem presents difficulties —unless you know about Johnson clutches. We offer you an efficient clutch made in any size or form that your machine requires. When you are designing a new machine, it will be worth while to consult us. Our facilities are at your disposal without any obligation to you.

THE JOHNSON
FRICTION CLUTCH
THE CLUTCH OF A THOUSAND USES

WRITE TO-DAY FOR OUR YELLOW DATA SHEETS

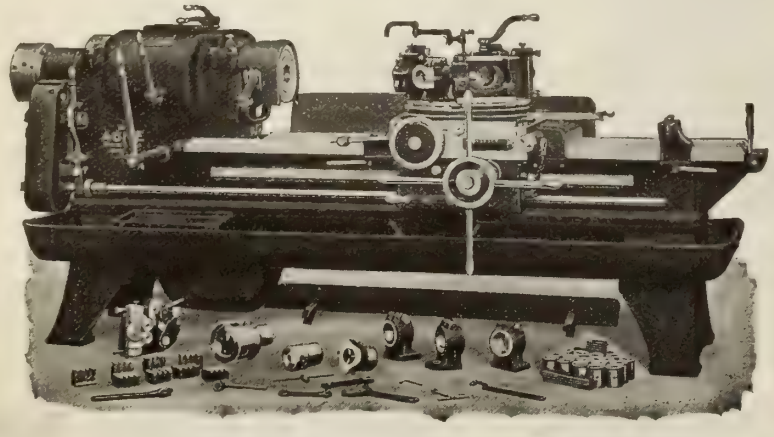
CANADIAN AGENTS:
WILLIAMS & WILSON, LIMITED, 84 Inspector Street, Montreal.
CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Doubly Efficient—Does Both Bar and Chuck Work

This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

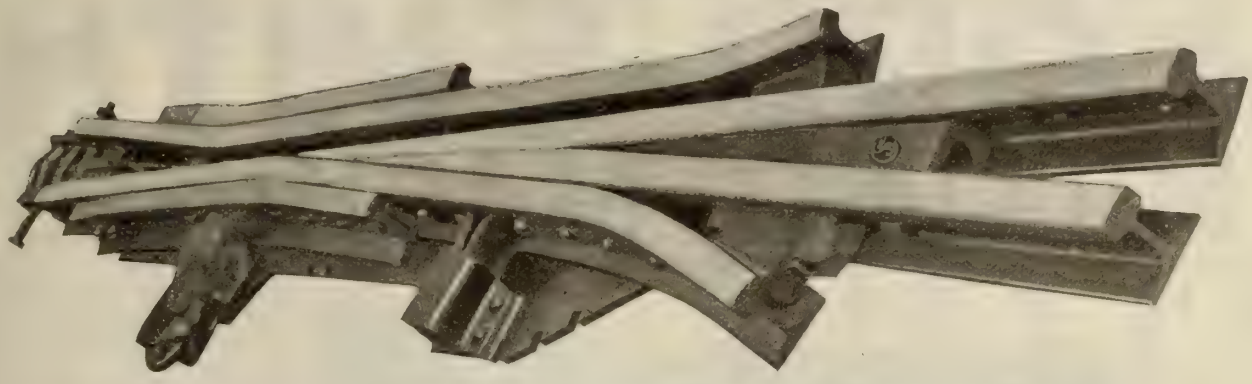
Write for Valuable Bulletin

The Acme Machine Tool Co.
Cincinnati, Ohio

Canadian Agents: Rudel-Belnap Machinery Co., of Montreal and Toronto

TRACKWORK

For Steam and Electric Railways



Built-Up Intersections
Frogs Switches
Hard-Centre Intersections
Mates Diamonds
Manganese-Steel Intersections
Crosses Switchstands

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

PIG IRON

Victoria Foundry and Malleable

Made by

The Canadian Furnace Co.

Port Colborne - Ontario, Canada

M. A. HANNA & CO.

Sales Agents: CLEVELAND

Canadian Office: 904 C.P.R. Building, Toronto

FIRTH'S Speedicut HIGH SPEED Steel

Insures Maximum Production

FIRTH'S CARBON TOOL STEELS

Standard Brands Highest Quality

THOS. FIRTH & SONS, Limited, Sheffield, England

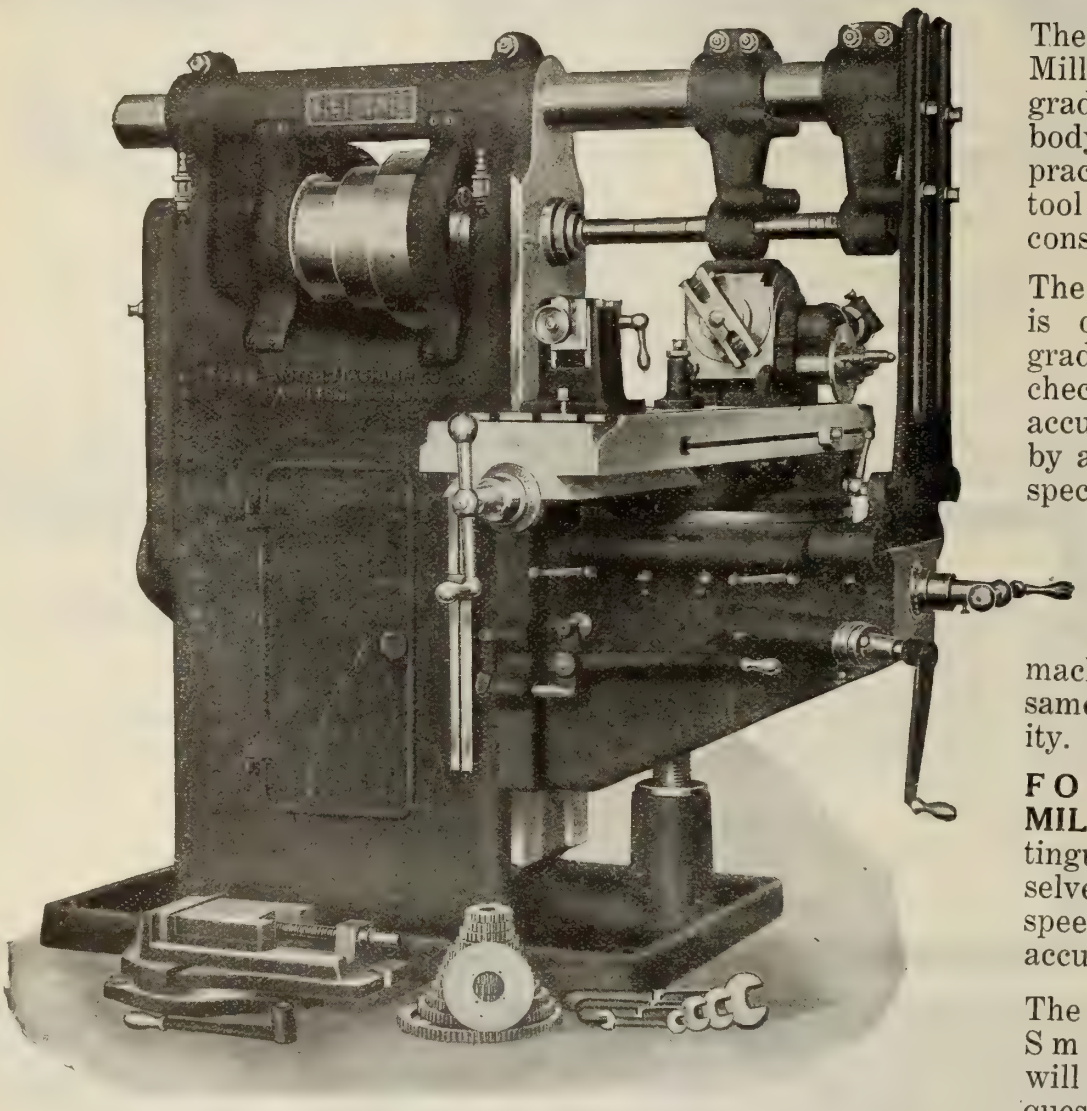
Canadian Warehouses
449 St. Paul St. West, MONTREAL
79 West Adelaide St., TORONTO

JOHN J. COLEMAN
Canadian Manager

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The Ford-Smith Machine Company

FORD-SMITH MILLING MACHINES



No. 3 Full Universal Miller

The Ford-Smith Miller is a high-grade machine embodying the best practice in machine tool design and construction.

The workmanship is of the highest grade and is rigidly checked for both accuracy and finish by an elaborate inspection system.

The Dividing Head and the other attachments for this machine are of the same superior quality.

FORD-SMITH MILLERS have distinguished themselves for power, speed and unfailing accuracy.

The latest Ford-Smith Catalogue will be sent on request.

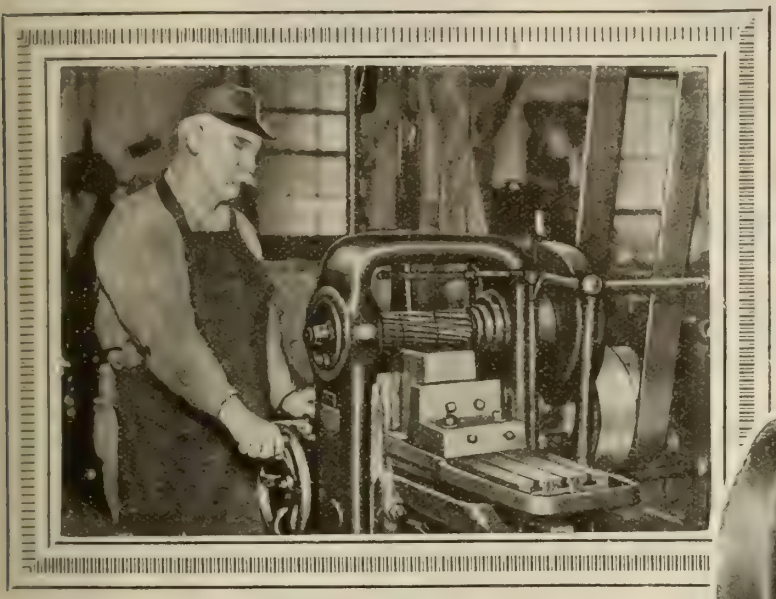
MANUFACTURED BY

The Ford-Smith Machine Co., Limited

HAMILTON, ONTARIO, CANADA

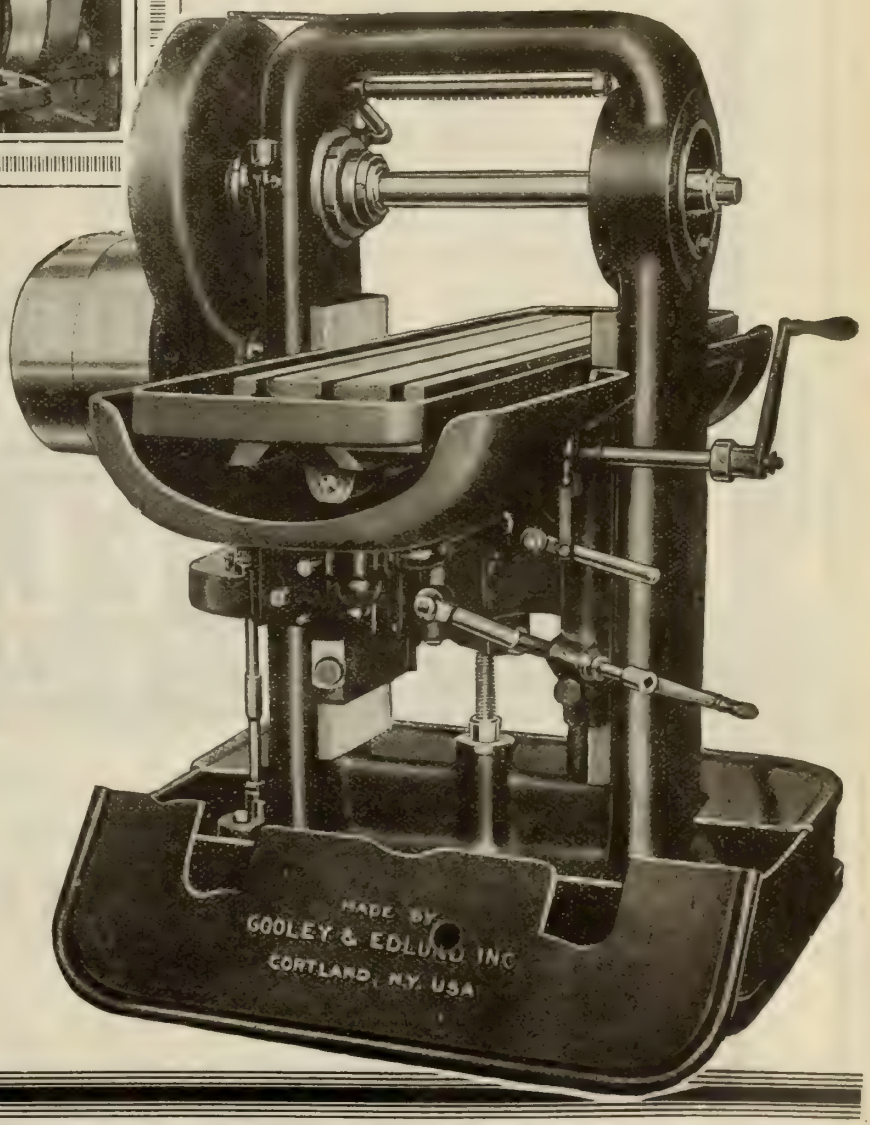
Foreign Agents: W. E. Storey, 3 Arundel St., London, Eng. Gollin & Co., Melbourne, Australia.
Atelier Demoor, Brussels, Belgium.

BRIGGS



MILLER

Keeps Five Die Sinkers Going



HERE you see the Briggs Miller Squaring Die Blocks, and it is working so fast it keeps five die sinkers going.

Some are new, squared from the rough; some are old, annealed, cut down and made over; some are oblong, some square, in sizes up to 9 inches. This Briggs Miller has been squaring blocks for four years; has never given any trouble. When cutters get dull the operator has another gang ready to go on with the work. Unusual rigidity accounts for Briggs' higher efficiency.

Don't you think you could use this tool to advantage in your shop? Write for the details.

Gooley & Edlund, Inc.
Cortland, N.Y., U.S.A.

Garlock Walker Machinery Co., Ltd.
Toronto, Ont.

Williams & Wilson, Ltd., Montreal

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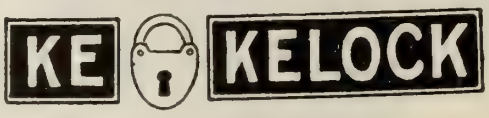
BRITAIN'S BEST

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BRANDS OF ALLOY & TOOL STEELS

In Billets, Bars, Sheets, Hot and Cold Rolled Strips, Cold Drawn Cast Steel, Wire and Drill Rods

HIGH GRADE STEEL FOR ALL PURPOSES



Our Principal Trademarks

KAYSER ELLISON & Co LTD

ESTABLISHED 1825 SHEFFIELD, ENG.

Complete Stock Montreal Warehouse

RALPH B. NORTON

Agent

126 Craig St. West Montreal, Que.

MAGNOLIA ANTIFRICTION METAL

WILL USE NO OTHER

ROSEMARY MANUFACTURING CO.

Roanoke Rapids, N. C.

Magnolia Metal Co. 9-6-18

Gentlemen:—

We have been using your MAGNOLIA BABBITT METAL for the past FOURTEEN years and we think so highly of its quality that we will use no other.

With best wishes for your continued success, we are

Yours truly,

T. W. MULLEN, Supt.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

Office and Factory

Montreal: 225 St. Ambrose St.

LOCOMOTIVE AND CAR WHEEL TYRES

HIGH-SPEED AND CARBON TOOL STEEL

MISCELLANEOUS SHOP TOOLS

MADE IN CANADA

ARMSTRONG WHITWORTH

OF CANADA, LIMITED

Head Office:
298-300 St. James Street, Montreal

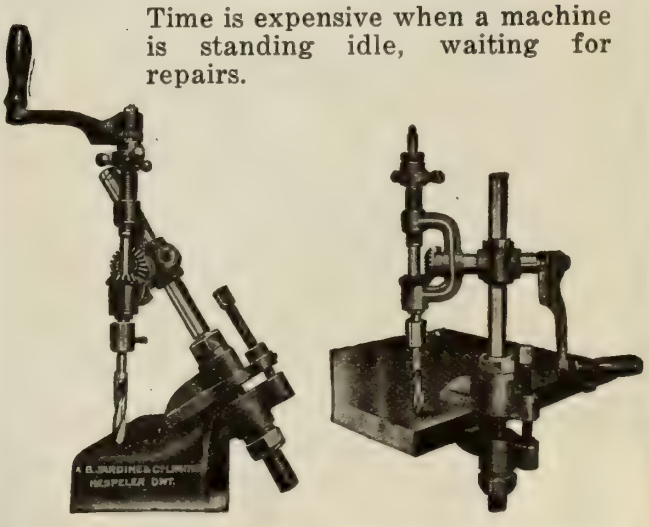
Works:
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Branches:

126 Wellington St. W. TORONTO
27 King William St. HAMILTON
McArthur Building WINNIPEG

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

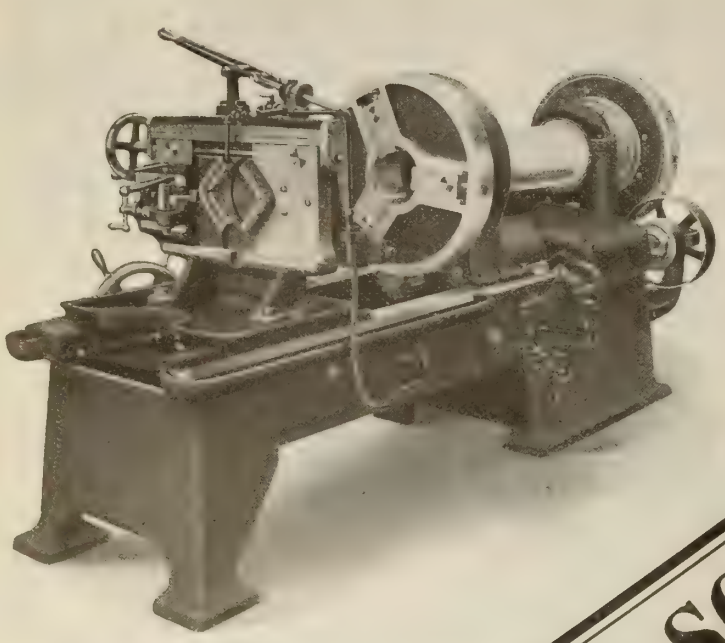
Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

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OUR SPECIALTY
PIPE MACHINERY

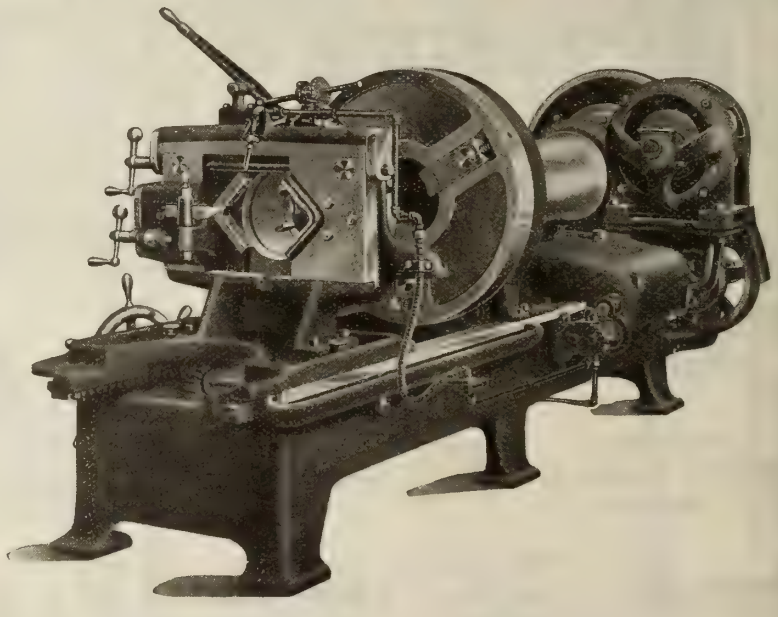
JOHN H. HALL & SONS, LIMITE

BRANTFORD, ONTARIO
MANUFACTURERS OF

Pipe Threading Machinery

No. 6 Belt Drive
Capacity 1 ¼ to 6"
Built to
Last

All
Sizes
Pipe Machines
Nipple Machines
Roller Pipe Cutters



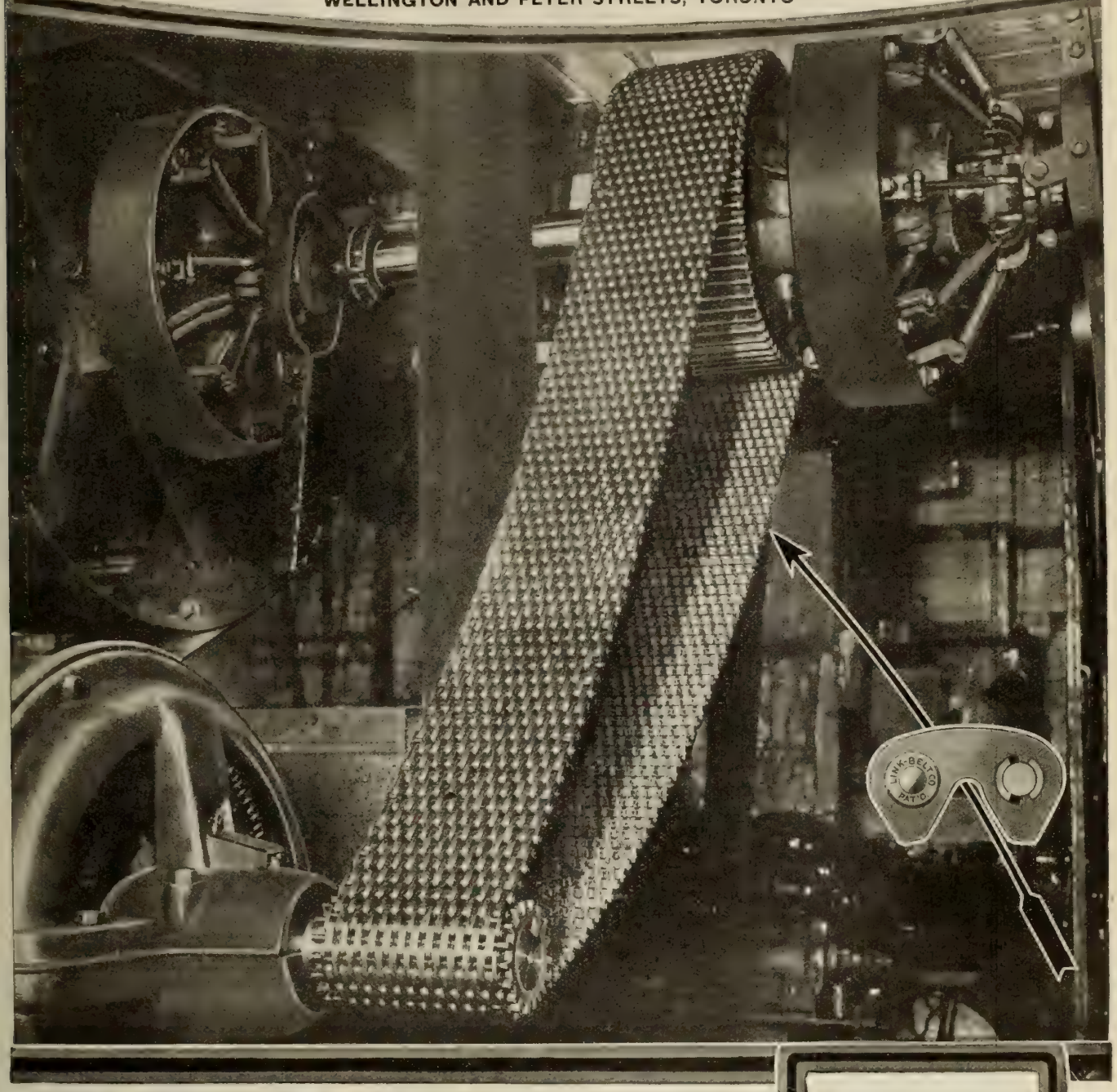
No. 8 Motor Drive
Capacity 2 ½ to 8"

Write for new
Descriptive Bulletins
Just Issued

Efficient Power Transmission

THIS illustration shows a 100 H. P. Link-Belt Silent Chain Drive operating the main lineshaft in the mill of the Medford Woolen Mfg. Co., Medford, Mass. This compact drive makes an ideal Power Transmission arrangement for any mill or factory where reliable operation is necessary. It is "Flexible as a Belt, Positive as a Gear, More Efficient Than Either." The lineshafts are equipped with Link-Belt Disk Friction Clutches. We make a complete line of Power Transmission Equipment. Let our experienced engineers work out your next transmission problem. Write for catalog.

CANADIAN LINK-BELT COMPANY LIMITED
WELLINGTON AND PETER STREETS, TORONTO



LINK-BELT
SILENT CHAIN DRIVES

We Also Make

- ☐ Elevators and Conveyors
- ☐ Link-Belt and Sprockets
- ☐ Truck and Tractor Chains
- ☐ Electric Hoists
- ☐ Portable Loaders
- ☐ Coal and Ashes Systems
- ☐ Coal Pockets
- ☐ Complete Sand and Gravel Plants

Write for Catalogs
Place X in Square

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STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Western Sales Offices:
Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

Prompt Deliveries Assured

MacKINNON STEEL CO., LIMITED
Sherbrooke, Quebec
Montreal Office: 404 New Birks Building

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ELECTRIC
Steel Castings

High Grade STEEL Castings
Of Every Description

Prompt Deliveries

Send us your drawings for estimates.

THE ELECTRIC STEEL AND METALS COMPANY, LIMITED
WELLAND ONTARIO

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



THE

TRADE K–T MARK IE A

FOUNDRY

GALT, ONT.

Do Your Castings Cost Too Much?

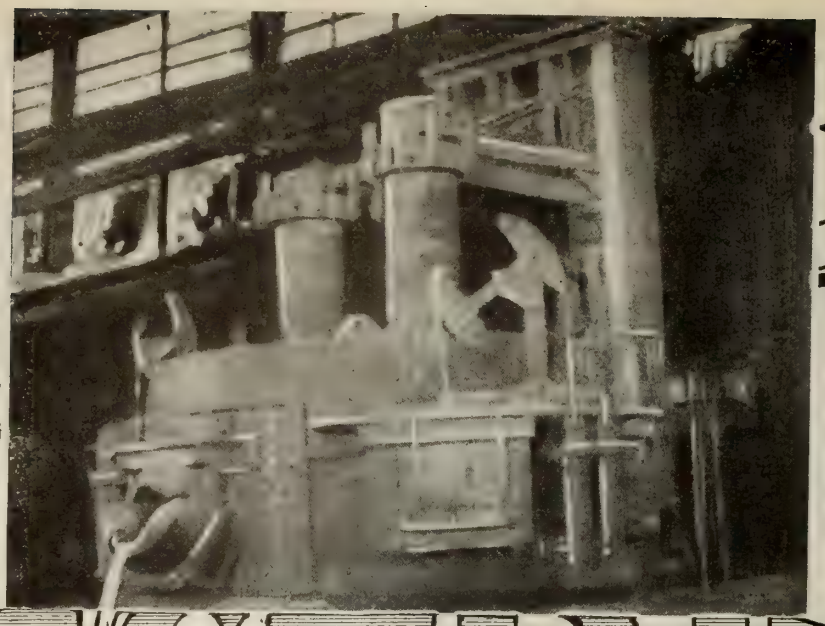
A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

ASK US

If interested tear out this page and place with letters to be answered.



ELECTRITE

High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.

LATROBE, PENN.

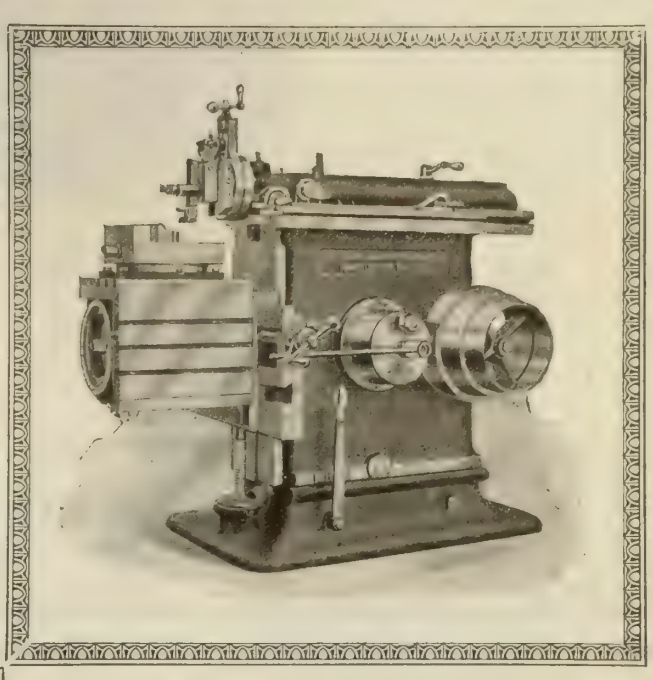
URANIUM

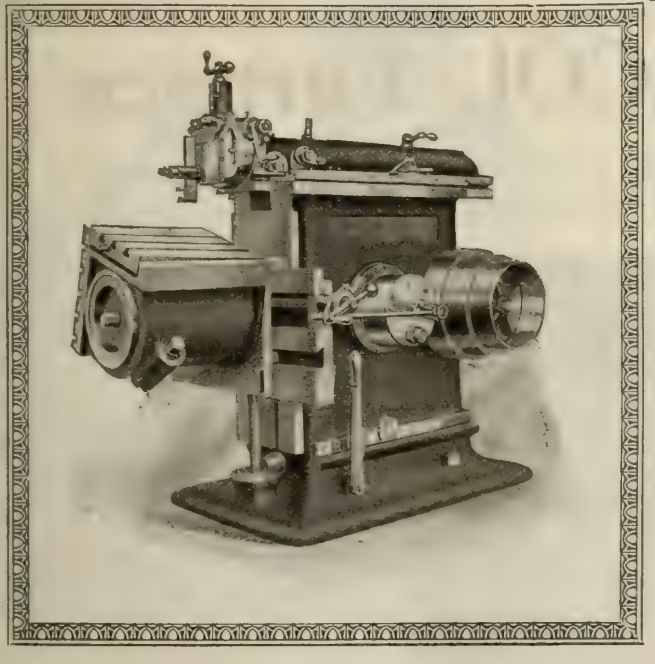
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Universal Shaping Machines

No special vises or fixtures needed, the Universal features of these machines take care of everything, making them particularly adapted to—

Die Work—
Tool Making and
General Manufacturing.





Machines regularly furnished with:

Swivelling Graduated Table.
Auxiliary Tilting Side for Compound Angles.
Power Down Feed on any angle with any variation of feed.
Automatic Feed Stop.
Graduated Collars on Tool Head Feed Screw and Table Feed Screw.
Swivel Vise and Graduated Base.
Table raised and lowered by power on 24-inch size.

Bulletin 38

Canadian Office: POTTER AND JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada
Works and Warehouses: Galt, Canada

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A Plant Equipped in Every Detail to Suit Your Every Need



STEEL PRODUCTS

Open Hearth, Basic and Acid, Electric and Alloy Steels.

CASTINGS

For Ships, Railways, Rolling Mills, Gears, Machinery and Ingots to 35 tons.

RAILWAY SPECIALTIES

Penn Couplers, Bolsters, Truck Side Frames, Draft Gears.

FORGINGS AND BILLETS

Heavy Ship Forgings, Locomotive and Car Axles, Miscellaneous Forgings.

PLATES

Plates and Heavy Sheets to 30 inches wide, Soft and High Carbon, Automobile Plates and Sheets.

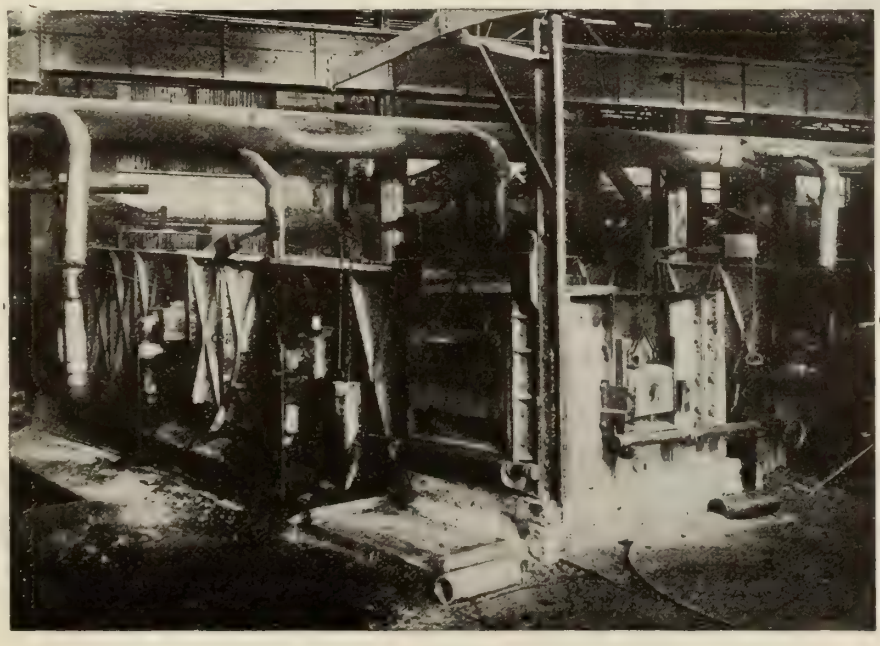
AGRICULTURAL STEEL

Soft Centre and Solid Plow Steel, Harrow Discs, Shovel Steel, Cultivator Blades.

DOMINION FOUNDRIES AND STEEL, LIMITED
HAMILTON, CANADA

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

Mechanical Engineering
Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

"Impossible With Any Other Style of Head Than the Landis"

A. Harvey's Sons Manufacturing Co., Ltd.

ESTABLISHED 1855

STEAM, GAS, PLUMBING GOODS,

PIPE, BOILER TUBES, FITTINGS, TOOLS AND MILL SUPPLIES

PIPE BENT, FORMED AND CUT TO SKETCH

BRASS AND IRON FOUNDERS AND MACHINISTS

DETROIT, MICHIGAN, March 27th, 1917.

Landis Machine Co.,
Waynesboro, Pa.

Gentlemen:-

It might interest you to know that after the installation of the 4" to 8" Landis Pipe Die Head on our 8" machine that this machine was in daily use for a period of ten hours each day and for the first fourteen months of service none of the chasers had to be removed from the head for even so much as sharpening. These chasers were of high speed steel and were used on cutting both steel and wrought iron pipe.

This performance in our opinion would be very difficult to equal and impossible with any other style of head than the Landis.

You are at liberty to use this letter as you see fit, either with or without our name, as it is a pleasure to us to recommend tools that have given us service that the Landis tools have been giving.

Yours very truly,

A. HARVEY'S SONS MANUFACTURING CO.

C. F. Harvey, Vice-Pres.



THIS is Mr. Harvey's experience with the Landis Die. This head was not an experiment with this Company for six Landis Machines and five Landis heads preceded this one, the performance of which, brought forth this letter.

A. Harvey's Sons' work is varied, it requires accuracy and a high production which is insured by the Landis die. The photograph shows one of the latest type 8" Landis Stationary Pipe Die Heads cutting 8" pipe, eight threads to the inch.

Keep the distinctive features of the Landis Die in mind—longer life, higher production, absence of annealing, hobbing and retempering, variable rake angle, permanent throat, etc.

The Landis Die will handle your threading requirements just as effectively as it has others.

Write to-day

Landis Machinery Company, *Inc.*, Waynesboro, Pa.

If interested tear out this page and place with letters to be answered.

"WACO"

THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
WM. ATKINS & CO., LIMITED
SHEFFIELD - - ENGLAND

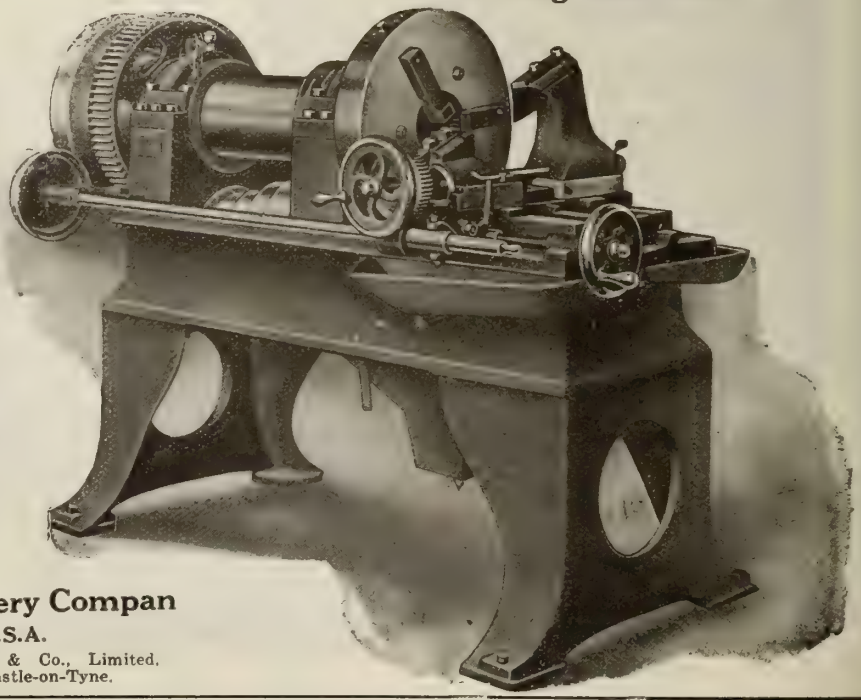
ALL SIZES
IN STOCK

Cut Your Cutting-off Costs in HALF

HURLBUT'S

Patent Cutting-off and Centering Machines

TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.



Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and **do twice the work.**

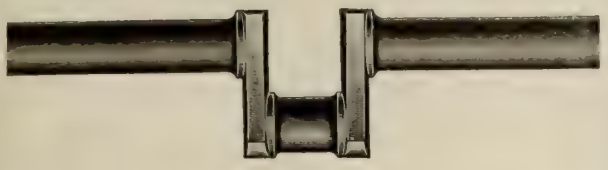
You can't afford to be without this machine. It saves real money. Let us tell you more about it. Write!

The Hurlbut, Rogers Machinery Compan
South Sudbury, Mass., U.S.A.

Foreign Agents—England: Chas. Churchill & Co., Limited, London, Manchester, Glasgow and Newcastle-on-Tyne.

CANADA
FOUNDRIES & FORGINGS
LIMITED

DROP FORGED STEEL



CRANK SHAFT MAKERS

Canadian Billings & Spencer Plant
Welland, Ont.

Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy



Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by
The Canada Metal Company, Limited

TORONTO - CANADA
HAMILTON WINNIPEG
MONTREAL VANCOUVER

You may not buy your machine tools on a beauty basis

But you're pretty certain to be suspicious of a machine which is ugly to the mechanic's eye.

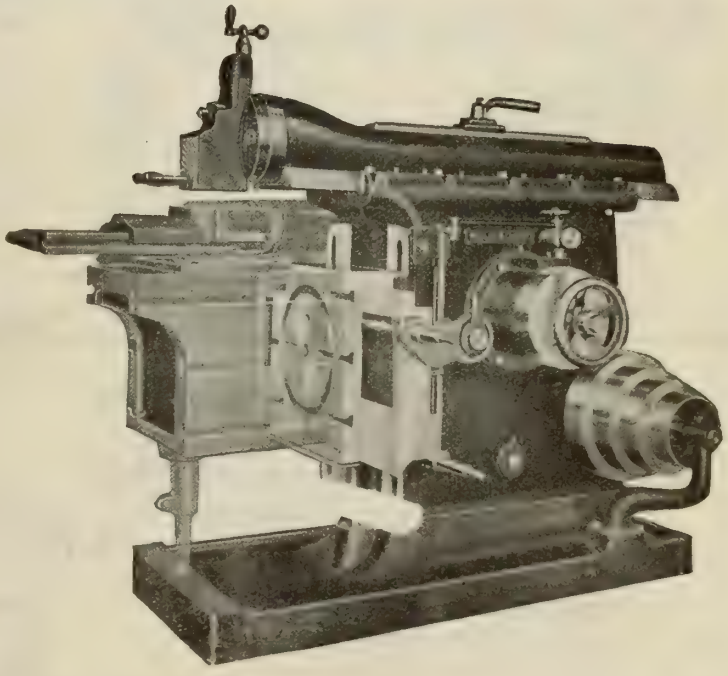
"When a machine is wholly right it is pretty sure to look right."—Professor Sweet.

The trained eye of the mechanic or the engineer rarely fails in its judgment. Heavy parts look awkward; light parts look weak; incorrect proportions look ugly; unnecessary parts look cheap.

"To be good, a design must be consistent."—Professor Sweet.

Designed by specialists in machine tool design, the Milwaukee Shaper is proportioned to be wholly right for its work. The machine is a beauty and we are proud of it. It's an indication of the quality of the design.

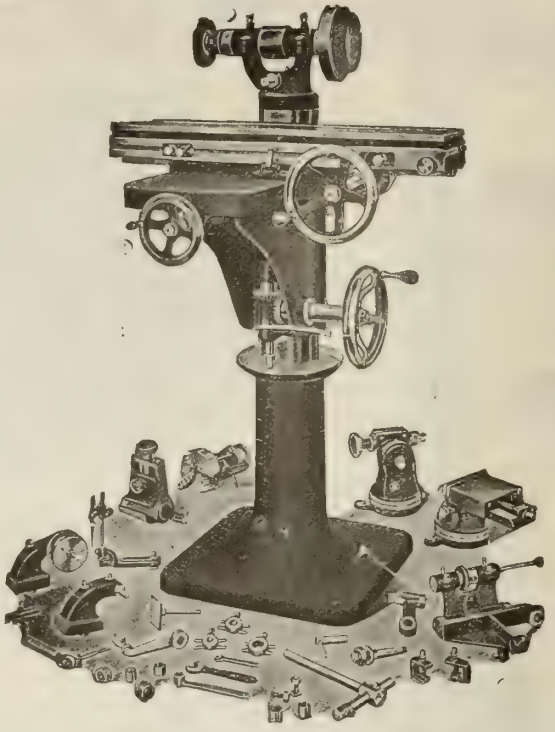
Literature describing this machine in detail, and any other information we can supply, is yours on request.



MILWAUKEE SHAPER CO.
1029 Coldspring Ave. Milwaukee, Wisconsin

If interested tear out this page and place with letters to be answered.

Greenfield



May we send you a complete description?

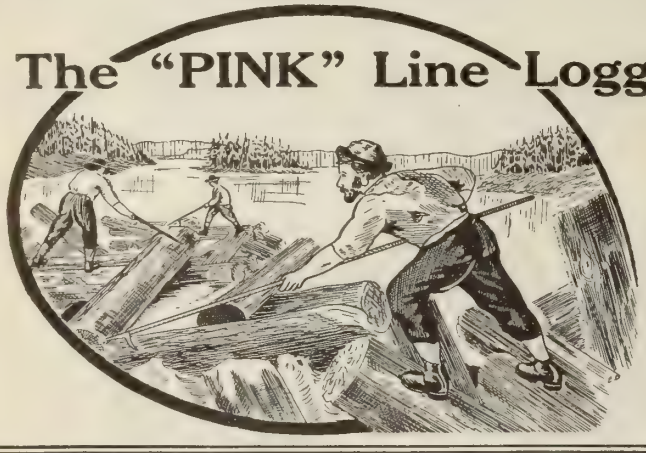
UNIVERSAL AND TOOL GRINDER

The Greenfield is equipped with all attachments for the grinding of milling cutters, reamers, taps, lathe centres, etc., and capable of handling all this work with the accuracy and convenience essential in the modern tool room.

The Greenfield is a simple necessity in the tool room for routine grinding work, but has a versatility outside this line that is astonishing. It is truly universal and handles all varieties of cylindrical, internal and surface grinding within its capacity with a consistent accuracy and finish that adapts it to the making of intricate jigs and goges.

Greenfield Machine Co.
GREENFIELD, MASS., U.S.A.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
PEMBROKE, ONT., CANADA

ELECTRIC STEEL AND IRON CASTINGS

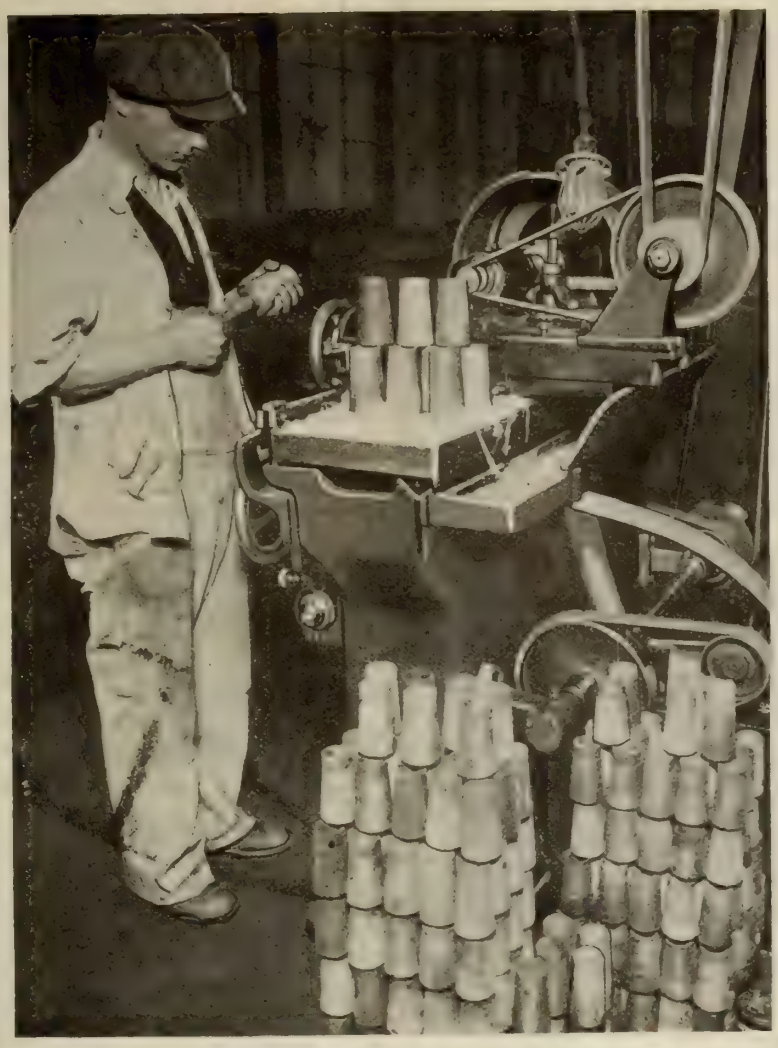
ALLOY STEEL GRAY IRON

High grade steel castings of every description. Send us your drawings for estimates.

Our motto is quality and quick service.

Canada Electric Castings Co., Limited, Orillia, Ontario

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



Grinding Extremely Accurate Parts

Commercially on the

HEALD

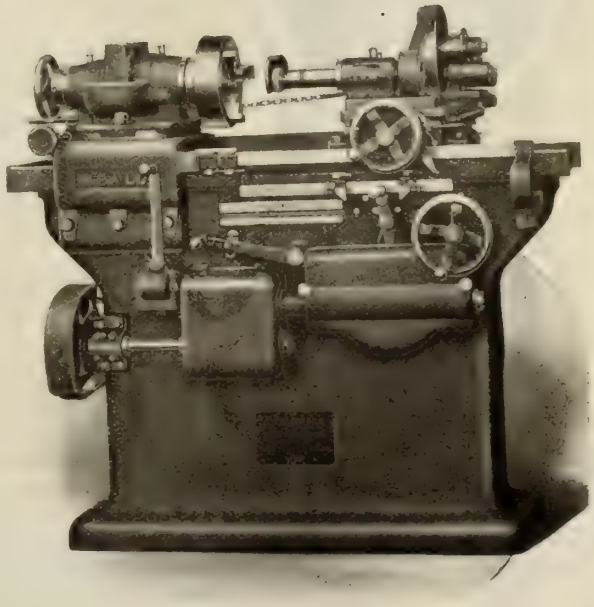
INTERNAL GRINDER

GRIND WITH A HEALD *AND BE SURE*

HIGH-GRADE machine tool builders require high class tools. That is why one finds the Heald on a job where limits of accuracy are practically negligible. The job above shows a Heald Internal grinding a hardened spindle sleeve 1.562 in diameter by 4" long to a limit of .000 and .001 at the plant of the Hendey Machine Co., Torrington, Conn.

For over three years this machine has been used on work of this character with perfect satisfaction and reliability.

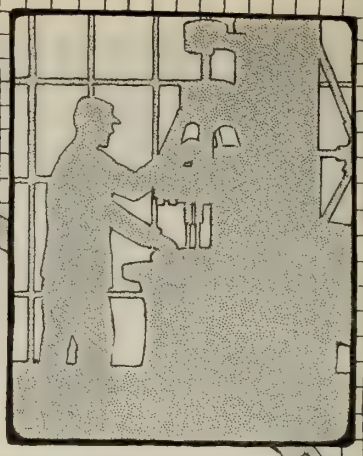
THE HEALD MACHINE CO.
WORCESTER, MASS.



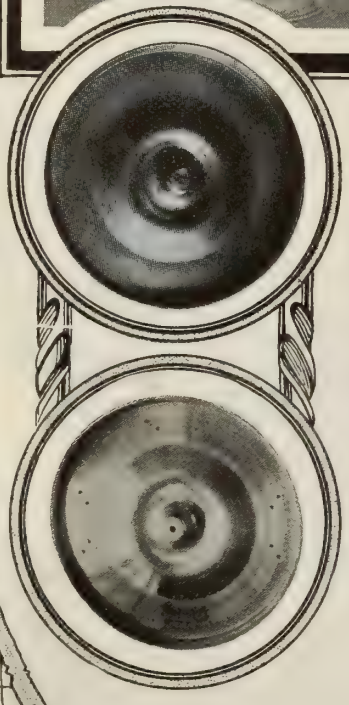
HEALD STYLE No. 75 INTERNAL GRINDER

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Two Years at the Stary Piano Company —and no Trouble



AFTER two years' service these people express themselves as being entirely satisfied with the NATCO.

This baby NATCO is drilling four holes in aluminum balloon valve pans, depth of holes 3/32, number of pieces per day, 120.

If you drill, ream, tap, counterbore, or spotface more than one hole in a piece, you need a NATCO.

NATCOS are built in eleven sizes, ranging from 2 to 72 spindles.

We also design and build jigs and fixtures for use in connection with NATCO Multi-Drillers

The National Automatic Tool Co.
Richmond, Indiana, U.S.A.

LIST OF NATCO FOREIGN AGENTS:
Burton, Griffiths & Co., British Isles; E. Isbecque Co., Belgium; Aux Forges De Vulcain, France; Allied Machinery Company of America, Italy, Spain, Portugal and Switzerland; Chr. A. Herstad, Norway, Sweden and Denmark.

MULTI-DRILLERS NATCO MULTI-TAPPERS

The "Hole" Story in One Word

Don't Try to Cut too Fast

Hack Saws, like men, can work only about so fast and be efficient.



Trying to cut the cost per cut by simply running the saw faster almost invariably results in just the opposite. Excess speed with a hack saw heats the blade and draws the temper. The likelihood of the teeth dragging on the return stroke is increased and if the teeth strike a soft spot in the work, and "dig in," they're almost sure to strip.

To cut down the cost of your hack saw work, select a good make of saw — most machinists prefer Starrett blades. Be sure that you are using the right blade for the particular work you have to do. Regulate your weight properly, flood the work with lubricant, and most of your troubles will vanish.

The Starrett Hack Saw Chart saves a lot of time and trouble wherever it's used. If you haven't a copy, your dealer will supply you or a copy will be mailed on request.

Ask for Catalog No. 21 "3" also.

THE L. S. STARRETT CO.

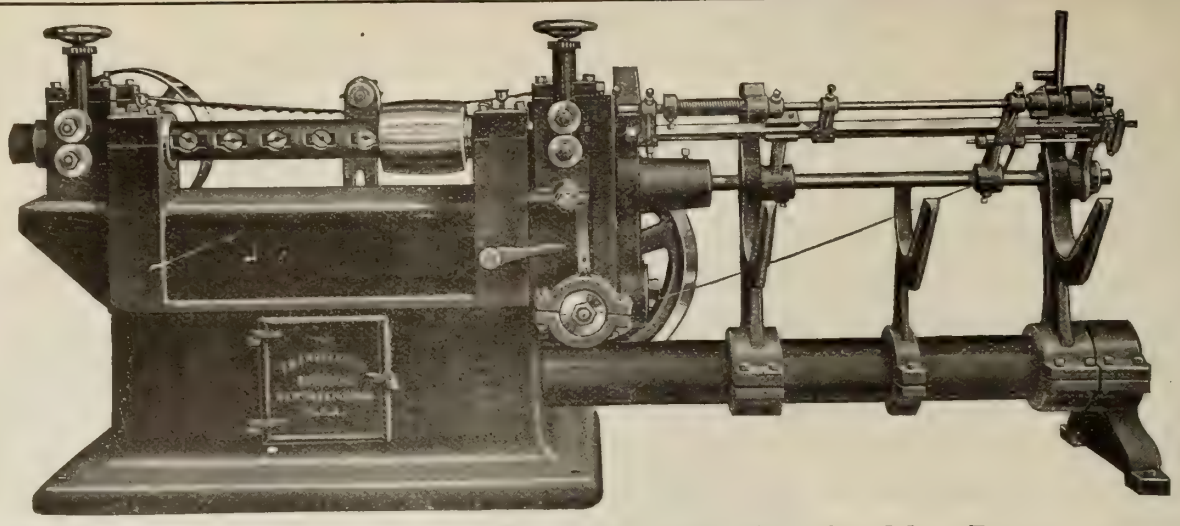
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

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Starrett Hack Saws



Perfect Wire Straightening Quickly and Profitably Done on Our

Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

THE F. B. SHUSTER CO., New Haven, Conn.

FORMERLY JOHN ADT & SON ESTABLISHED 1886

ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

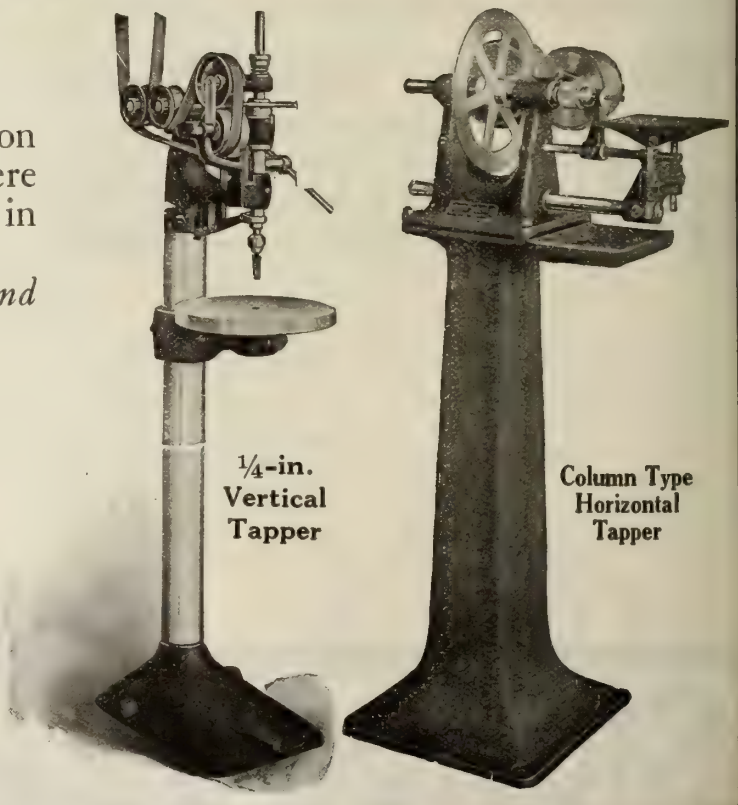
RICKERT - SHAFER TAPPERS

Save Tap Breakage

The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on ⅝-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.



¼-in. Vertical Tapper

Column Type Horizontal Tapper

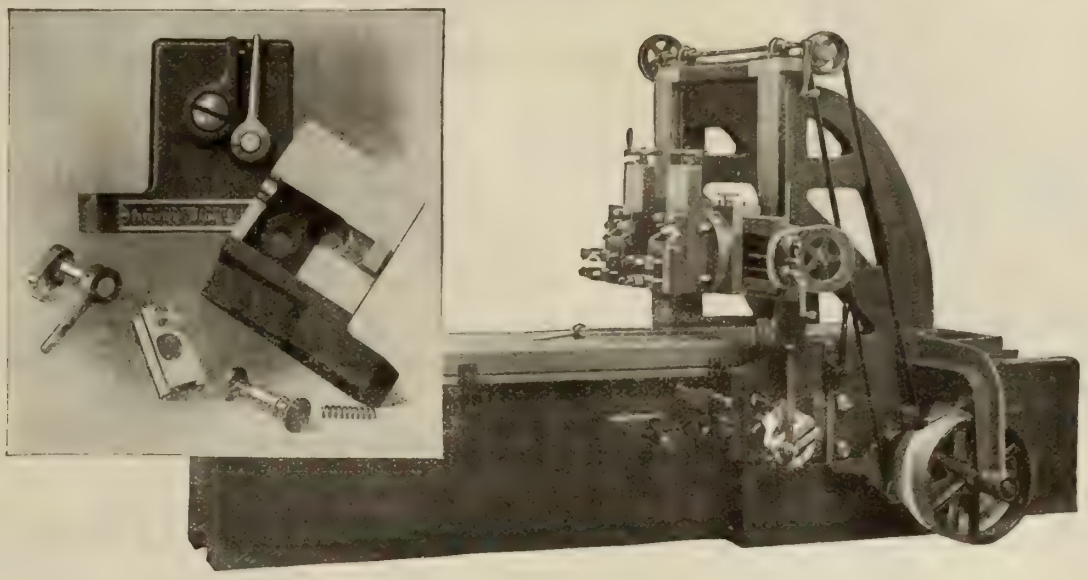
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The Rickert-Shafer Co.

ERIE, PA., U.S.A.

FRED HERBERT, Foreign Agent, Coventry, England

Distinctive Features that Build Speed Into Whitcomb-Blaisdell Planers



The Patented Self-Locking Shipper Dogs

Provide Quick and Easy, Yet Safe Adjustment of Table Travel

Finger pressure upon the small lever releases the shipper dog for shifting. When slid into the desired position, the releasing of the lever locks it instantly and automatically.

No wrenches are required for adjusting these shipper dogs. No time is wasted; only a moment is required for positioning the table travel just as required by the work.

The danger of the operator being caught between the table and the housing of planer, while changing the stroke, is entirely eliminated.

This is typical of the many provisions for rapid adjustments on the Whitcomb-Blaisdell Planer.

It is not alone the extremely high cutting speeds, permitted by the Patented Second-belt Drive, which makes the Whitcomb-Blaisdell Planer so productive. Hardly less important a factor is the completeness of its provisions for speed in adjusting and operating.

Write for our latest Catalog, which tells in detail all the reasons for Whitcomb-Blaisdell Planer Speed.

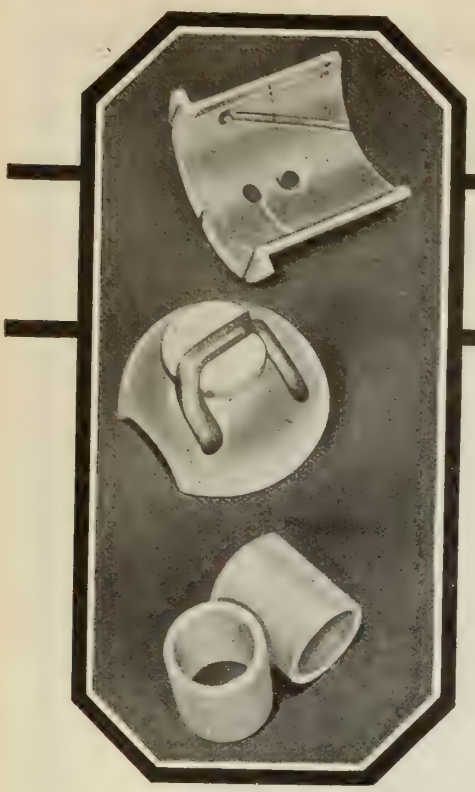
LATHES From 14" to 30" SWING

WHITCOMB-BLAISDELL MACHINE TOOL CO.
WORCESTER, MASS., U.S.A.

PLANERS From 17" to 48" WIDE

For Sale by A. R. Williams Machinery Co., Toronto, Ont.

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DIE-CASTINGS

They Solve Cost and Production Problems

The demand for increased production is due to the need for lower costs. Franklin Die-Castings can help meet both these requirements.

Canadian manufacturers can substitute Franklin Die-Castings for many parts they now machine, and turn their labor and equipment to more urgent needs. At the same time they will lower their production costs. Franklin Die-Castings are cheaper than machined parts because they are accurately and uniformly finished in one operation—thereby saving both the time and material lost in machining.

Twenty-eight years ago Franklin engineers originated the die-casting industry. Through their advice on the use of die-castings, much machinery has been cheapened, simplified, or made commercially possible.

We cast in Aluminum, Tin, Lead, and Zinc base alloys, and make estimates from samples, drawings, or blue-prints. Send for booklet.

FRANKLIN DIE-CASTING CORPORATION

GIFFORD AND MAGNOLIA STREETS, SYRACUSE, N.Y.

Speed Up Your Metal Cutting



Drive your sawing machines to the limit. They'll stand it if you fit them with

Hunter "Duplex" Blades

The design of this inserted tooth saw gives the greatest possible number of teeth, with the result that material can be cut with greater speed, as the rigid construction withstands heavier feeds.

For fast cutting and long life specify Hunter "Duplex."

Hot Saws, Friction Discs, Solid Blades made from Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines, Inserted Tooth Grinders. Hardened Steel Specialties, etc. Write for prices.

Hunter Saw & Machine Co., Pittsburgh, Pa.

THE MASTER METAL ▣ THE MASTER METAL

STELLITE

Not a steel—but its master

Here's the point—

Stellite is a cutting tool that is immune to heat. Stellite cuts coninuously at temperatures up to 1800 deg. F. Stellite operates just as well or better when it is red hot.

Stellite will not burn or crumble under high speeds or heavy cuts. Stellite production is limited only by the capacity of the modern lathe. Stellite tools permit speeds never before known in lathe tool history. The introduction of Stellite into a shop means a soaring leap in quantity and quality of work — accompanied by a tremendous increase in economy.

Stellite is the vital factor in modern shop methods. You should know all about it. We will send a demonstrator on request.

DELORO
Smelting & Refining
Company Limited

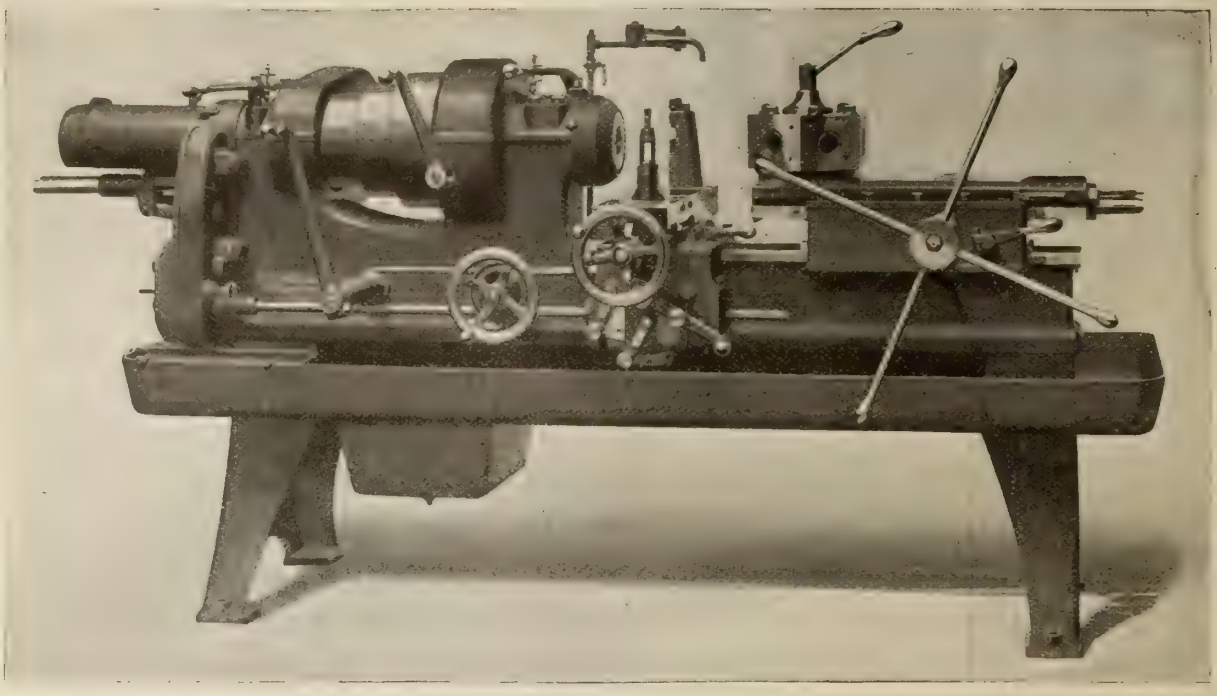
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THE MASTER METAL ▣ THE MASTER METAL

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New W & S Turret Lathe
is more powerful yet easier to operate



THIS NEW No. 6 TURRET LATHE is welcomed by manufacturers who finish gear blanks, forgings and tough alloy steel parts. As powerful as the large and more expensive machines used on this work, the No. 6 increases production and is easier to operate.

Capacity:
2¼" thru automatic chuck
9¼" swing over carriage
20⅜" swing over bed

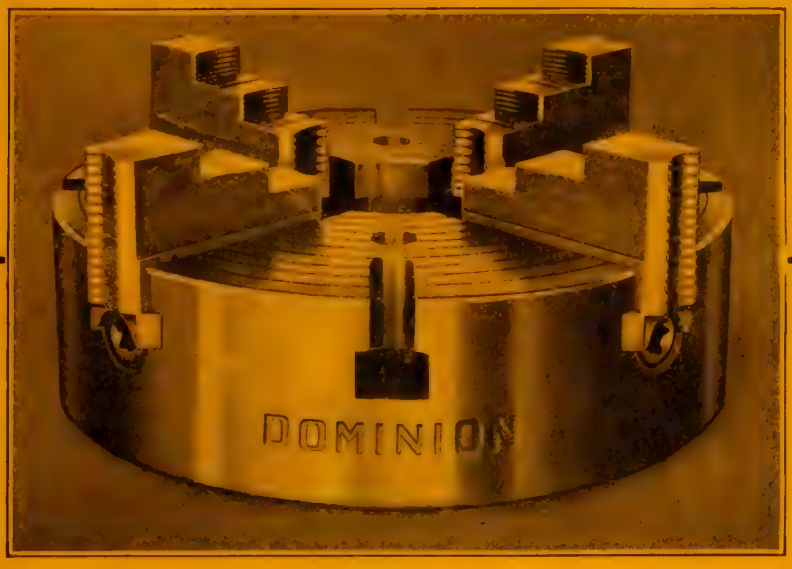
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Detroit Office: Ford Building
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Boston Office: Oliver Building
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Canadian Agents: Williams & Wilson, Ltd., Montreal
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DOMINION CHUCKS



Especially Adapted for Severe and Heavy Duty Work

BODY—The body is of heavy cross section and so designed to give broad and deep bearings for the jaws.

JAWS—The jaws are drop forgings, heat treated. The jaw is so designed that the threaded portion makes 180° contact with the screw.

SCREWS—The screws are large in diameter, broached at both ends and are reversible.

Dominion Chucks can be furnished in crucible steel or cast iron bodies.

Designers and Manufacturers of

Rubber Manufacturing Machinery.
Rolling Mill Equipment.
Marine Line and Propeller Shafting, Stern Tubes, etc.
Cut Gears—Worm, Spur, Helical and Bevel.
Heat Treated Tool Steel Gears and Pinions.
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Dominion Steel Products Co., Limited

Engineers and Manufacturers

Brantford, Ontario

Cable Address: "DOMINION, BRANTFORD" :: *Codes Used:* A.B.C., 5th Edition

1

FOUNDRYMEN——

Sift Sand by Electric Power and cut down your pay roll



THE "PRESTON" Ball Bearing Electric SAND RIDDLE

WILL save in wages $1.00 every hour the sifter runs—at the most conservative estimate.

WILL riddle sand as fast as a man can shovel it in and costs only one cent per hour for current used.

"If you need it you pay for it whether you buy it or not"

OUR OFFER:
Sand Riddle sold subject to 10 days' trial; and acceptance of same left entirely to the judgment of the purchaser.

Buy Made in Canada Goods and Make Sure that your good Canadian Dollar Buys 100 Cents worth.

PRESTON WOODWORKING MACHINERY CO., LIMITED, PRESTON, ONT.

The LYMAN LINE

of Industrial Equipment includes

"Cyclone" High Speed Chain Hoists



"Cyclone" Hoists get their leverage and power without the use of any small gears or pinions—by a method quite different from that used in any other chain hoist. "Cyclone" construction lessens friction, vibration and wear, increases strength and produces a smoother, easier running hoist that will outlast any other.

The trim compactness of this 40-ton model is typical of the whole range of sizes, from ½ ton up.

The inside of the "Cyclone" High Speed Chain Hoist is one of the most ingenious and effective pieces of mechanism in general use. If you are not familiar with it one of our representatives will be glad to show a complete model, or we'll send you our new catalogue describing the construction.

Made by

Chisholm-Moore Manufacturing Co.

Cleveland, Ohio

Latrobe High Speed Drills and Bridge Reamers

Made from selected "Red Cut Superior" High Speed Steel. Forged to approximate shape and accurately milled to finished dimensions. We carry a good

Stock in Montreal

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Thrust and Journal Ball Bearings

To meet the increasing call for ball bearings in machinery of all kinds, we carry a wide range of both thrust and journal ball bearings for light, medium or heavy work, in varying degrees of accuracy and cost according to the service required.

Let us quote you for immediate

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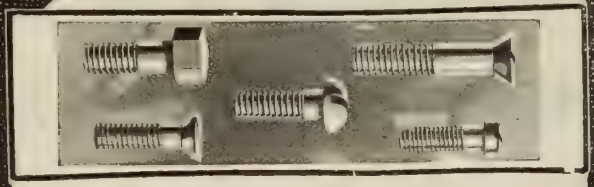
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Wood Screw Making Machinery

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Series B6



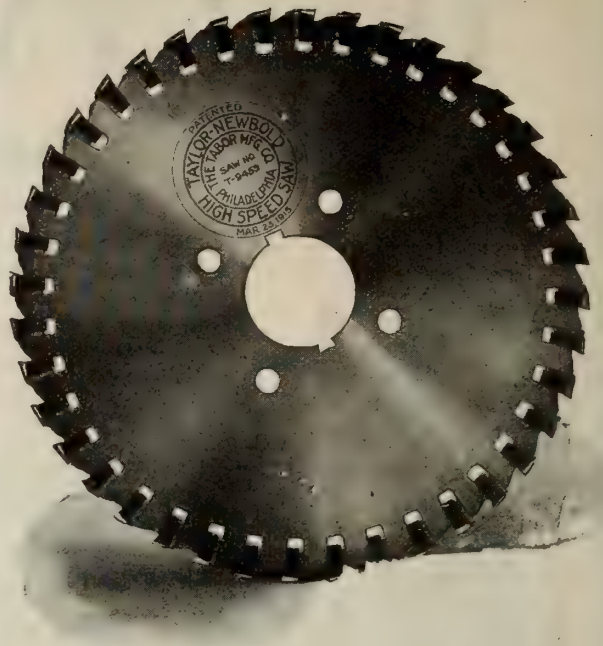
For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

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Codes: Liebers
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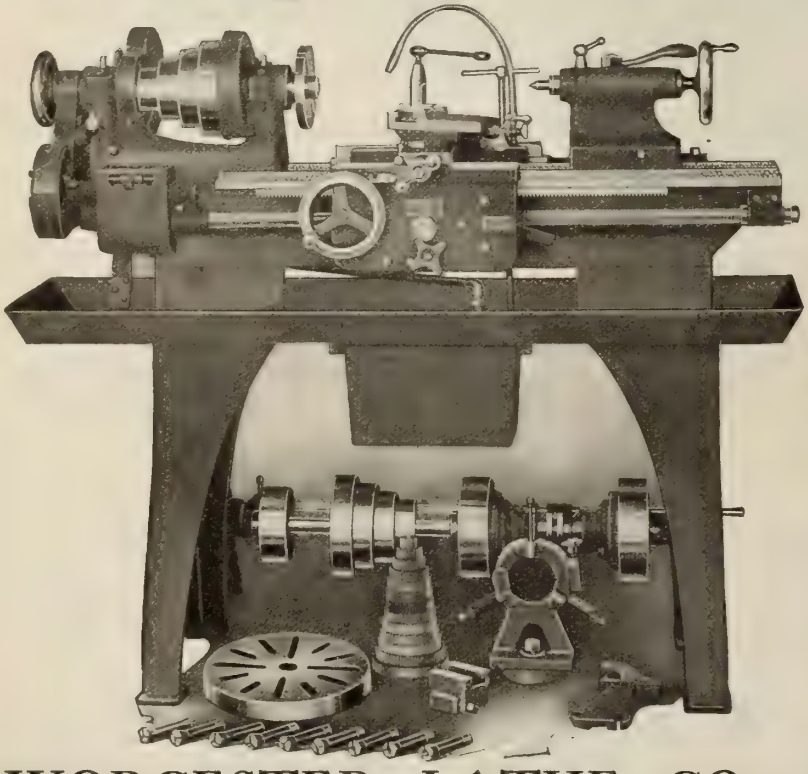
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TAYLOR-NEWBOLD



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WRITE FOR BULLETIN T-S
Tabor Mfg. Co., Philadelphia, Pa., U.S.A.

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12″ and 14″ Swing
Cone or Geared Head
Single Pulley or Motor Drive.

WORCESTER LATHES are especially noteworthy for light toolroom work and are particularly adapted to it because of their accuracy and the small floor space which they require.

In addition to our usual toolroom equipments as shown in illustration, we can also furnish the following: Semi-automatic Turret on Shears, Four Tool Post, Automatic Lateral Feed Stop and Milling Attachment.

Write for Complete Information

WORCESTER LATHE CO., WORCESTER, MASS.

Every Emery Wheel With Its Own Dresser



Desirable, isn't it, now that cost is no objection? For with an inexpensive Desmond-Stephan Dresser for every wheel, every wheel will be touched up frequently and so kept true and equal to its original cutting efficiency.

For all ordinary shop grinding wheels specify "Diamo-Carbo" —the perfect diamond substitute.

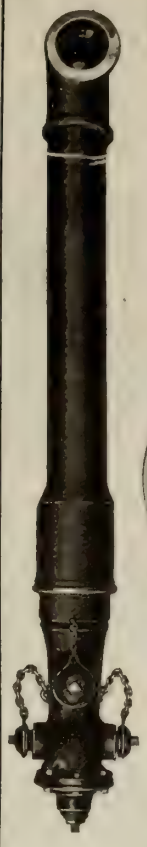
For large, coarse, hard wheels ask for the "Desmond-Huntingdon."

Sherman Corrugated, 2 sizes
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Magazine
Diamonds

The Desmond-Stephan complete line of Economical Grinding Wheel Dressers is catalogued. Write for copy.

The Canadian Desmond-Stephan Mfg. Company
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Grey Iron Castings
Of Every Description





Valves and Hydrants
Made for City of Toronto and York Township

The name Hepburn has been recognized in Canada for many years as a standard of consistent quality and reliability in a machine. We are experienced iron founders and machinists and are ready at all times to undertake ordinary or rush work of any kind or size. Allow us an opportunity to quote you on your requirements.

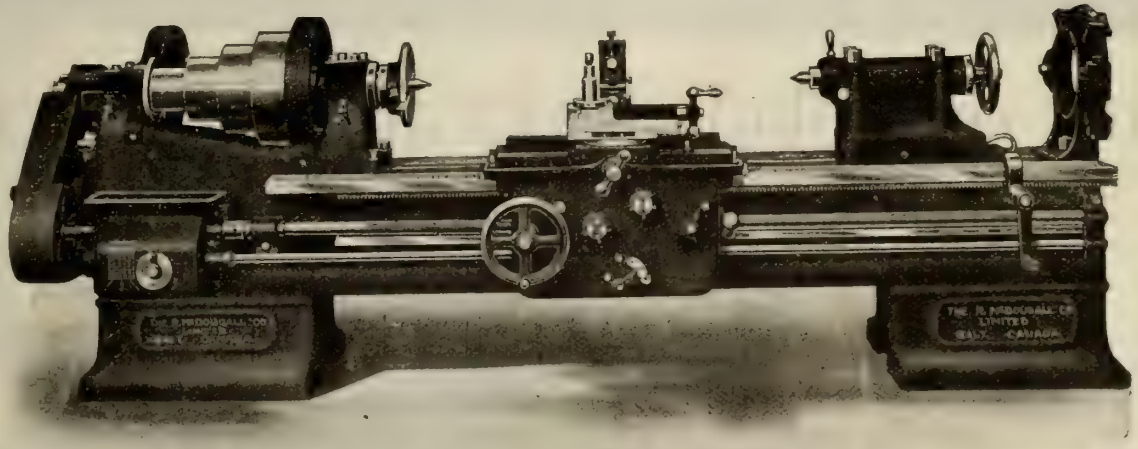
We manufacture special machinery, and also standard lines in planers, pumps and cranes of all kinds.

JOHN T. HEPBURN, Ltd.
18-60 Van Horne St., TORONTO, Ont.

EXPERT Workmanship

IS MUCH IN EVIDENCE IN THE CONSTRUCTION OF

McDOUGALL Engine Lathes



No pains are spared in the construction of this machine to make its accuracy and finish consistent with its perfect design.
McDougall Engine Lathes possess all the features which ensure economical production, dependable accuracy, and ease of operation.
Shall we send you our literature describing this lathe in detail?

THE R. McDOUGALL COMPANY, LIMITED, GALT, ONTARIO
The Canadian Fairbanks-Morse Co., Limited, Sales Agents

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Photograph by Courtesy of our Customer

"Just one blank strip after another"

This is where The Arrow Electric Company of Hartford, Conn., turns out blanks for electric light fixture parts and—makes records on "BLISS" Presses. When a strip of steel, brass, copper or pressed paper has clicked through, another follows it with the promptness of machine-gun delivery.

There are two special rules in the Arrow plant: first, rapid-fire production; second, "BLISS" presses (over 100 of them). Like everything else in the plant these two rules work together mighty smoothly.

Ask for Catalogue Section No. 2-A.

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E. W. BLISS COMPANY

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BLISS 1920

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No. 13



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Three decades of constant effort and careful development have placed Sturtevant Direct Current Motors in the foreground of electrical apparatus built in this country.

The motor you purchase should embody efficient design, selected materials, and skilled workmanship to assure you of a unit which will stand up under most exacting operation.

Sturtevant
(TRADE MARK)

TYPE "D" GENERAL-PURPOSE HEAVY-DUTY DIRECT CURRENT MOTORS

WITH GUARANTEED OVERLOAD CAPACITY

are designed and built to give you enduring, reliable service and power economy. They are readily adaptable to constant or variable speeds and to all requirements demanding a commutating pole type unit. The bearings are liberally designed and do not leak oil. All parts requiring attention are very accessible. Consult any one of our 24 engineering offices or ask us to send Bulletin 217H.

B. F. STURTEVANT CO., OF CANADA, LTD.

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Inferior Files Mean Waste Money

If your files fall short of perfect efficiency and reasonable length of service, you are throwing away money.

Famous Five Files do a job as perfectly as it can be done and do not dull quickly.

The steel in them is made from a special formula, the teeth are properly cut and they are thoroughly hardened.

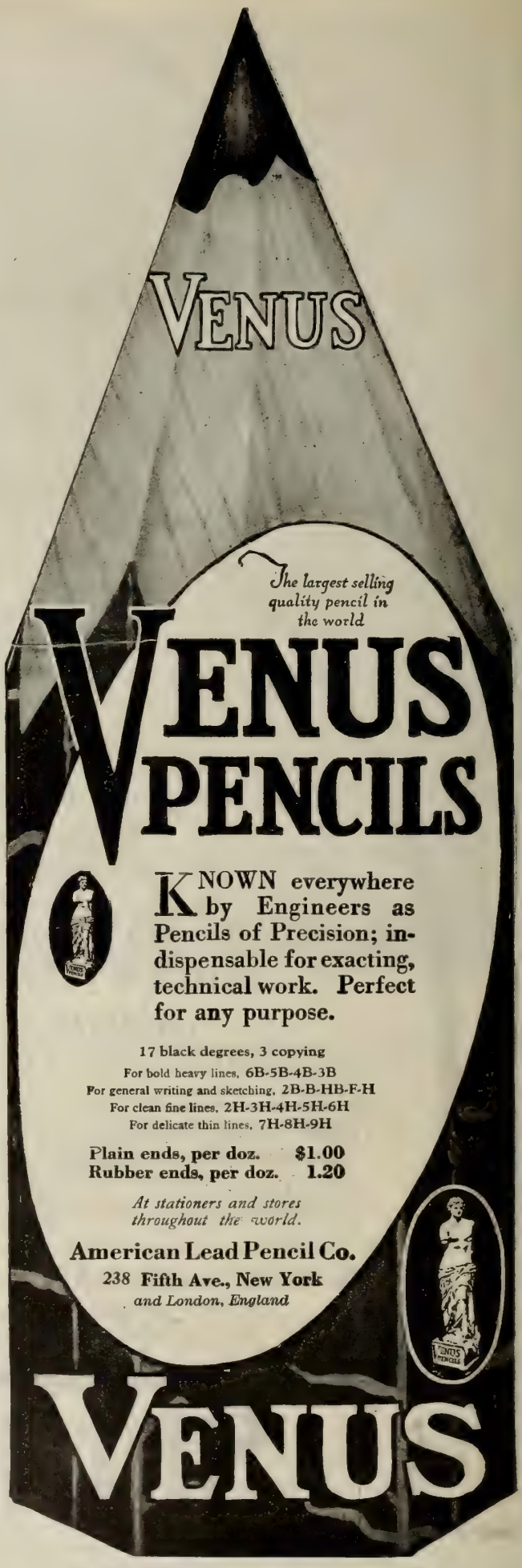
They get the best results with little effort. They last.

The Famous Five are:

KEARNEY & FOOT
GREAT WESTERN
AMERICAN
ARCADE
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Made in Canada by





Individuality

RED-CUT SUPERIOR HIGH SPEED STEEL

VANADIUM ALLOYS STEEL CO LATROBE, PA

A GREAT MAN wrote this: "I'm called away by particular business, but I leave my character behind me." And nobody had to guess whose character it was. Even if the familiar Red Cut label should disappear there would be no doubt as to the character of the steel that remained. More than ever would the quality shine forth in the results when it was worked. Adherence to the highest standard with an unvarying uniformity has placed a well merited reputation all its own on

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

The Best For All Machine Work

VANADIUM-ALLOYS STEEL CO.

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Works : Latrobe, Pa.

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CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

Write for Bulletins

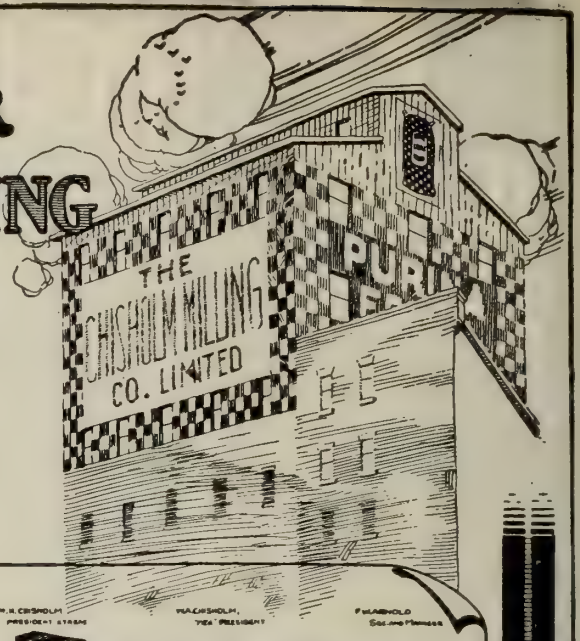
MESTA MACHINE CO.

Pittsburgh, Pa. U. S. A.

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GOODYEAR
MADE IN CANADA

EXTRA POWER BELTING



Pulling the Peak Load

Nearly every industry has some belt-drives with variable loads.

Nearly every industry has had belt trouble when the peak came on these drives.

One of the best things Goodyear Extra Power Belting does is to take care of peak loads without trouble.

How it has solved one peak load problem is told in a letter to us from the Chisholm Milling Company (reprinted here).

The very qualities which give Goodyear Extra Power its great advantage where loads vary, make it a better belt for all-round use.

The *pulley-gripping friction surface* pulls over the stiff places and prevents power waste through slippage.

The *great strength of the fabric plies* which are welded into one by much fine rubber, gives very long life.

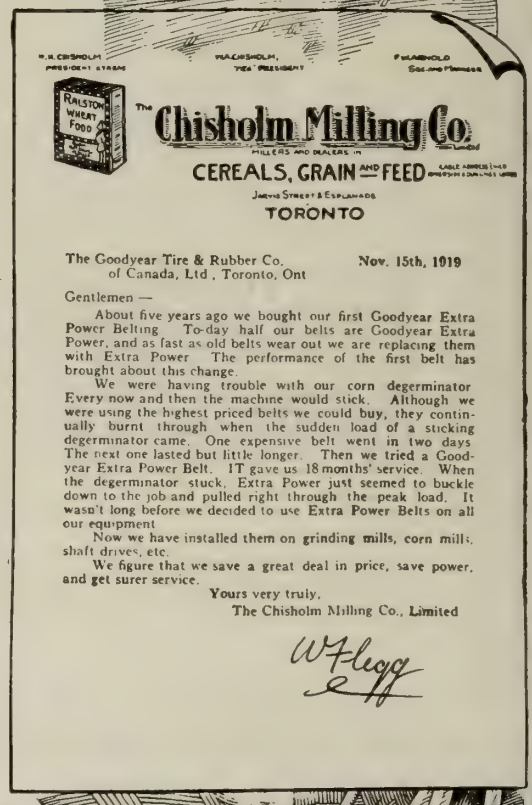
Practically *all the stretch is taken out* of Goodyear Extra Power before you buy it—saving costly shut-downs to tighten belts.

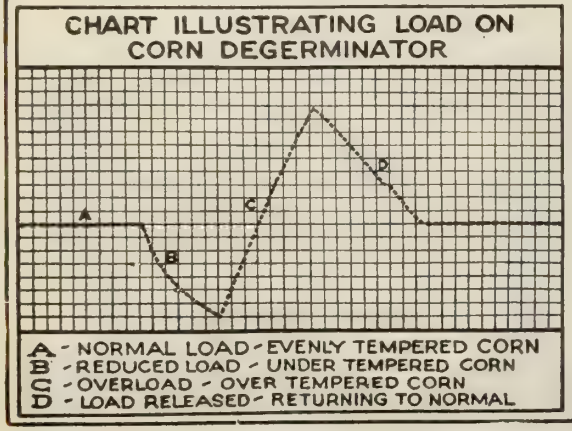
The fine rubber, *which seals the seam*, prevents ply separation.

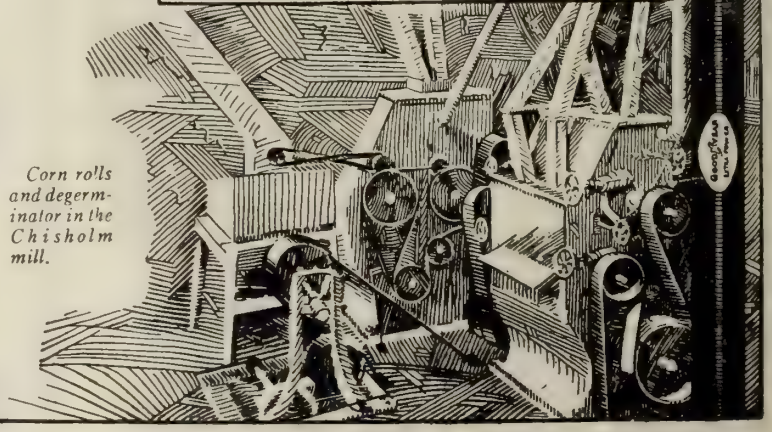
Over 1000 Canadian industrials have found Extra Power Belting an economical proposition—in price, in length of service, in efficiency of service. Some of them have solved problems exactly similar to yours. Let a Goodyear-trained belting man tell you about it. No obligation. Just phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co. of Canada, Limited

Branches—Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver, Victoria. Service stocks in smaller cities.







Corn rolls and degerminator in the Chisholm mill.



BRISTOOL

Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

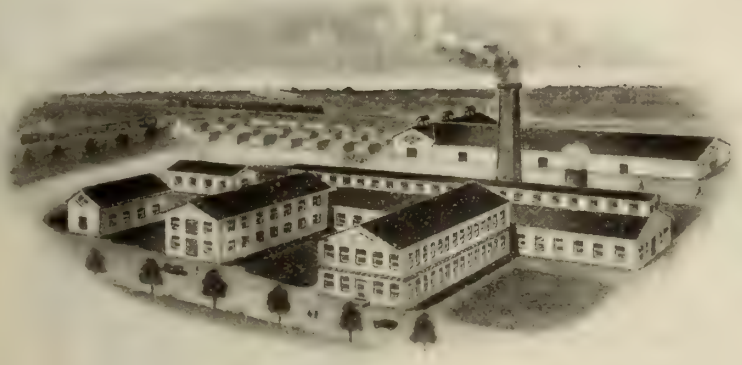
Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

"BERNARD"
TRANSMISSION APPLIANCES



have achieved an enviable reputation in the Industrial World.

Their performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.

We stand back of our products and will give Dealers every assistance.

Put them to the test.



The A. Bernard Industrial Co.

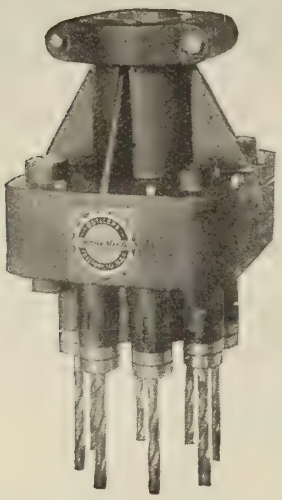
Manufacturers of High-Grade Power Transmission Appliances

Offices and Works: FORTIERVILLE, Que., Canada

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2 Minutes or 20?

This Is The Vital Question





Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.

THE HOEFER Mfg. Co., Freeport, Ill.

621 Washington Blvd., Phone Haymarket 2408, Chicago, Illinois; 1113 Citizens' Bldg., Phone Main 795, Cleveland, Ohio; 217 Stanwix St., Phone Court 1911 or 1912, Pittsburgh, Pa.; 602 Kerr Building, Phone Cherry 2884, Detroit, Mich.; 30 Church Street, Phone Cortland 1615, New York City; Badger-Packard Mchy. Co., Milwaukee, Wisconsin; National Supply Co., Toledo, Ohio; John M. Howett, 18 W. Second St., Dayton, Ohio; 881 Ellicott Sq., Phone Seneca 2033, Buffalo, N.Y.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House For Mechanical Goods"

Halifax St. John Quebec Montreal Ottawa Toronto Hamilton Windsor Winnipeg Saskatoon Calgary Vancouver Victoria

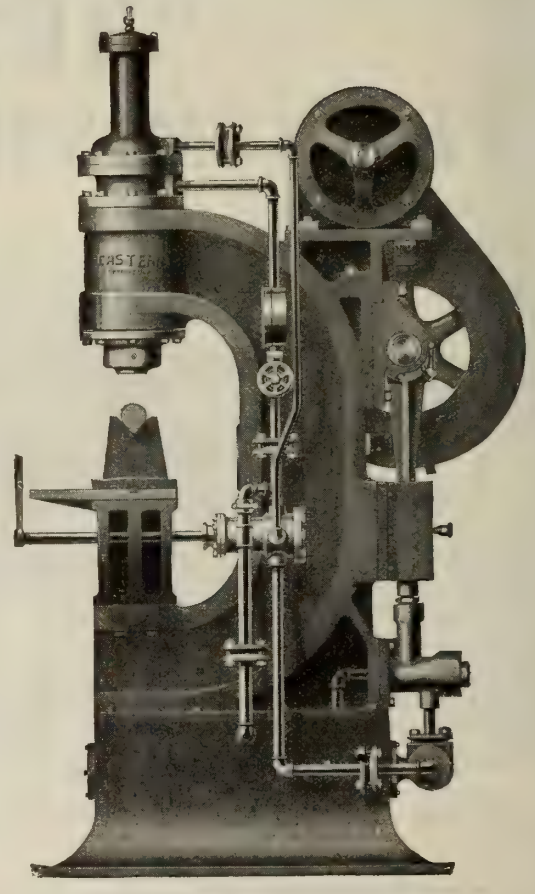
A SELF-CONTAINED HYDRAULIC UNIT



EASTERN UNIVERSAL HYDRAULIC PRESS. Supplied in 20-35 and 50 ton capacities, full hydraulic depending on no springs or weight for return of ram, delivering pressure instantly at a speed of 1½" per second return of ram 3" per second.

Length of Ram Travel .....6 in.
Depth of Throat ..... 10 in.
Length of Table .....8 ft.
Width of Table .....10 in.
Table to Ram.....10 to 14 in.

EASTERN UNIVERSAL PRESSES are tested before leaving our plant at 33 1/3% overload. They are furnished with rolling centres and are unexcelled for straightening of motor crankshafts, heavy wheel shafts, broaching splines in drive plate, differential gears, and others. Straightening front axles and spindles.



Write for details

EASTERN PRODUCTION COMPANY

137 Leib St., DETROIT, MICH.

120 Wisconsin St., MILWAUKEE, WIS.

Canadian Representatives:

F. F. BARBER MACHINERY CO., Limited,
Foy Building, TORONTO

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



Welding Fence Gate Frames with Armco Iron Welding Rods

ARMCO IRON

WELDING RODS

used for Welding Wire Link Gate Frames

We use Armco Iron Welding Rods in our own manufacturing departments for both oxy-acetylene and electric arc welding.

One of our quality products is a Wire Link Fabric used extensively for partitions and fences in and around industrial plants. This fabric is made of Armco Iron and only the best welding wire would be considered good enough for welding the gate frames. Armco Iron Welding Rods are therefore used exclusively for this purpose.

Armco Iron Welding Rods have a guaranteed minimum pure iron content of 99.84 per cent. and are unequalled in chemical and physical uniformity. They flow freely and make an even weld which lends itself perfectly to finishing operations.

Our nearest sales office will give you the addresses of Armco distributors in your locality. And if you happen to be interested in factory partitions or fencing we will be glad to inform you fully regarding Page Armco Iron Wire Link Fabric.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

Makers of ARMCO IRON Welding Rods and Electrical Wire; "Copperweld" Copper Clad Steel Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stock Room Partitions; Architectural Iron.

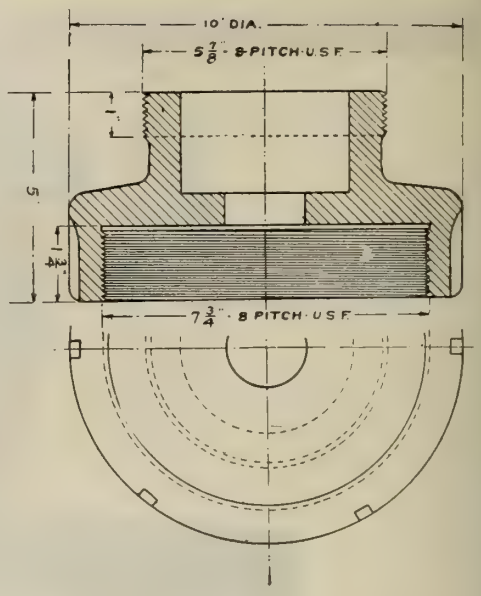
Plants: Monessen, Pa., and Adrian, Mich.
SALES OFFICES: 30 CHURCH STREET, NEW YORK.
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Thread milling the ordinary work means better threads—it also means *greater* economy

We're publishing a time study on the simple, everyday job because we want to show you that the Smalley-General Thread Miller is just as economical on simple as it is on the more intricate, complicated work. It's not a special machine for special jobs. It's a practical time and labor saving machine that will cut the cost of practically any threaded work—simple or difficult—that you have in your shop.

Send us blueprints of any of your threaded work and we'll work out guaranteed production speeds of the Smalley-General Thread Miller on it. If you send us a few samples we'll be able to show you the accuracy and quality that milling will put into your threads.

Smalley-General Co., Inc.
Bay City, Mich.
Montreal and Toronto: Rudel-Belnap Co., Ltd.



MATERIAL—Cast Iron.

LATHE TIME—Outside thread, 30 minutes, approx.; inside thread, 45 minutes approx. Not including chucking.

THREAD MILLER TIME—Outside thread, 4 minutes; inside thread, 5 minutes. Floor to floor.

Note—Milled from rough. No turning or boring necessary on threaded surfaces.



Type B
Guaranteed to 80,000 lb. pressure

Speed Up Tool-Making

Manhattan Screw Press

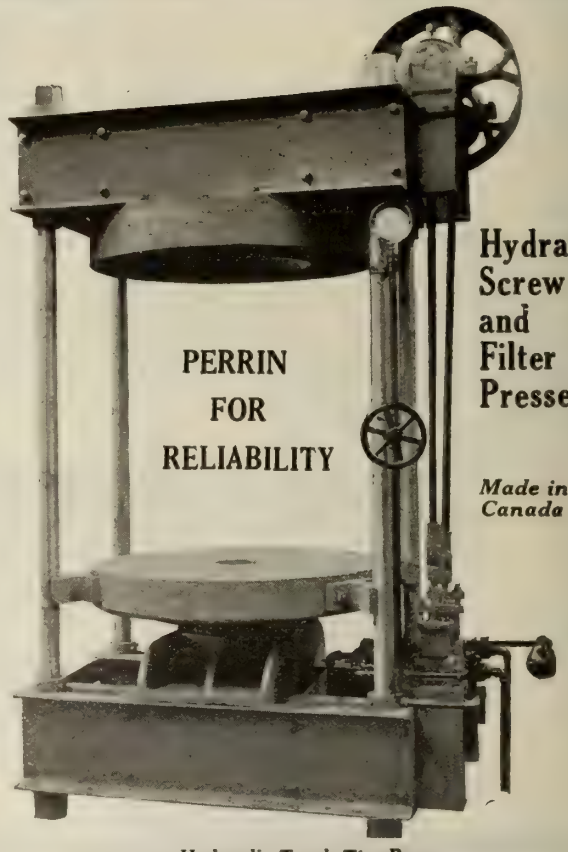
A great time-saver for the tool-maker, offers utility in the highest degree.

A one-man machine—tool-maker requires no help in handling the dies.

You should know more about it. Send for full details.

Manhattan Machine & Tool Company
Grand Rapids, Mich., U.S.A.

Foreign Representatives: "Aux Forges de Vulcain," Paris, France. Farmer & Co., Clerkenwell, London, E.C.



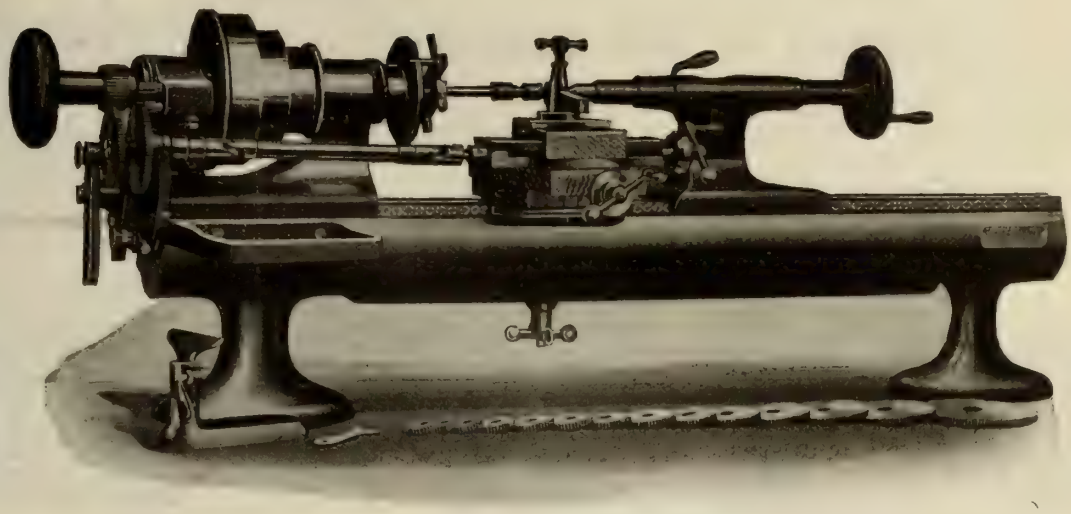
Hydraulic Screw and Filter Presses

Made in Canada

Hydraulic Truck Tire Press
WILLIAM PERRIN LIMITED
TORONTO

CATARACT BENCH LATHES AND ATTACHMENTS

Cataract Bench Lathes are finely constructed precision tools, with responsive controls, simple adjustments and numerous convenient attachments adapting them to a wide variety of work **Study this illustration.** Note the base, the circular bed, the sliding tool post, massive head stock (indicating strength), range of gears, special tailstock, arrangement of gears.



Hardinge Bros., 1770 Bertau Avenue, Chicago, Ill.

Canadian Representatives : Garlock-Walker Machinery Company, Limited
Montreal - Toronto - Winnipeg



BEND PIPE COLD

ELIMINATE FRICTION

2 New Models

"Wonder" Pipe and Tube Bending Machines (pat.) electrically operated to bend from 1" to 8".

We also manufacture 10 other sizes

Hand operated to bend from ⅛" to 6".

American Pipe Bending Machine Company

52 Pearl Street

BOSTON, MASS. U. S. A.

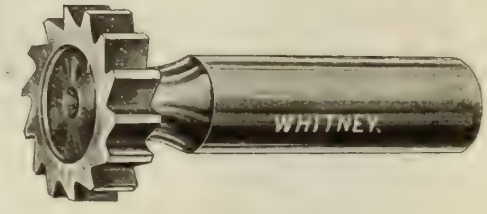
The Canadian Fairbanks-Morse Co., Ltd., Montreal, Que., Agents for Canada

"WHITNEY"

KEY-SEAT CUTTERS

For the Woodruff System of Keying

GET OUR PRICES



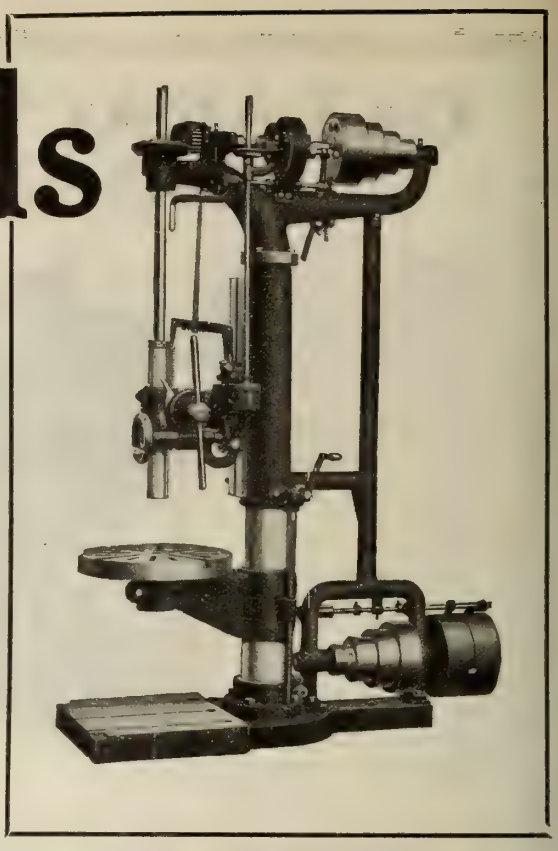
Either carbon or high-speed steel.
Material the best obtainable.
Unsurpassed in efficiency and durability.
Centred at both ends.
Unsurpassed in accuracy and finish.
Large quantities carried in stock.

The Whitney Mfg. Co., Hartford Conn.

Chains, Keys and Cutters, Hand Milling Machines

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Silver Drills



Economy on High Class Work

When accuracy and finish are essential in the work, increased production can only be obtained from a **powerful** drill that has the rigidity necessary to retain its accuracy at high speeds.

All Silver Drills possess this vital feature—and you will not find another drill that is simpler to operate.

There are a number of models and sizes. The cut shows the 25-in. with 8 spindle speeds, 6 positive geared feeds, automatic stop, etc.

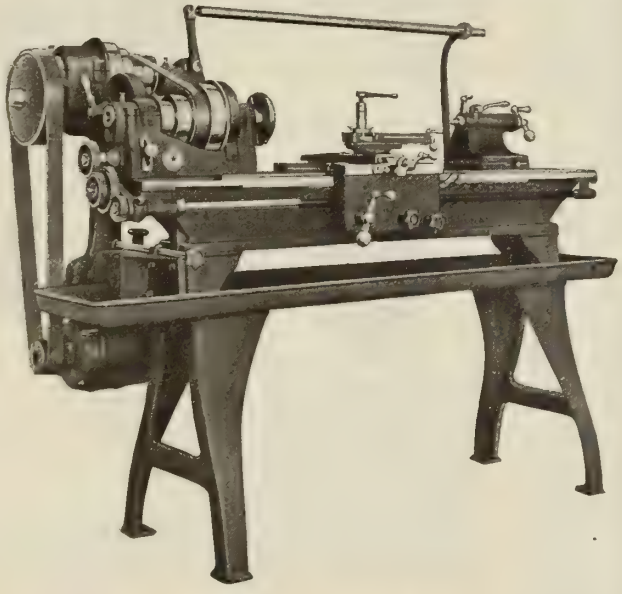
Our catalogue contains detailed information and data on all Silver tools. It is yours on request.

The Silver Manufacturing Company, Box 290, Salem, Ohio

Manufacturers also of the Silver Radials

"STAR" Screw-Cutting Engine Lathe

11" Swing, 5 ft. Bed, WITH ELECTRIC MOTOR DRIVE
Showing Gear Guard Removed



The individual motor drive is a valuable attachment for any size of "Star" lathe—9 in., 11 in., or 13 in—in shop or tool room service.

The belts are of ample size to develop the full capacity of the lathe, and the resulting drive is flexible enough to prevent the damage both to lathe and motor which is a possibility with gear or chain connections. The belts may be quickly tightened without shortening.

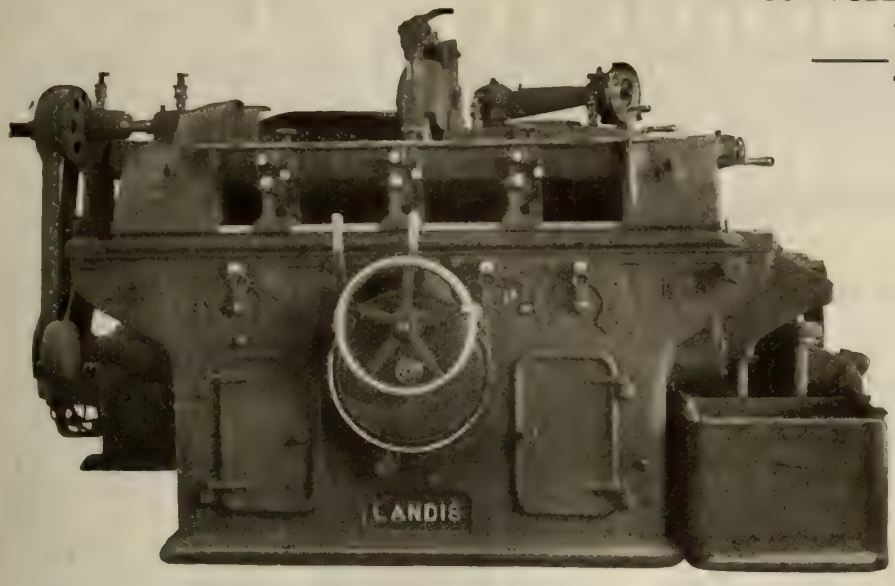
Starting, stopping, and reverse rotation of lathe spindle controlled by shifting bar within easy reach of operator. Reverse speed faster than forward motion. Eight spindle speeds are immediately available with a four-step cone. Motor to suit any voltage, A.C. or D.C., supplied by us or by purchaser of attachment.
Full description of this attachment and complete catalogues of the "Star" line on request.

THE SENECA FALLS MFG. CO., Inc.

366 West Falls Street SENECA FALLS, N. Y.

LANDIS

Landis Speed —Dependable



Big production from the LANDIS has come to be the expected thing.

Users depend upon it.

The manipulation of the LANDIS is simple and easy. In fact, its universally high production records are due mainly to the ideal combination of machine and operator attained in the LANDIS.

Its traveling wheel head, powerful drive and many other advantageous features make it the machine for production records. *Send for Catalogue*

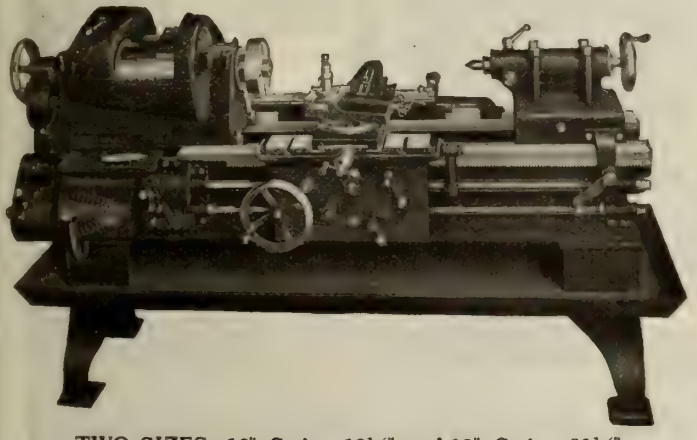
LANDIS TOOL COMPANY, Waynesboro, Pa.

NEW YORK: 50 CHURCH STREET

CANADIAN AGENTS:—A R. Williams Machinery Co., Toronto, Winnipeg and Vancouver. Williams & Wilson, Montreal

"LEHMANN LATHES"

Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for heavy duty where power, strength and rigidity are required.

Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

We know you are interested, so don't put off writing us. Do it to-day. Now!

LEHMANN MACHINE COMPANY, 612 S. BROADWAY, ST. LOUIS, U. S. A.

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The Connecting Link between Power and Production

MAXIMUM production can only be attained through uninterrupted transmission of power from line-shafts to machines. Belts *will* break. Because no method to-day equals the "Clipper" for speedy repairs, "Clipper" belt hooks are the connecting links between power and production. "Clipper" hooks make possible practically continuous operation of machines during working hours in the workshops of the world.

The Clipper Belt Lacer
Laces a Belt in Three Minutes

Out-of-date methods take from ten minutes to half an hour. The "Clipper" makes a durable joint—one that is smooth on both sides, is as flexible as the belt itself, is safe and pulls right.

The "Clipper" goes to manufacturers on free trial and is perpetually guaranteed.

Clipper distribution is world-wide through mill-supply houses. Where we are yet open for representation our dealer proposition is one of mutual profit.



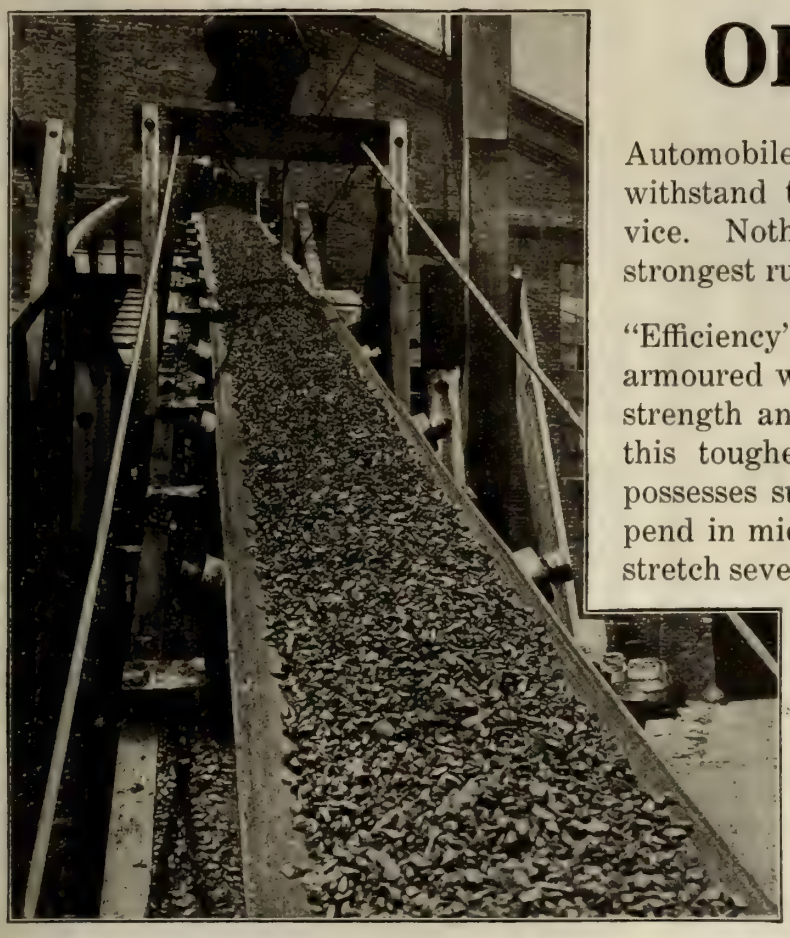




Clipper Belt Lacer Co. REGISTERED TRADE MARK

Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U. S. A.
LONDON, ENGLAND—NO. 10 NORFOLK STREET

Conveyor Belts that Stay on the Job



Automobile Tire Treads encounter and must withstand the most abusive, abrasive service. Nothing but the very toughest and strongest rubber stock will stand it long.

"Efficiency" Conveyor Belts are heavily armoured with Tire Tread Rubber of great strength and elasticity. A single cord of this toughened rubber, one inch square, possesses sufficient strength to readily suspend in mid air a big load of hay and will stretch several times its original length without breaking.

"Efficiency" Conveyors, like highest grade Auto Tires, are made for the most exacting service.

Though of immense strength they trough perfectly, and, of their own weight, automatically conform to the idlers.

Other very important features in their construction we are unable to detail here, but they represent economy in operating cost for you. When in need of Conveyor Belting let us send a representative to demonstrate them.

Rubber Belting for Every Purpose.
Rubber Goods of all kinds for Every Mechanical Service.

Gutta Percha & Rubber, Limited

Head Office and Factory: Toronto, Ont.

Branches:

Halifax, Montreal, Ottawa, Toronto, Fort William, Winnipeg, Regina, Saskatoon, Edmonton, Calgary, Lethbridge, Vancouver, Victoria

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Your Money's Worth

Never again will the Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET YOUR MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools; in other words he must and will

USE ARMSTRONG TOOL HOLDERS

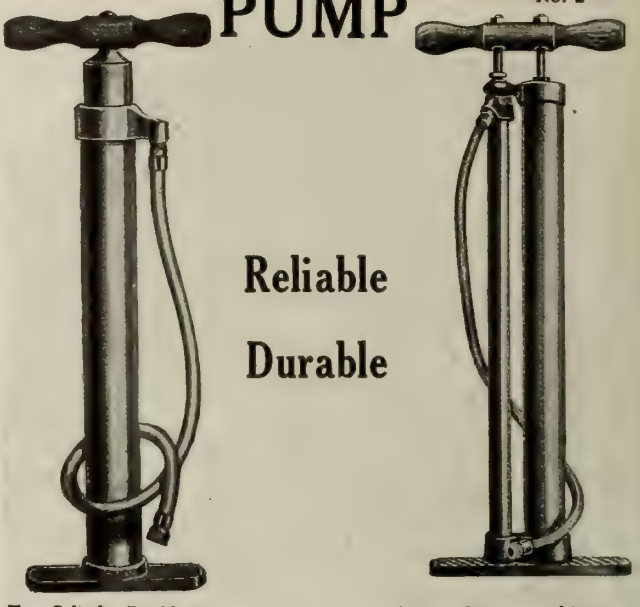
No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men—a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

Insist on Getting a
TALLMAN TIRE PUMP



Reliable
Durable

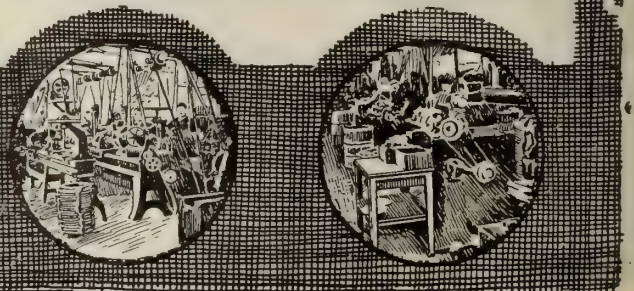
Two Cylinder Double Action — Double Barrel Compound Pump

Tallman Brass & Metal Limited
HAMILTON, ONT.

SPECIAL TOOLS

Automatic Machinery
for all purposes
Punch Press Work
Screw Machine Products
Consult us on your machine problems

Toronto Tool Company
516 Richmond St. West — Phone Adel. 1181



Refer Safety Problems To Us

Give Your Time to the Development of a Safer Plant

WELDERS! CHIPPERS!



For chippers, grinders, welders and others.

ADJUSTOGLASS GOGGLES with Protexal reinforced lenses will not shatter; will keep your indispensable men on the job; the most popular goggle made; no assorted sizes required.

PROTEXAL SAFETY CLOTHING



Made of rubber, leather and asbestos.

Fire, water and **acid-proofed duck material.**

A garment for every worker —leggings, gloves, aprons, suits.

Every article guaranteed.

The quickest and surest way to get what you want is to ask us for it. Send for catalog D2.

THE STRONG, KENNARD & NUTT COMPANY

SAFETY, FIRST-AID AND WELFARE EQUIPMENT

2044 E. 9th Street -- CLEVELAND, OHIO

If it's for Safety, we sell it.



McCrosky

McCrosky WIZARD Quick-Change Chucks and Collets

WIZARD production is continuous output on many jobs. On any job they will pay their own cost in a short time.

The tools are changed in rapid succession, without stopping the spindle for a moment and while running at any speed. Will more than double your drill-press in one continuous operation.

With the WIZARD you can drill, ream, counterbore, tap, set studs, etc.

Think what it means to turn out completed jobs with only one handling of the work. It means cutting out costly lost motion which eats up your profits. It means that a WIZARD outfit enables a girl to do more and better work than two men, the old way.

It means keeping your plant busy when the less efficient plant is having a hard time to make ends meet.

Read the full story of the WIZARD and other McCrosky Cost Cutting Tools in Efficiency Book No. 6. Yours on request.

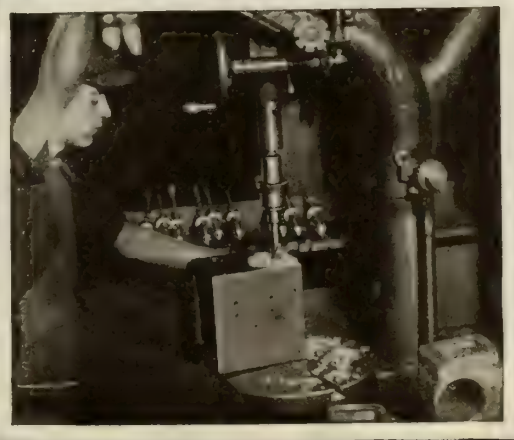
McCrosky Tool Corporation

(Formerly McCrosky Reamer Co.)

Meadville, Pa.

Detroit : Kresge Bldg., Mr. C. M. Sutton, Mgr.

Export Manager :
B. Whittaker, 21 State St., New York



COST CUTTING TOOLS



Don't Scrap the other Chasers

If one in a set breaks,

Put in a New Chaser

Grinding set to uniformity.

This *Is* Practicable *If* You Use

HARTNESS AUTOMATIC DIES

JONES & LAMSON MACHINE COMPANY

(AUTOMATIC DIE DEPARTMENT)

109 Queen Victoria St., LONDON, ENG. SPRINGFIELD, VERMONT, U.S.A 503 Market St., SAN FRANCISCO

American Agents for Dies and Chasers:

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Machinists Supply Co., Pittsburgh, Pa.
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Robinson, Cary & Sands Co., St. Paul & Duluth.
A. V. Wiggins & Co., Syracuse, New York.

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Holland, Spliethoff, Beewukes & Company, Rotterdam, Holland.
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Sweden, A. B. Galco, Ltd., Stockholm.

Wherever Pipe is Cut or Threaded Economically

The probability is two to one that it's a

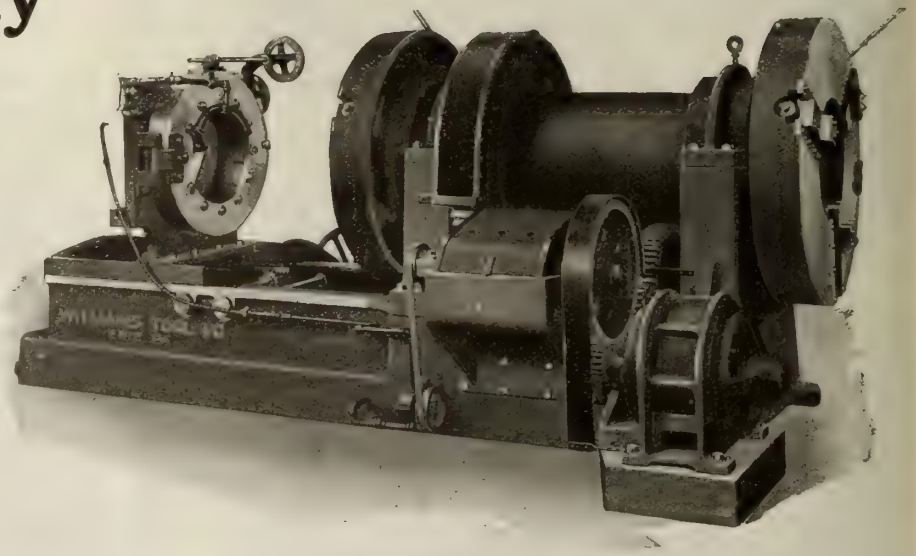
Williams Pipe Machine

that's on the job.

For in approximately two-thirds of all the larger plants in this country Williams' Pipe Machines are used.

It was the Williams Pipe Machine that brought highest honors home from the Panama Exposition.

The Machine illustrated has a capacity of 21½" to 12". Also nine other sizes to meet your requirements.



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Williams Tool Company

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The A. R. Williams Machinery Co., Limited, Toronto, Canada

European Agents:
Universal Machinery Corp London - England

—for Quality Castings



6-Ton VOLTA Furnace in Running Position

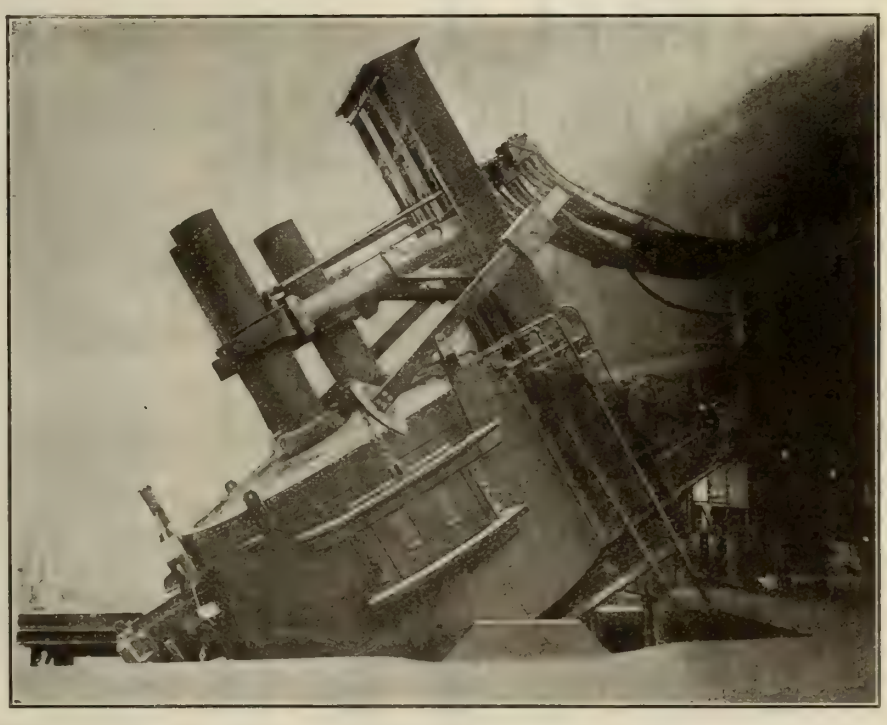
Besides the economy involved, the production of steel castings with the electric furnace means a particularly fine grained product, with a perfect control of its chemical composition.

VOLTA Electric Furnace

A consistent producer of high grade steel castings of superior physical properties.
For the most economical results an electric furnace must be designed with all the modern operating devices which help in eliminating delays between heats and excessive length of time in refining.

Volta Electric Furnaces are built in capacities from one to six tons and nothing is spared in their design and equipment to make them efficient. Our ten years of extensive experience in electric furnace work has made us competent to advise you on your steel casting proposition.

The accompanying illustrations show the Volta furnaces recently installed by us for the Dominion Foundries and Steel Co., Hamilton, where the two six-ton furnaces have replaced the open hearth furnace for the production of high-grade steel castings and alloy steels.



6-Ton VOLTA Furnace in Pouring Position

Volta Manufacturing Co., Limited, Welland, Ont.

If interested tear out this page and place with letters to be answered.

Heat Under Accurate Control

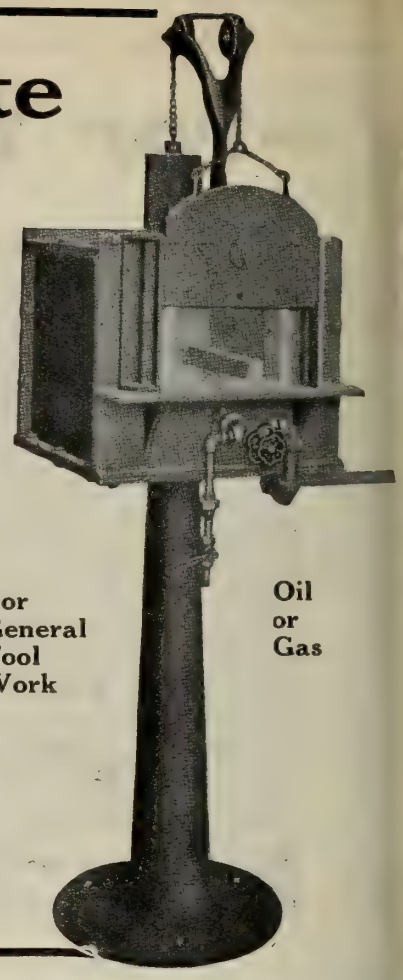
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

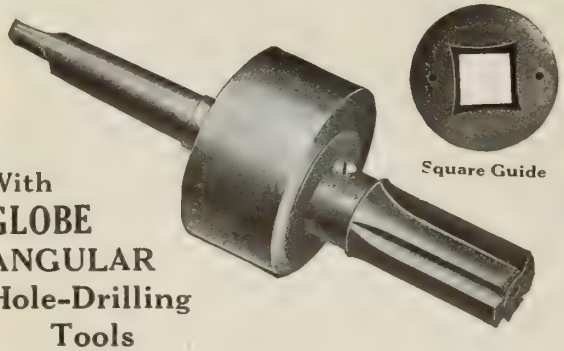
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703 Bellevue Ave. - Detroit, Mich.

Representatives in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

DRILL

those Square, Hexagon or other Angular Holes



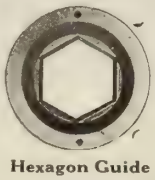
Square Guide

With GLOBE ANGULAR Hole-Drilling Tools

A GREAT TIME-SAVER

A large number of Canadian manufacturers are profiting by reduced production cost—a direct result of Globe Angular Hole Drilling Tools.

Why not investigate? May we send you full details?



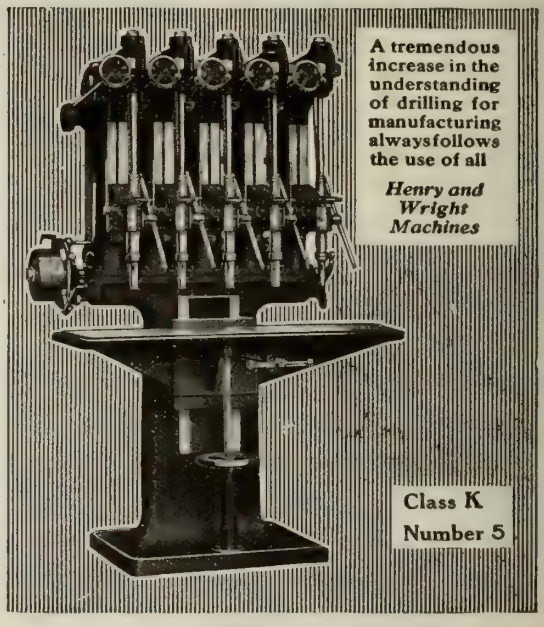
Hexagon Guide

Globe Engineering Co., Limited

HAMILTON, CANADA

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Drilling Machines



A tremendous increase in the understanding of drilling for manufacturing always follows the use of all *Henry and Wright Machines*

Class K
Number 5

The Henry & Wright Mfg. Co.

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If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

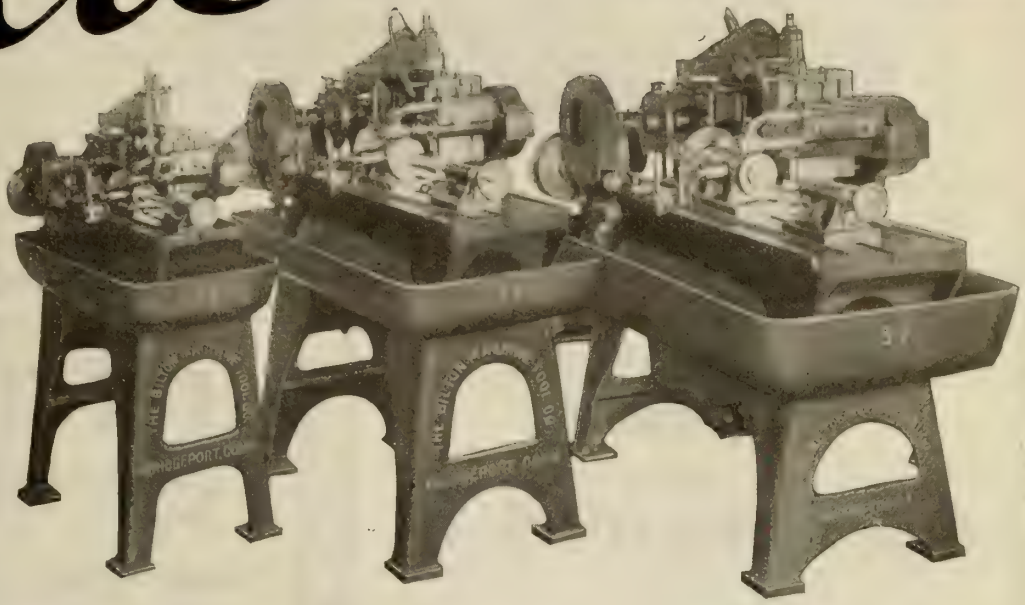
Bilton GEAR MILLERS

Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver—as indexing takes place during return stroke of cutter — which is removing metal 90% of the time.

Write us for Catalog 30-6



Over 500 leading manufacturers now use the Bilton for high production on accurate work.

Bilton Machine Tool Co. Housatonic Avenue **Bridgeport, Conn., U.S.A.**

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co. Ltd.

Wire Cloth

of every description

We make **Machinery Guards** of all kinds.

Metal Lockers for Clothes.

Overhead Wire Guards for Elevators.

Wire Rope

Drop a line for full details.

Canada Wire & Iron Goods Company

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Eastern Representative:
H. E. O. Bull, 184 Mance St., Montreal, Que.

Have as many Trucks as you want

With the Holyoke System it won't cost much



Just build strong wooden platforms, pile your material on them, and one man and one "Holyoke" will put any part of that material on wheels in a few second, even if it weighs 2½ tons. Your material is always ready for the next machine, storage, inspection, or the warehouse—without handling the material or damaging it in any way.

And when you don't need so many trucks, just pile your platforms in a corner. They'll stack neatly, won't waste valuable floor space, won't represent a lot of capital tied up, and are ready for use immediately. The "Holyoke" system is the rational, sensible system. You can't beat it for flexibility and economy of time and labor. Besides all that, it's the cheapest system in first cost. Shall we send you our booklet "Inside Transportation?" It explains the superiority and economy of the "Holyoke."

Holyoke Truck Company

119 Race Street Holyoke, Mass., U.S.A.

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FOR ANY PURPOSE

Quick Deliveries

We Build and Design

STORAGE TANKS
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Distilleries
Packing Houses
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Chemical Works
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PENSTOCKS

The St. Lawrence Welding Co., Ltd., 138-140 Inspector St., Montreal, Que.

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HACK SAW BLADES
UNEQUALED IN QUALITY ANY SIZE OR LENGTH
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OILGAS Industrial Furnaces

"The only distinct advance in furnace practice since Siemen's time."
Double the capacity of the ordinary furnace with the same oil consumption.
A line of continuous forge furnaces of the highest overall efficiency, reliability, and convenience of operation.
Other furnaces of every description for the application of heat to any industrial process.
Write for your copy of Bulletin Fifty-four.

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Complete line. 8-inch to 50-inch swing

Gang Drills.—Horizontal Drills.

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When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

ELK FIRE BRICK

has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRANDS:

"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
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Try us on your next fire brick needs. You'll find both our quality and service right.

Large stocks of various shapes carried in warehouse in Hamilton.

ELK FIRE BRICK CO. OF CANADA LIMITED
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Hoyt Babbitts, particularly Frost King, represent maximum value at minimum prices, possessing all the qualities and overcoming all the usual Babbitt faults found in ordinary bearing metals. We've been making Babbitts for nearly half a century.



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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

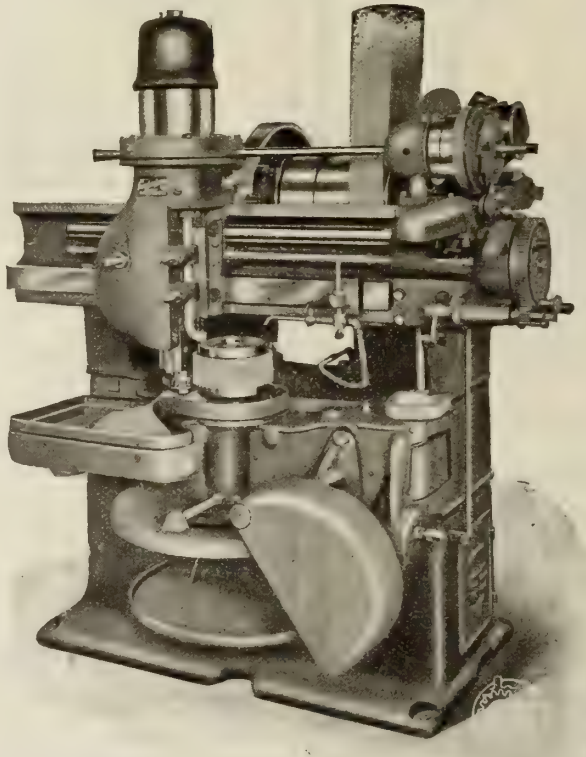
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.

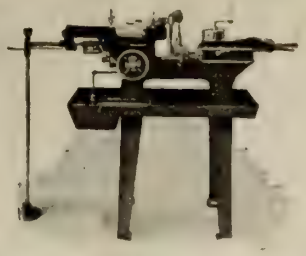


The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting.

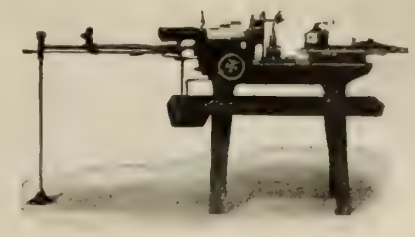
The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

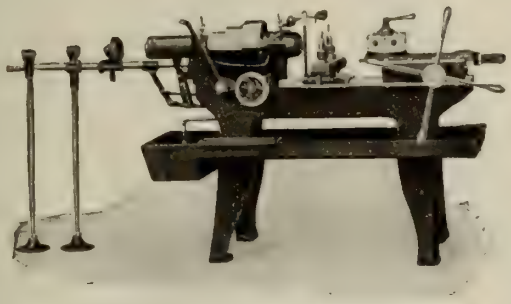
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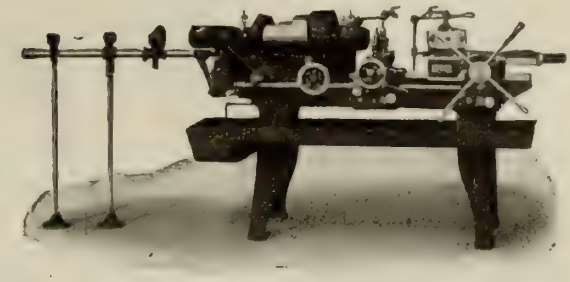
No. O—P.H. Screw Machine.



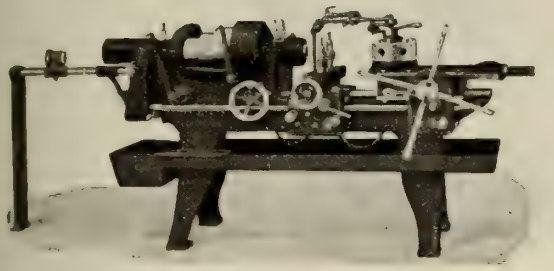
No. 1—P.H. Screw Machine



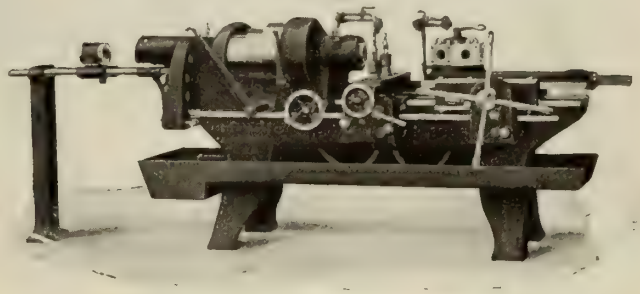
No. 3—P.H. Screw Machine.



No. 3—F.H. Screw Machine



No. 5—F.H. Screw Machine.

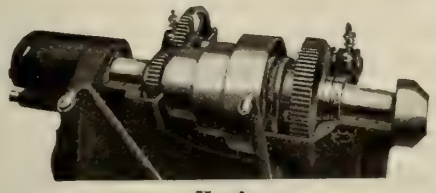


No. 7—F.H. Screw Machine

DESIGN OF HEAD

SECOND OF A SERIES OF ADVERTISEMENTS

DESCRIBING THE FOSTER NEW LINE OF HAND SCREW MACHINES



Head

Since Fred W. Taylor made the initial discovery of high-speed steel, improvement of same has followed improvement in rapid succession. The cutting steels have been made to stand higher speeds and faster feeds.

This has forced machine tool builders to redesign their machines from time to time. Larger amount of power and more rigidity has been called for because of better cutting tools.

In this Foster new line of Screw Machines an ample margin of power and rigidity has been added above the maximum requirements with a view in mind of taking care of and providing for additional improvements in cutting steels that may be brought to the front during the next few years to come. This has been done without making the machines unnecessarily heavy and without in any degree sacrificing the ease of control of operation.

The halftone shows the design of the friction head for the Nos. 3-5 and 7 Screw Machines. The gear covers have been removed in order to more clearly show the design.

The powerful friction clutch mounted on the spindle between the cone pulley and the friction gear serves to engage the spindle into driving connection direct with the cone pully on one side or with the back gears through the large diameter spindle gear on the other hand. The frictions are of the cone pulley type and are operated by the hand lever through the medium of a large movable sleeve and four fingers mounted on the spindle. The friction is very sensitive in operation and extremely powerful.

The spindle is made of a high carbon steel forging and is journalled in liberally proportioned bearings made of a special high-grade bronze.

The head is cast integral with the bed. The rigid double girder type of bed is very heavily ribbed internally and is designed throughout to gain the maximum rigidity without the use of unnecessary large amount of cast iron.

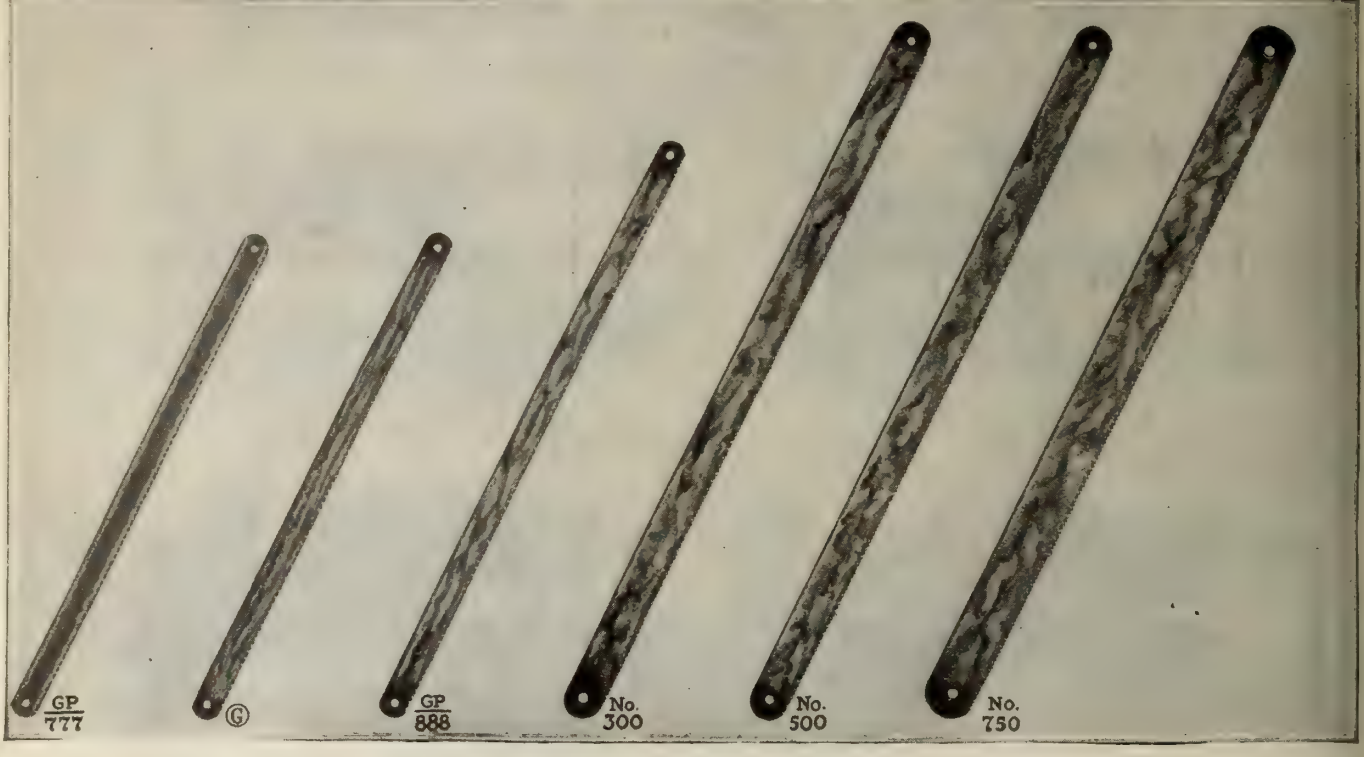
We have ready for instant distribution circulars of each size of Screw Machines. These circulars also describe our excellent and comprehensive new line of Screw Machine tools for each size of machine.

Write for these circulars.

FOSTER MACHINE CO., ELKHART, IND.

If interested tear out this page and place with letters to be answered.

GOODELL-PRATT
1500 GOOD TOOLS





Hack-Saw Blades

Goodell-Pratt Hack-Saw Blades are the best it is possible to manufacture. They are made of the highest grade of hot-rolled sheet steel and tempered with the greatest care. Every blade undergoes rigid inspection after each manufacturing operation.

It is impossible to get satisfactory service from a hack-saw blade unless it is suitable for the work to be done. Goodell-Pratt Hack-Saw Blades are made in enough different sizes and pitches to enable anyone to select just the right blade for the job.

Goodell-Pratt quality is as evident in these hack-saw blades as it is in all of the 1500 Goodell-Pratt Tools. The materials used, the skilled workmen employed, and the great care exercised combine to make Goodell-Pratt Tools known the world over for their excellence.

Write for a complete pocket catalog of the 1500 Goodell-Pratt Tools.

GOODELL-PRATT COMPANY *Toolsmiths* Greenfield, Mass., U. S. A.



American Gas Furnaces
Standardized with Nichrome

Thousands of hours of service is the reason—plus uniformly high results in the treated product—plus lower ultimate cost to users. Nichrome—the casting durable—is responsible for *all* these advantages. Therefore, the American Gas Furnace Co. uses Nichrome Retorts.

Manufactured under Henderson Patents

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What do *I* get out of the Difference *between*

This and *This*



STOCO

SAFETY GOGGLES

"CELOGLAS"

SHATTER-PROOF LENS

Increased production, reduced labor turnover, better workmanship and closer co-operation from employees are a few of the advantages which follow elimination of the industrial eye hazard.

In other words, viewed from a purely dollars-and-cents profit-and-loss angle, equipping with Stoco Safety Goggles every worker who is doing eye hazardous work in your plant is a profitable proposition.

Price per hundred (f.o.b. Geneva, N.Y.), with extra heavy optical glass lenses, $90.00

With Celoglas Shatter-proof Lenses $115.00

Of course, we sell in lots of less than a hundred. We also give interesting discounts for quantity orders.

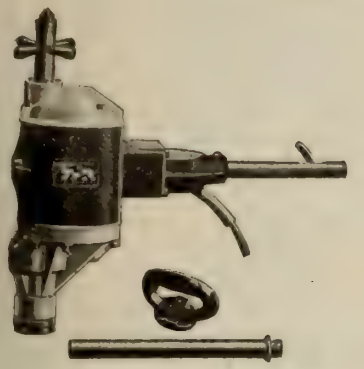
A sample of the Stoco Safety Goggle will be sent interested responsible people on receipt of request on letterhead.

STANDARD OPTICAL CO.

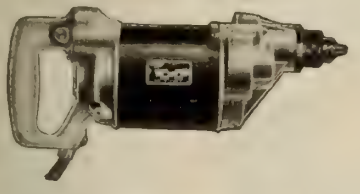
GENEVA, N.Y. U.S.A.

HISEY
Electric Machine Tools

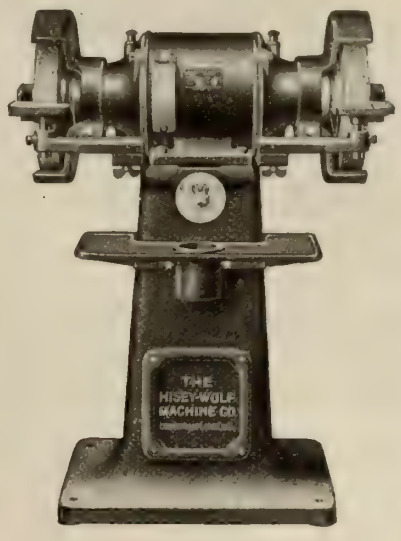
For all requirements from the lightest to the heaviest where power and dependability are essential.



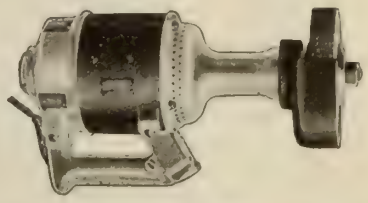
Heavy Duty Drill and Reamer, made in seven styles and sizes up to 1¾″ drilling capacity.



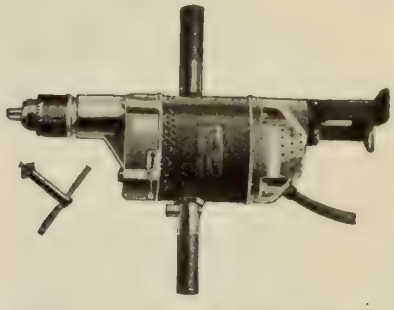
Electric Hand Drill. Made in 3 sizes — 3/16″, ¼″ and 5/16″ capacity.



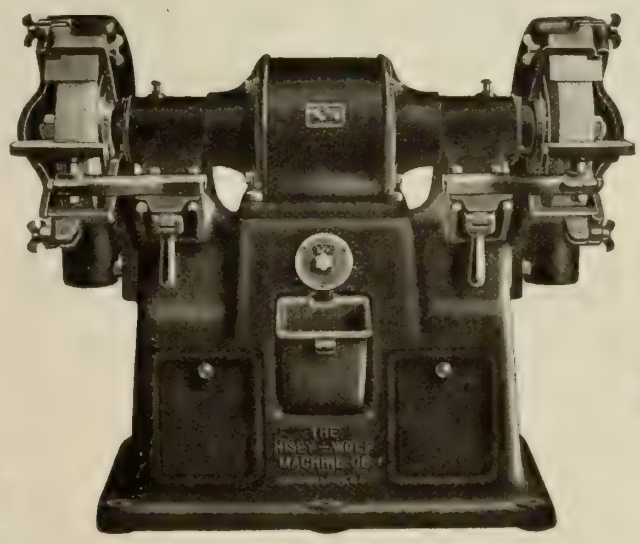
Ball Bearing Floor Grinder. Made in following sizes:—
½ H.P. with 8x¾″ grinding wheels
1 H.P. with 10x1″ grinding wheels
2 " " 12x1½″ " "
3 " " 14x2″ " "

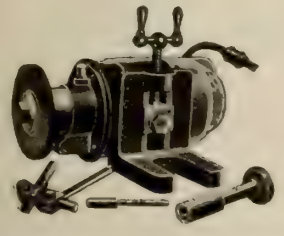


Portable Hand Grinder. Made in 5 sizes—¼ H.P. to 3 H.P.



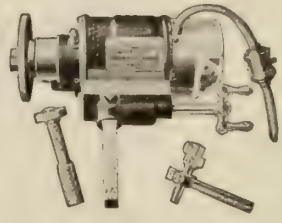
Hand and Breast Drill. Made in single and two-speed designs in ⅜″, ½″ and ¾″ capacities.





Angle Plate Roll and Surface Grinder. Made in 5 sizes—¼ H.P. to 3 H.P.

Ball Bearing Floor Grinder. Made in 5 H.P. and 10 H.P. sizes. 5 H.P. recommended for 18x3″ wheels—10 H.P. recommended for 24x4″ wheels.



Lathe Centre Grinder. Made in ¼ H.P. and ½ H.P. sizes.

HISEY products are systematically designed and BALL BEARINGS are used where applicable.

108-Page Catalog No. 19CM Free for the Asking.

The Hisey Wolf Machine Company, Cincinnati, Ohio, U.S.A.

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Baines & David, Limited

Toronto

IRON AND STEEL MERCHANTS

Bars, Angles, Channels, Beams.
Shafting, Screw Stock.
Cold Drawn Flats, Squares, Hexagons.
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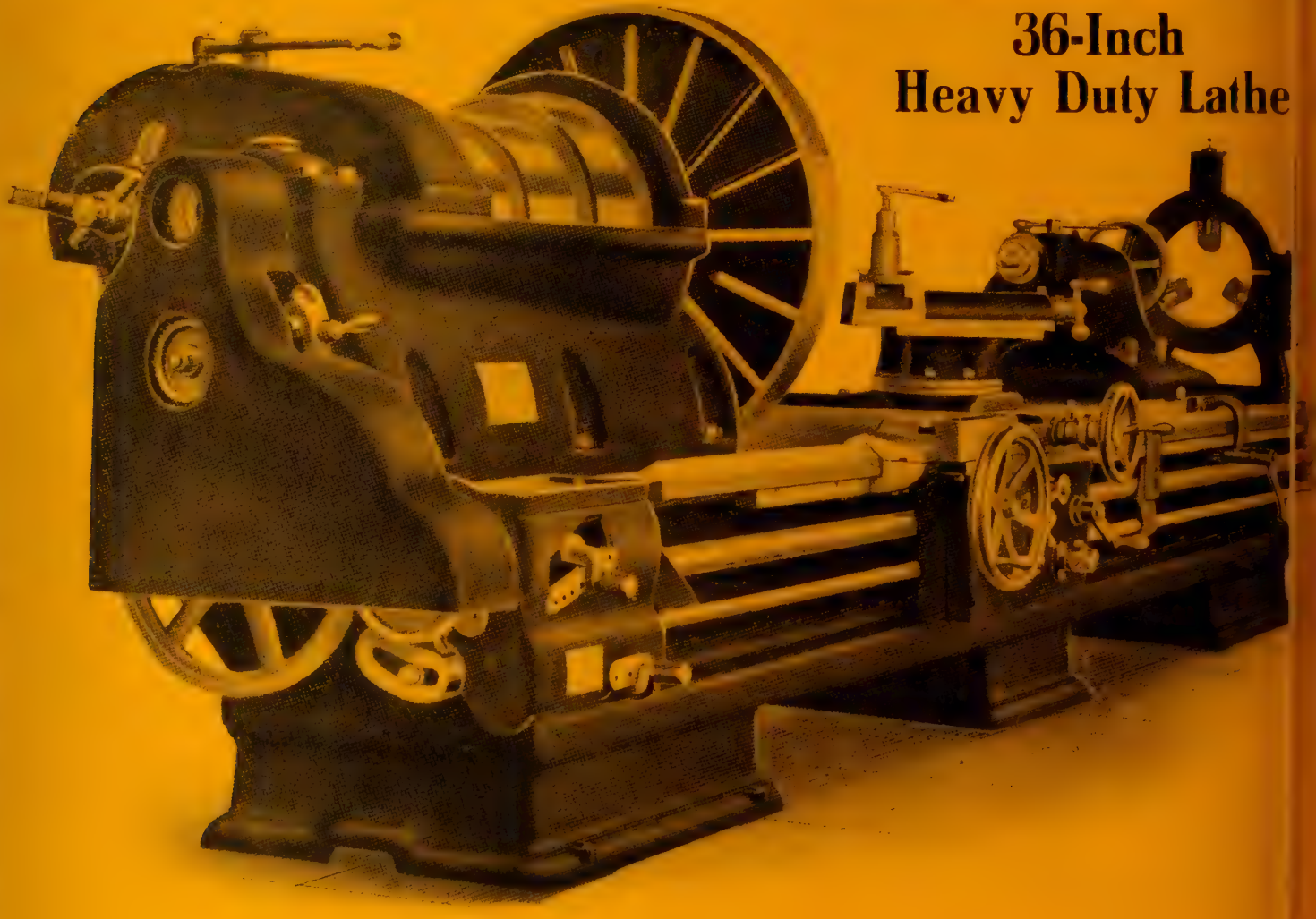
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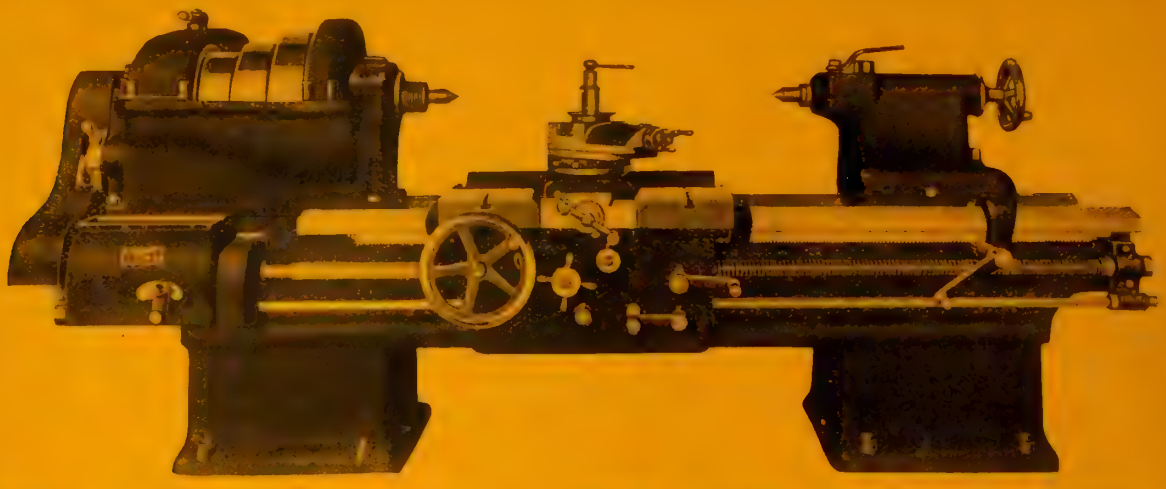
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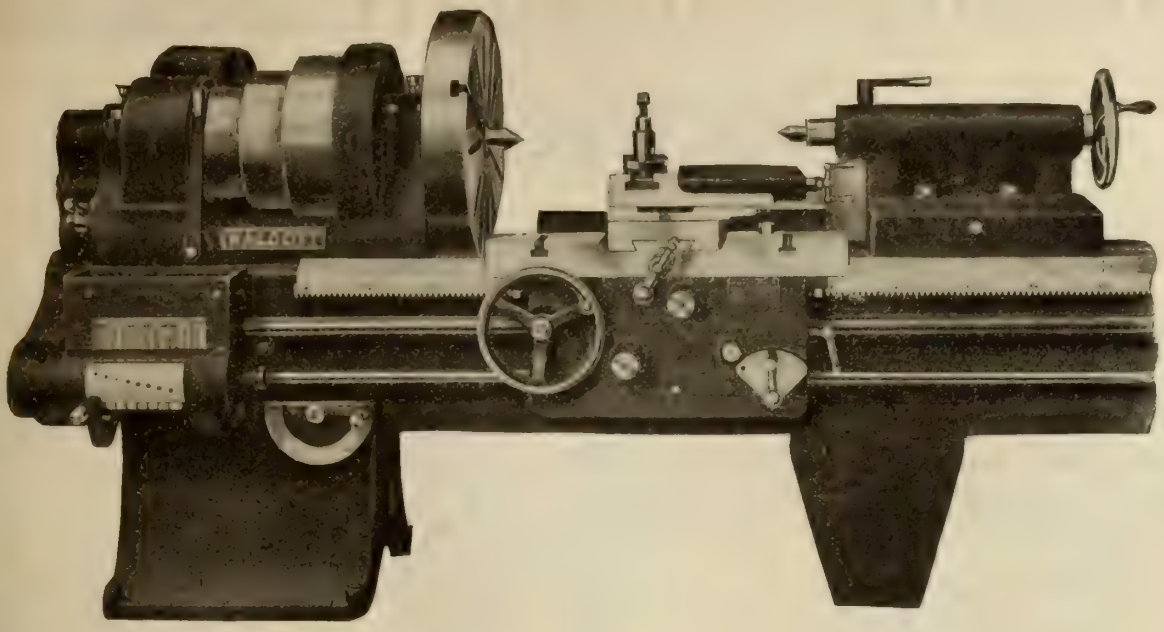
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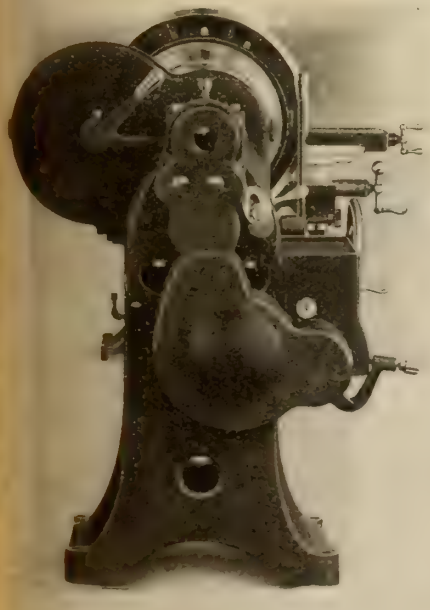
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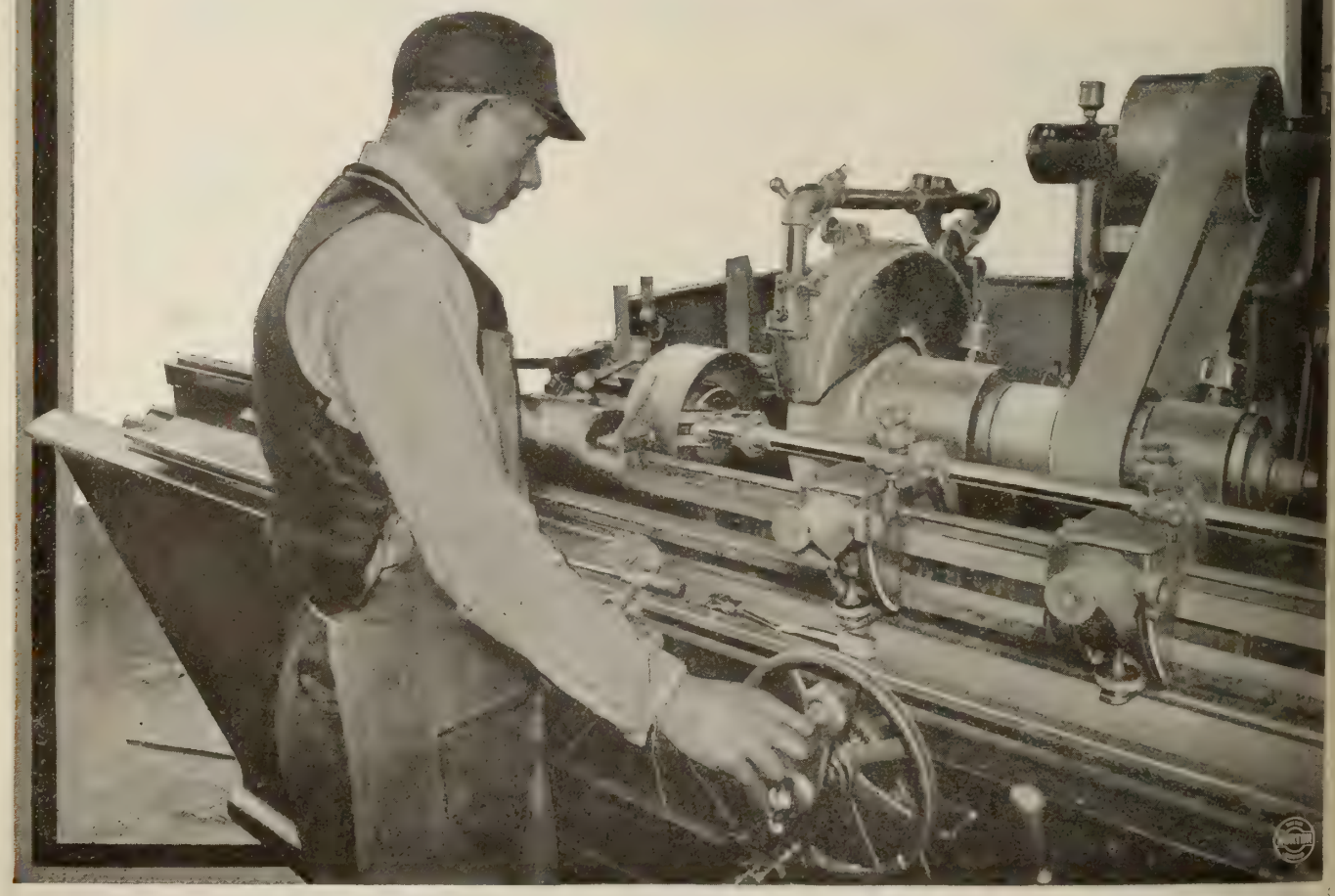
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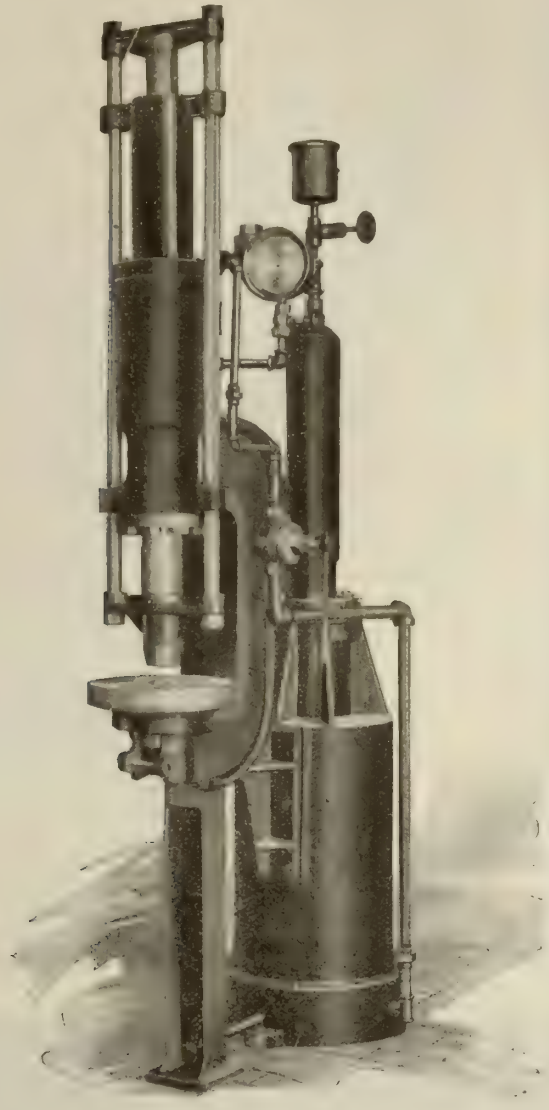
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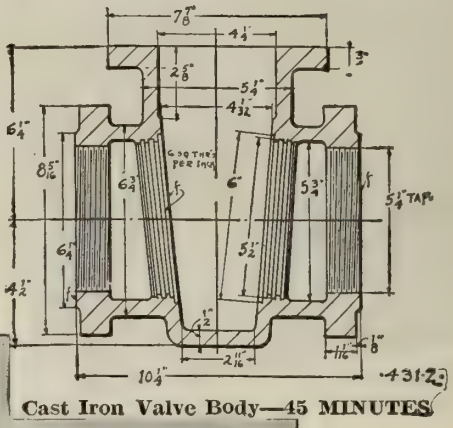
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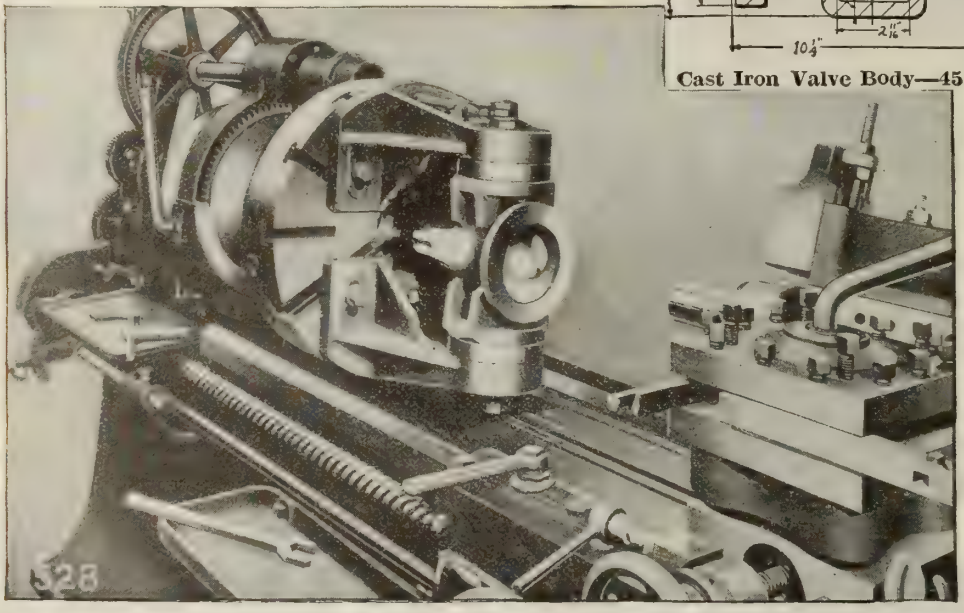
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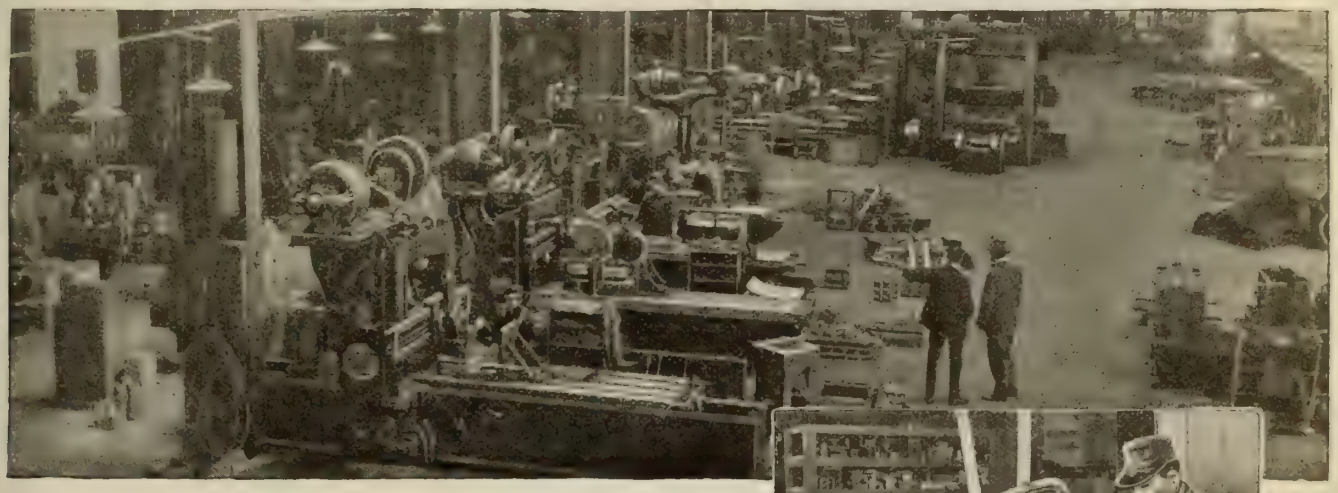
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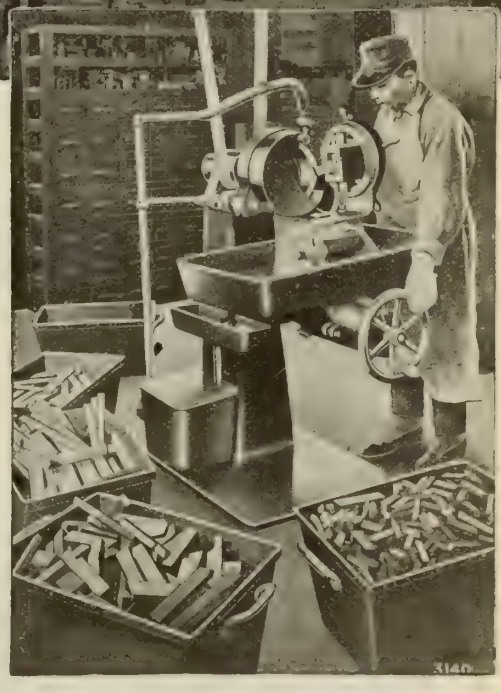
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 6 February 5, 1920

The History and Manufacture of the Telephone

When You Use the Telephone, Do You Realize the Work Entailed in Its Manufacture? The Fundamental Principle of Telephony, With the Manufacture of the Conductors, Etc., Are Explained

By G. C. BROWN*

THE telephone has become so available and its use is so habitual with the majority of us, that we accept it as a necessary part of our daily scheme pretty much without comment, forgetful of the fact that our great grandparents did not know the blessing of a telephone and transmitted their communications either by means of messengers or through the medium of letters written in longhand. Whenever we speak into our office or home telephones and hear the reply coming back from a distance of one hundred or a thousand miles, a marvel is enacted before us, which makes all previous accomplishment in the field of communication look small and ridiculous. In the year 490 B. C., a Greek runner carried to Athens the momentous tidings of the victory of the Greek General Miltiades over Darius and his Persian host on the field of Marathon. The athlete completed the distance of twenty-six miles in something over two hours, delivered his glad tidings and then fell dead. If Miltiades had possessed a field telephone connecting the Grecian camp with Athens, he could have communicated the news of his victory in two minutes and the runner's life would not have been sacrificed. Comparisons of this nature bring home to us something of the debt that we owe, both to the man who invented the telephone and to those who during the past forty years have labored to improve it.

It is just forty-three years since Alexander Graham Bell exhibited his telephone at the Philadelphia Exposition of 1876. The telephone of to-day does not greatly resemble this first working model which was a crude affair that would barely transmit speech over short distances. A succession of developments, following each other with bewildering rapidity, have given us first long distance or toll lines, next the automatic telephone and as a final triumph, the wireless telephone.

While this rapid development has brought untold benefit to our twentieth

*Associate Member Am. Soc. M. E.



FIG. 1—MAIN FACTORY AND GENERAL OFFICES. NORTHERN ELECTRIC COMPANY, LIMITED, MONTREAL.

century civilization, it has carried with it the disadvantage that time has not been provided for the preparation of standard text books on telephone manufacture. In other fields of scientific development, notably the application of steam and electric power to industry, there have been periods of quiescence or breathing spaces during which a comprehensive literature has been created and kept reasonably up-to-date. The history of the telephone, since its inception, has been one of constant change and manufacturing practice has had to undergo a corresponding process of continual readjustment. A number of excellent books on the telephone have been published. These, however, are devoted chiefly to elucidation of the principles underlying telephony and to the design of the telephone and its auxiliary equipment. Problems of manufacture are either not touched upon, or at best are dealt with in a perfunctory manner.

In order to successfully manufacture telephones from day to day, peculiar problems in almost all branches of applied science and economics have had to be attacked and solved, and to this list, which I will not trouble to enumerate, have recently been added problems in Sociology and Vocational Training.

Fundamental Principle of Telephony

In order that the various steps in telephone manufacture shall be properly comprehended, it is desirable that we dwell briefly on the fundamental principle which makes the telephone possible, and also on the "modus operandi" of a telephone system. The telephone in its most elementary form includes two units, each consisting of a transmitter and a receiver, situated apart, and interconnected by means of two electric wires into which a delicate electric current is automatically switched when the receiver is raised from its hook. The transmitter or "speaking" part contains a circular metal diaphragm,, sufficiently thin, and so placed that it will vibrate under the influence of the human voice. In the transmitter the current must pass through a small box of granulated carbon before reaching the line wire, the transmitting diaphragm forming the outer or "mouthpiece" side of this box. When the transmitting diaphragm vibrates under the influence of sound, it controls the current passing through the carbon and into the line. The receiving or "listening" part of the telephone contains a permanent magnet with both its poles in close proximity to a circular metal disc similar to that in the transmitter. The fundamental priciple of the telephone consists of the control of the delicate electric current in the line by means of the vibrating transmitter-diaphragm, the variations in current thus produced passing over the line and into the magnet of the distant receiver. The energising effect produced on this magnet sets up sympathetic vibrations in the receiver diaphragm, which when held to the listener's ear, reproduces the sound or sounds registered into the distant transmitter.

This simple description applies to a condition where communication is provided between two telephones only. In a telephone system, however, there are many hundreds of telephones, all of which must be interconnectable. This difficulty is solved by bringing all the telephone wires into one central exchange and having them terminate at a switchboard, a socket in the board marking the terminus of each line. An operator in the central office or exchange is now able to temporarily interconnect any two sockets by means of flexible interconnected wires or, as they are termed, "cords," each equipped at one end with a metal plug. By placing one of these plugs into the socket corresponding to one telephone line and a second plug into another socket, both phones become directly connected to each other and communication is established. This provides for the connection of any two lines on the switchboard, but does not provide a connection between the exchange operator and the distant telephone which is seeking a connection. It has, therefore, been found convenient to have additional sockets placed in front of the operator, and to carry branch lines from her main line to these sockets which are termed "answering jacks." One of these "answerin jacks" is, therefore, provided for each telephone connected with the exchange.

In order that the exchange operator may know when one of her subscriber wishes to speak to her, a miniature electric lamp is placed beside each "answering jack." This lamp is automatically switched on when the calling subscriber raises the receiver from its hook, and when "Central" has made the desired connection, it is automatically switched off. The switchboard also has "ringer" keys and the operator by depressing one of these keys, which are situated in front of her, can ring any subscriber's telephone, and in this way signal the fact that connection is established with another subscriber. The term "subscriber" by the way covers anyone who has rented telephone service from the Telephone Company and is, therefore, connected up to an exchange.

The conductors which serve as the carrying medium in a telephone system, naturally constitute a very important part of the system. Under the heading of "Conductor" are included, first — the large telephone cables, either underground or aerial, which are used in congested area, or for long distance transmission between cities, or for connecting up exchanges. The chief advantage following the use of a cable lies in the fact that is compact, and serves as a container for a considerable number of telephone circuits or individual lines. Telephone cables are made up of annealed copper wires, each wire insulated with spiral wraps of paper. Two of these conductors are then twisted together to form a "pair." The required number of pairs are then stranded into the form of a cable and covered with paper wrapping. This cable or "cable core" as it is termed at this stage, is next dried, and as a final operation, is covered with a protective metal covering or "sheath," consisting of an alloy of either lead and antimony or lead and tin. These steps

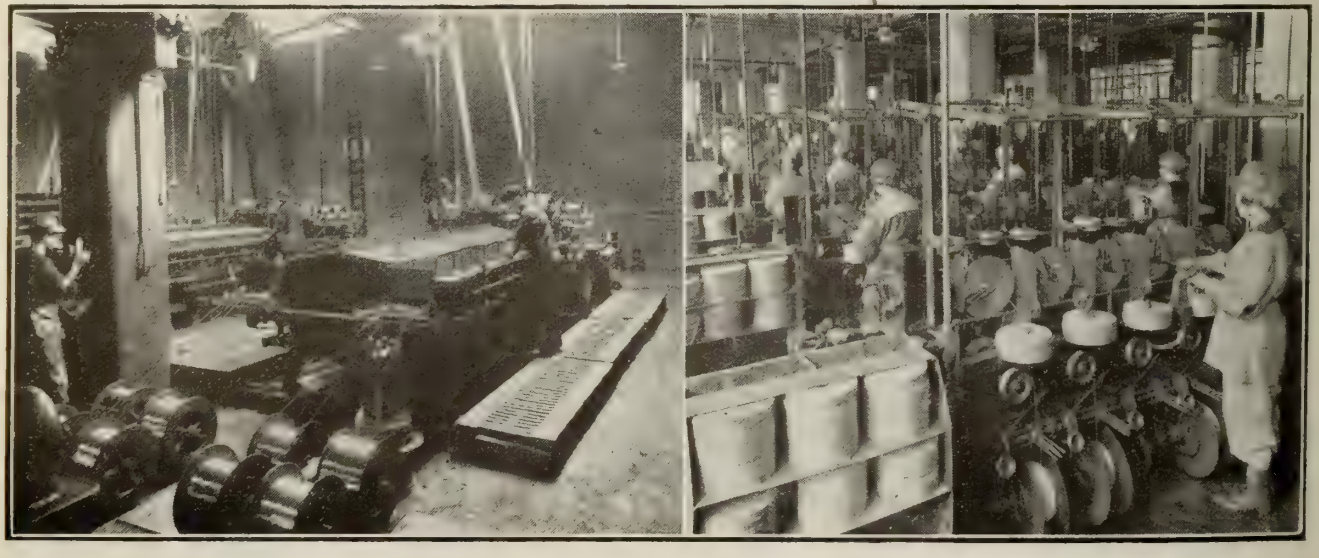


FIG. 2—DRAWING WIRE OR WIRE-DRAWING MACHINES.

FIG. 3—FIVE HEAD TELEPHONE INSULATOR MACHINE USED FOR PAPER INSULATING TELEPHONE CONDUCTORS

in cable manufacture will be dealt with in more detail later on.

Under the heading of "Conductors" are included next the various feeder or distributing wires, so termed because they serve to distribute telephone service from the larger cables to public or private buildings. These wires are used between poles and houses, and at the house entrance connect into other conductors known as inside wires. Both of these forms of conductor are insulated with rubber, over which is braided one or more layers of cotton, and if the conductor is to be exposed to the outside weather, it is impregnated with a weatherproof compound which serves to greatly increase the durability of the insulated covering.

Next we have the switchboard wires which, as the name suggests, are used in the wiring of telephone switchboards at the exchanges, then the distributing frame or "jumper wires," which provide a connecting link between telephone cable and switchboard; then the flexible cords used in making the switchboard plug connections, and which are also used as the local connection between telephone and ringer; and lastly, the fine silk or cotton covered magnet wires used for winding about relays, induction coils, etc.

Manufacture of Conductors and Telephone Apparatus Conducted Separately

In order that telephone service be brought within the reach of humanity, therefore, it is necessary to manufacture:

First—Telephone conductors, including cables, telephone wires, magnet wire, switchboard wire and cable, distributing frame wire and flexible cords.

Second—Telephone apparatus, including the assembled switchboard, distributing frames, receivers, transmitters, signalling apparatus, etc.

I have placed the conductor first, because the assembly of numerous pieces of telephone apparatus pre-supposes the existence of various forms of conductor. Induction coils for instance must be wound with magnet wire before they can be assembled into telephone apparatus. The switchboard, before it can be assembled in permanent form, must have the necessary switchboard wires, distributing frame wires and flexible cords. The manufacture of the conductor in a certain sense precedes the manufacture of the telephone apparatus.



FIG. 6—TWO ROWS OF NEW ENGLAND BUTT BRAIDERS. EXTERNAL BRAIDING SILK AND GLAZED COTTON ON FLEXIBLE CORDS

Until quite recently it has been considered desirable to manufacture conductors and telephone apparatus through separate organizations, chiefly owing to the fact that from the production standpoint there are marked points of dissimilarity between the problems involved. The building up of a telephone cable, for instance, is a synthetic operation in which, starting with a copper wire base, something is added at every stage until, at the end of the last stage, we have the finished cable. This same idea applies to the manufacture of all conductors. The types of machines used, moreover, are peculiar to that class of work, and in many cases have been developed to perform a definite operation. Under this heading are included insulators, twisters, stranders, etc. The manufacture of telephone apparatus is characterized by a constant flow of small parts towards a final assembly, the machines used being largely the conventional type found in all factories, lathes, screw machines, punch presses, etc.

While practice has until very recently kept the manufacture of conductors and the manufacture of telephone apparatus distinct, the manufacturing operations for the two classes of work being performed through separate organizations and in separate factories, this is in process of change, and the entire manufacture of the telephone is gradually being brought under one functional organization. In outlining the manufacturing operations, however, we will observe the division mentioned, and will proceed, first, with a brief description of the operations incidental to the manufacture of cables, wires and cords, as performed



FIG. 4—LARGE TELEPHONE STRANDER SHOWN STRANDING UP A TELEPHONE CABLE.



FIG. 5—THIRTY-INCH LEAD PRESS AND MELTING KETTLE. TELEPHONE CABLE CORE BEING COVERED WITH LEAD

in the Shearer Street factory of the Northern Electric Company.

The Manufacture of a Telephone Cable. Wire Drawing

The first stage in the manufacture of a telephone conductor consists of drawing the copper wire to the desired gauge, wire for use in telephone cables being in most cases drawn to a finished diameter of either Nos. 19 B & S or 22 B & S gauge (.036 in. and .025 in. respectively). The drawing of copper wire is rendered possible through the property possessed by that metal of permanent extensibility with a corresponding reduction in cross-sectional diameter, when a rod rolled from a copper ingot is pulled through a die, or a number of dies, the inside diameter of which corresponds to the diameter of wire desired. The wire-drawing operations are performed on various types of machines, the details of these varying in accordance with the fineness of gauge required in the product. All wire-drawing machines, however, fall into one of two general classes depending on whether one die, or more than one die is used in a single drawing operation or "pass." These two classes are:

(a) Single Block Machines.—When one die is used, effecting a single reduction in the diameter of the wire.

(b) Continuous Machines.—When a number of dies, effecting simultaneously a series of reductions are used.

All telephone conductors are drawn on continuous machines, and magnet wire as small as No. 40 B & S gauge (about the same diameter as a human hair) is produced daily. The die used in wire drawing may be a piece of chilled iron, or for finishing gauge it may be a diamond or a ruby. The object of utilizing precious stones is to enable the dies to be used for a considerable time without losing their size and so producing wire of incorrect diameter.

The mechanical action or wire-drawing has the effect of hardening the wire, this rendering it unworkable, and also impairing its electrical properties. It must therefore be annealed at intervals during the progress of drawing. The annealing operation at the Northern Electric Co. is accomplished in large gas-fired furnaces served by two gas producers.

Fig. No. II shows one of the Northern Electric Company's continuous wire-drawing machines.

Insulating and Twisting

If the wire is to be used in the manufacture of lead-covered cables, it must, after having been drawn to the correct gauge, be insulated with a wrapping of paper. This operation is accomplished on high-speed insulators, the paper being spiralled about the wire, which travels through the machine at a high rate of speed and in finally wound about iron reels known as "take-up reels." Each insulator is equipped with five insulating heads arranged in such a way that five parallel wires pass through simultaneously. A girl attends to all five heads as shown in Fig. III.

The insulated wires are next twisted into pairs, this operation being performed on high-speed twisters. The twisted pair obtained at this stage provides a single telephone circuit. The twister heads, sometimes termed "fliers," turn at a speed of 500 r.p.m., the twisted wire being taken up on large metal take-up reels in readiness for the operation of stranding which follows next in the sequence.

Stranding

From the high speed twisters we have an accumulation of reels of insulated and twisted pairs, each pair a distinct telephone line. These twisted conductors must be bundled into the compact form of a cable, and as a cable frequently contains as many as nine hundred telephone lines, the bundling or stranding machine must be somewhat elephantine in design.

By referring to Fig IV, showing one of the Northern Electric Company's large telephone stranders, two outstanding features will be observed. First, that a strander occupies considerable longitudinal floor space, and second, that the reels of twisted pairs are loaded upon it in a cluster-like arrangement throughout its entire length. A telephone strander consists of a number of hollow cylindrical sections, known as strander drums, each section accommodating a certain number of reels of twisted pairs, and as a cable during the progress of stranding is increasing in diameter throughout its length, the capacity of each strander drum for these reels is successively greater than the one before it.

When the reels are in position on their respective shafts, the end of each twisted conductor is threaded through an eyelet, all the conductors converging then towards a central die, one of the latter being in place before each strander drum. The various drums are then placed in operation and revolving in alternately opposite directions, bundle the cable into compact spiral layers. As the stranded cable emerges from the last strander drum, a layer of cable paper is wrapped about it in regular convolutions, the cable at this stage being known as a "cable core." (It does not, by the way, attain the full dignity of a finished cable until lead covered. The cable core is finally taken up on a vertical drum mounted on a truck termed a "core truck," and when the latter is full, it is removed from its position in front of the strander and an empty core truck substituted.

Testing for "Crosses" and "Opens"

It frequently happens that the paper insulation about individual conductors is not continuous and that through some accidental circumstances there is at some point in a length of stranded cable an uninsulated or "bare" spot. If two of these bare spots occurring in adjacent conductors are squeezed into contact with each other, the resulting condition is termed a "cross." It frequently happens, also, that, owing to the necessary tension on conductors during stranding, one or more of these are broken, the cable under these circumstances emerging from the strander with certain conductors not continuous. This second condition is known as an "open." If a cable containing either of these defects were permitted to leave the factory and be placed in service, the result would be a short circuit through the crossed conductors, and no circuit through the open ones. It is very important, therefore, that all telephone cables be carefully tested for these faults, and this test is conducted immediately after stranding by connecting the pairs one by one with an electric bell or buzzer, and ringing them out. If a cross or an open is found through the failure of certain pairs to ring out in a satisfactory manner, the exact location of the defect must be established, this being accomplished by means of a Wheatstone bridge. When the faults have been located, the paper wrapping is removed from the cable at this point and if the fault is a cross, the conductors are properly insulated apart; if an open, they are brazed together.

Drying the Cable Core

The next operation is that of drying



FIG. 7—BENCH WORK ON FLEXIBLE CORDS. GIRLS BINDING ENDS OF CORDS AND SOLDERING METAL CONNECTIONS INTO PLACE.

or desiccating the cable core in order to expel all moisture. The loaded core trucks are now wheeled to large steam-heated drying ovens, where the cable is exposed to a drying heat for a period ranging from twenty-one to forty-two hours, this period governed by the size (number of pairs of the cable).

The elimination of moisture from a cable by drying has the effect of greatly increasing the transmission efficiency of its component pairs by controlling two electrical properties known technically as "electrostatic capacity" and "insulation resistance." The electrostatic capacity of a dried cable is low and uniform, while its insulation resistance is very much higher than that of an undried cable. Moisture, while not a good conductor of electricity, is nevertheless a conductor, and if permitted to remain would cause a condition similar, in a sense, to the fault described as a "cross," thus creating local interference throughout the cable when placed in service.

Lead Covering

After drying, the cable core is covered with a protective lead pipe or sheath, the thickness of which varies from 1-32 to ¼ of an inch, depending on the diameter of the cable core. The core truck with its load of cable core is transferred, after the drying operation, to another oven situated behind a large hydraulic press, the latter equipped with a hollow core-tube and forming die, and driven by a multi-speed pump. Immediately above the assembly of core-tube and die is placed a lead cylinder or container into which molten cable sheath alloy, consisting of lead plus a small percentage of either antimony or tin, is run from an independent melting kettle. The lead cylinder is first charged with molten alloy, and the charge permitted to cool to plasticity. The hydraulic press is then placed in operation and forcing the plastic alloy into contact with a vertical ram, squeezes it out between the core tube and forming die, at which point it comes in contact with the cable core, the end of which has previously been thrust into the hollow part of the core tube. The cable sheath thus forced through the die, grips the cable core and carries it along, the lead-covered cable as it emerges from the press being reeled up on large wooden cable reels.

The operation of a lead press requires considerable skill on the part of the workmen employed, as the cable sheath must be perfectly concentric throughout its length. The usual gang consists of an operator, who attends to the running of the press, and a helper who attends to the charging of the melting kettle and press cylinder and also sees that the cable is being properly reeled up on the take-up reel.

A sense of proportion in regard to this operation will be gained by glancing at Fig. V. which shows a 30-inch lead press extruding cable sheath.

The cable, from the manufacturing standpoint, is now complete, and passes next to a rigid final inspection. If it comes through this ordeal in a satisfactory manner, it is pronounced fit for shipment and is encased on the cable reel by means of wooden lags, after which the reel is transferred to the shipping platform.

The Manufacture of Rubber-Covered Telephone Wires

The distributing wires or "feeder" lines which form the connection between poles and house entrances and the inside wire running from the house entrance to the telephone, have no protective lead covering as in the case of large underground cables. In order that the individual conductors shall be properly insulated apart and moisture-proof, it is necessary that they be rubber covered. The Northern Electric Company therefore maintains complete equipment for the compounding and manufacture of rubber, and also machines for encasing the conductor in its rubber covering. Two types of machine perform the latter operation. One, a "strip insulator," equipped with a grooved die, which presses longitudinal strips of rubber about the conductor. The other, a "tube insulator," which extrudes the rubber through a core and die in much the same way that a lead press extrudes the metal sheath about a cable core.

The manufacture of the rubber used for insulating purposes is in itself a veritable science, and gives rise to many special problems. The rubber is received in crude form from forests and plantations in the tropics, and must undergo a cycle of preparatory operations before it can be used for insulating purposes. First it must be washed for the removal of foreign matter. Next it is hung up in long strips and subjected to a slow drying process. Then it is mixed or compounded with other materials which are added in various proportions, in order that the final compound will possess the proper physical characteristics. One of the most important materials used in compounding is sulphur, the vulcanizing constituent of all rubber compounds, which, when added, tends, under the influence of heat, or as it is termed "a cure," to interact chemically with the rubber and greatly increase its physical strength.

If the rubber is to be used for strip insulating purposes, it passes, after mixing, to calender rolls, where it is pressed into thin sheets, which are cut into strips of a suitable width for the strip insulator. If it is required for tube insulating purposes, it is rolled into heavier sheets, which are then cut into thick strips and fed into the forming die of the tube-insulating machine.

In order that sulphur in the rubber compound will not interact chemically with the copper conductor, the latter after wire-drawing, and before insulating, is coated with tin, by passing it through a molten bath of that metal. After the conductor has been strip or tube insulated, it is subjected to a steam or a dry cure, the nature and effect of which have been referred to. It then passes to a braiding machine, and is covered with an external braid of cotton, through which is run a thread of another color known as a "tracer" and used for identification purposes.

Figure No. III shows a double row of braiders working on flexible cords. It will be observed that the braider consists of a horizontal table, with individual vertical spindles or "carriers" provided for each spool of cotton or silk, and that the wire passes vertically from a give-up reel into the machine, receives its braid, passes about an overhead capstan, and finally down to a take-up reel situated near the floor. Interesting details in the construction of a braider consist, first, of a mechanism whereby the braider automatically stops if a single thread breaks while it is in operation; and next, the



FIG. 8—MULTIPLE SWITCHBOARD IN A CENTRAL EXCHANGE.

fact that two or three distinct layers of braided insulation can be simultaneously braided by using a braider with double or triple decks of carriers. On certain types of wire, one girl can, without difficulty, operate as many as forty-five of these machines.

After braiding, the conductor is impregnated in dielectric or weather-proof compounds and is polished mechanically. Two wires are then twisted together to form a pair. A careful inspection follows, after which the twisted pair is coiled into the desired length, the coil is tied with tape and finally wrapped with paper or packed in boxes ready for shipment.

Telephone and Switchboard Cords, Magnet Wire and Switchboard Wire and Cable

The green telephone cord, a familiar part of our office or home telephone equipment, and the switchboard cord, which enables the exchange operator to make her myriad of daily connections, differ from the forms of conductor which we have hitherto considered, in that the conducting element of a cord is not a solid copper wire, as in the previous cases of telephone cable and rubber covered wire. It is obvious that the most important characteristic of a cord in service must be perfect flexibility combined with sufficient durability. Tinsel threads are therefore twisted together, and these instead of a solid copper wire form the conductor. Each cord consists of two or more conductors, insulated, apart and covered with an external braid of either cotton or silk, the finished cord having at either end the necessary terminals or connectors.

As many styles of cord are manufactured, the following list of operations on a switchboard cord can be regarded as typical of all cords, the greatest number of operations incidental to the manufacture of any cord being included:

I.—Insulating the tinsel conductor with two lappings of silk.

II.—Impregnating the insulated conductor with a moisture-proof compound.

III.—Braiding the impregnated conductor with soft cotton. One thread of a distinctive color being used as a 'tracer" for identification purposes.

IV.—Twisting two or more conductors together with a filler of twine to render the cord round.

V.—Cutting the twisted conductors to the proper length.

VI.—Unravelling the cord at switch and plug ends.

VII.—Binding the conductors with cotton and wire at switch ends.

VIII.—Binding the conductors with silk, cotton and wire at plug ends, also forming ends of conductors to fit plug.

IX.—Braiding reinforcements of soft and glazed cotton wherever required on cord. External braiding of entire cord.

X.—Soldering connectors on plug and switch ends of cord.

XI.—Waxing cord at plug end. (In wax tank).

XII.—Inspection of finished cord.

Figure VII shows the manner in which the binding and soldering operations are performed on telephone and switchboard cords by girls working at benches. Soldering is accomplished by means of electric soldering irons.

The manufacture of magnet wire is less complex than the processes which we have been describing, as fewer component operations are involved. The incidental operations, however, require the exercise of great skill and care owing to the extreme fineness of the work. Magnet wire is frequently as small as No. 40 B. & S. gauge (.0031 in.), and as its insulation must be spiralled on perfectly even by an insulator running at a very high rate of speed, the operation is necessarily a delicate one. The girl operators, in time, develop a high degree of skill in detecting the presence of skips or knots in the insulation as the wire passes through, and promptly shut off the heads in order to repair the trouble. A skilled magnet wire operator is said to possess "a touch" which signifies that by running her fingers lightly and deftly over the moving wire she can find flaws in insulation which would probably escape her if she depended wholly on sense of sight.

The copper conductor used in the manufacture of magnet wire must have high electrical conductivity and be thoroughly annealed. Only the highest grades of cotton or silk can be used, the Northern Electric Company using for this purpose a soft, even cotton known as "Sea Island" cotton, and a high grade of silk called "Italian Tram." The insulating machine is similar in principle to the five-head telephone insulator shown in Fig. III, with marked differences, however, in details of design and using an entirely different insulating material.

Magnet wire is manufactured in either round, flat or square form and is insulated with either cotton, silk, asbestos or combinations of these materials as required. Before being sent out of the factory on wooden spools, it receives a careful inspection.

Switchboard cables, each containing a number of conductors insulated with servings of silk and cotton, stranded into the form of a core and covered with either an external flame-proof braid or a protective lead sheath, constitute the main feeders in central exchanges. The conductors may be stranded in singles, pairs or threes, the cores being covered by one of three methods outlined in the "Northern Electric Handbook" as follows:

First Method: Dry Core—Layer of paper tape, layer of lead tape, layer of paper tape, an external flame-proof braid.

Second Method: Impregnated Core—Two layers of paper tape, an external flame-proof braid.

Third Method: Dry or Impregnated Core—Two layers of paper tape, a protective lead sheath.

Switchboard wire, as implied by its name, is used for interior wiring in cen-



FIG. 9—GIRLS WINDING INDUCTION COILS, RELAYS, RECEIVER MAGNETS, ETC.



FIG. 10—ELECTRO PLATING BATHS USED IN NICKLE PLATING TELEPHONE APPARATUS.

tral exchanges and is manufactured in the form of single conductors or twisted pairs. The individual conductors are of annealed, tinned copper insulated with servings of silk, covered with an external cotton braid and finally impregnated with a moisture-proof compound. Switchboard wire for use under special conditions, receives a coat of enamel before insulating, this being a recent manufacturing development.

Distributing Frame Wire

The last type of conductor which we will consider is distributing frame, or as it is more commonly known, "Jumper" Wire. This conductor forms the connecting link between the large telephone cables, at the exchange, and the more local switchboard cables, every large exchange having beneath the switchboard floor a complicated arrangement of these interconnections. Distributing frame wire is rubber insulated in a manner similar to rubber covered telephone wire and is afterwards braided and saturated with flame-proof compound.

The Manufacture of Telephone Apparatus

The production of telephone apparatus has already been described as a continuous flow of countless component parts or "piece parts," through a succession of manufacturing operations towards a final assembly, from which latter stage emerges a piece of assembled apparatus containing, perhaps, thousands of the original piece parts. The term piece part, incidentally, is applied to any component which is not complete in itself, but which must be assembled with one or more other piece parts, before it can be catalogued or shipped. When it attains this state it becomes a piece of apparatus. Piece parts are constantly losing their identity, as they journey through a factory, by assembly into larger piece parts or "assemblies," these assemblies being swallowed up in larger assemblies, until the final assembly is made. Samples of telephone apparatus which pass through these stages are: switchboards, power boards, distributing frames, subscriber's set, desk stands, transmitters, receivers, etc. In the manufacture of these and additional forms of telephone apparatus, piece parts numbering into the millions are used.

Each piece part must pass through one or more operations before it is ready for an assembly and each assembly must, in its turn, be machined or otherwise treated until the apparatus stage is finally attained. The telephone apparatus shop of the Northern Electric Co. includes, therefore, completely equipped wood-working, iron-working and mechining departments in addition to those engaged on assembly work.

As it is impossible within the compass of an article to describe all of the manufacturing operations and assemblies incidental to the manufacture of telephone parts, a few outstanding ones of special interest will be dealt with.

Winding Induction Coils, Relays, Etc.

The manufacture of magnet wire has been described under the heading of conductors. This wire, after inspection, is transferred on wooden spools to the winding department, where—by means of small winding machines installed in front of work benches—it is wound in horizontal layers about solid or laminated cores, emerging finally in the form of induction, retardation, relay, receiver magnet or resistance coils, etc.

This operation is performed by girls seated at benches, as shown in Figure IX. While the transfer of the layers of wire, from the wooden spool to the coil, is accomplished by means of the winding machine, the wire is "cross-fed" or guided across the core by hand, and as it is extremely fine in gauge, great skill must be exercised so that convolutions will be regular and layers even. Girls employed on this work, as in the case of magnet wire insulators, develop a "touch" which tells them when all is not well. Under the latter circumstance, the winding machine is stopped and the uneven convolutions of wire unwound by hand, after which the winding operation is resumed. This "touch," which impresses the observer as a sort of sixth sense, is the result of years of practice, during which a degree of skill, bordering on intuition, has been gradually developed.

The Desk Stand and Subscriber's Set

The most widely known form of telephone equipment is probably the familiar "Desk Set," which, to the casual user, consists of a telephone receiver suspended from a hook; the latter projecting out from a vertical metal handle surmounted by an adjustable mouthpiece and supported by a conical metal base with a felt bottom. Equally obvious details are the two flexible cords, one of which passes from the top of the receiver down to a hole in the supporting base, the other passing from the base to a ringer box of polished cabinet wood fastened, usually, to the concealed surface of a desk.

If the subscriber is observant he will note that when he moves the receiver from its hook, the hook undergoes a slight change in position by springing upwards for a distance of about one-eighth of an inch. Nothing more in the external working of his telephone is apparent, and yet, in the space of a few seconds, if he is holding the receiver to his ear, the exchange operator's "number please," comes to him over the line. It is obvious to him that by some mysterious agency he has been connected with the switchboard, but there is nothing to suggest to him in what manner this has been accomplished. So he usually "lets it go at that."

Assembled into the upright handle, (which is a length of hollow brass tubing, with its outer surface either japanned or nickel-plated), is a terminal strip of galvanized steel, to which one end of each flexible cord is connected. Fastened to the side of this terminal strip, are three smaller nickel-silver strips,



FIG. 11—RECEPTION ROOM AT MAIN ENTRANCE TO THE GENERAL OFFICES.



FIG. 12—EMPLOYEES CAFETERIA DURING LUNCH HOUR.

insulated apart and having on their adjacent sides, platinum contact points. One of these strips is longer than the other two and is sprung against the inner or concealed part of the receiver hook. The weight of the receiver hanging on the hook is sufficient to hold this spring in such a manner that the contact points are kept apart. When this weight is removed, however, the points spring together, and a connection is established with the switchboard. That, in brief, is what happens every time the receiver is lifted from the hook.

Surmounting the handle, is the transmitter box containing the transmitter diaphragm—a thin disc of aluminum japanned on its outer side—and the carbon "button" assembly, which is connected with the terminal strip by means of a conductor running down through the interior of the handle. The carbon button and transmitter diaphragm are held in position by means of a galvanized iron bridge, which serves as a mounting for the transmitter assembly. The hard rubber mouthpiece with its perforated rubber back can be included as the final detail in this assembly.

The receiver assembly is simpler than that of the transmitter, and consists of a hollow rubber shell, into which is placed the receiver magnet. At one end of this magnet is the receiver diaphragm, protected by a hard rubber cap, while mounted at the opposite end is the concealed binding post, to which the flexible cord is fastened.

The ringer box or "subscriber's set" forms the last detail in this desk equipment. The ringer box is of polished cabinet wood, surmounted by two nickel-plated bells and contains an induction coil, a condenser and ringer coils.

The Multiple Switchboard

The largest, most imposing and most complicated piece of telephone apparatus is undoubtedly the multiple switchboard. Kempter B. Miller, in his "American Telephone Practice," refers to it as "That wonderful complex whole—the modern multiple switchboard," and when it is considered that any of the exchange operators can, without moving from her chair, connect up any calling subscriber who is connected to that exchange, some idea will be gained of the scope of a single section of one of these boards.

A multiple switchboard is built in sections, somewhat in the manner of a sectional bookcase. These sections are erected beside each other in the central office, expansion up to the limit of available floor space being thus provided for. The multiple characteristic is obtained by having all the subscriber's lines multiplied through all the sections, each operator being thus enabled to plug into the line of any subscriber.

The "Jacks" or switchboard terminals are mounted in strips, these held parallel in a hard rubber mounting by means of brass binders, known as "binding strips." Each exchange operator has on the vertical panels in front of her, horizontal rows of sockets belonging to three divisions of these jacks. The upper division comprises subscriber's multiple jacks, those in the middle division are trunk jacks connecting with other exchanges, while the lower division is devoted to subscriber's answering jacks. Figure VIII, showing a large multiple board in a central exchange, will make clear the jack arrangement, as well as the sectional construction of the board.

The manufacture of the component parts of a switchboard and also a part of its assembly is performed at the factory prior to shipment. Most of the assembly, however, is done at the exchange before erection, after which the connections with the underground cables are made through the main distributing frame.

Details in switchboard construction include the forged iron frame, screwed together in jointed sections—the keyboard with its horizontal row of assembled listening and ringing keys—the maze of rear connections and electrical apparatus including relays, induction coils, retardation coils, terminal strips and local switchboard wires; the assembled jack-strips and switchboard cable; the exterior wood work of polished cabinet wood; and the flexible cords with their plug terminals.

A necessary adjunct to the switchboard is the "Distributing Frame," which, as in the case of the switchboard frame, is fashioned from forged iron and assembled into standard sections. These sections are shipped to the various exchanges and are erected usually on a floor below the operating room. The distributing frame through the medium of "jumper" wires, serves to distribute the outside lines to their proper switchboard connections. The distributing frame wires may be cross-connected at will, this enabling a subscriber to change his residence in the same district and yet retain his original phone number.

Electroplating and Japanning

It is necessary that the outer surfaces of many telephone parts be protected against corrosion, and also that the appearance of certain parts be enhanced by a special finish. This is accomplished by nickel-plating, electro-galvanizing, or japanning the parts in question. If a nickel-plated surface is wanted, the piece parts are hung on brass racks; a row of these racks being then suspended into a plating tank containing a nickel salt solution. Opposite this row of racks are hung a row of pure nickel bars, which serve as anodes or positive poles, the racks of telephone parts providing cathodes or negative poles. Current supplied from a special generator causes the disassociation of the pure nickel anodes, the particles of which, carried through the solution by ionization, plate out at the cathodes, causing a deposition of nickel on the telephone parts. After an immersion of about forty minutes, the racks are removed from the plating baths, the plated parts then being detached from their hooks and transferred to a buffing department where they are polished on buffing wheels. Nickel-plated parts of desk sets, etc., are treated in this way.

Piece parts intended for service where protection from corrosion, rather than appearance, is desired, are electro-galvanized or zinc-plated. This is accomplished in the manner just described, excepting that the anodes are pure zinc bars, the electrolyte solution consists of a zinc salt, and the parts receive in this instance an immersion of twenty minutes.

The familiar black finish seen on the handle and base of the desk stand is obtained by spraying on a coating of japan with an atomizer. This coating is then baked to hardness in an oven.

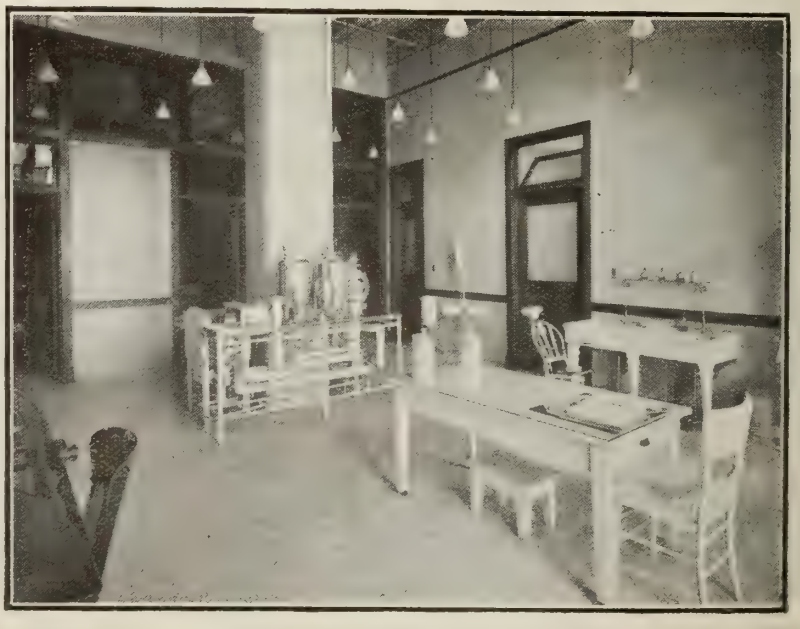


FIG. 13—RED CROSS AND MEDICAL EXAMINATION

Figure X shows the Northern Electric electro-plating department. The tanks in the foreground, containing an acid solution, into which the various parts are dipped before immersion in the plating tanks; this dip serving to remove all foreign matter and provide a smooth plating surface. The operators are shown holding up the brass racks of attached telephone parts.

The General Manufacturing Organization

In the foregoing description, manufacturing operations have been dealt with from the standpoint of their actual performance in the factory. There are other phases of manufacture, however, which bear more indirectly, but with equal importance on the success of the final result. An adequate labor supply, for instance, must be secured, trained, maintained and compensated. Store rooms must be stocked with raw materials and supplies, and these in turn must be issued to the proper shop departments when needed. Each of the multitude of piece parts, which are passing constantly from operation to operation, must be at its proper place, at the proper time and in the proper way. The manufacturing cost of labor, raw material, machinery, tools and supplies must be carefully ascertained and kept, to serve as a barometric record on the economy of manufacture. A raw material, process and final inspection, including physical, chemical and electrical testing, must be conducted in order that a uniformly high standard of quality in the product shall be maintained. A power supply must be generated and distributed. Mechanical equipment must be kept in a state of repair and newer and better equipment must be designed and built, or purchased. Manufacturing methods must be subject to constant development and standardization. Time and motion studies, a necessary preliminary to the setting of piece work and bonus rates, must be conducted. Sanitary and attractive working conditions for factory and office employees, must be provided and maintained. To sum up the whole matter in a single word, all the stages and conditions in and surrounding manufacture must be planned and planned in advance. The operating branch, concerned with the actual performance of the manufacturing operations, is supplemented, therefore, by the following additional branches which attend to the more indirect details of manufacture:

(a) A production branch.
(b) A clerical branch.
(c) An inspection branch.
(d) A plant service and maintenance branch.
(e) A technical branch.
(f) An industrial relations branch.
(g) An installation branch.

These branches are subdivided into, and function through divisions and departments.

In order that the collective efforts of branches, divisions and departments shall attain their greatest impulse, an atmosphere of sympathetic and unselfish co-operation must circulate so thoroughly throughout, that no individual will escape its influence. The importance of this principle as a dominant characteristic in industry is being widely recognized to-day, and the sociological problems incidental to manufacture are receiving greater attention than ever. And they will receive even greater attention to-morrow. Walt Whitman's famous statement that, "Whoever walks a furlong without sympathy, walks to his own funeral dressed in his shroud," applies to life generally, and a great factory, with its assembled human medley, is just a manifestation of life.

Hexagon Making Scheme

By LEONARD SNARY

Thinking that you might be interested in the method which I used in drawing the hexagonal prism (as it appears to the eye), I will endeavor to explain the details, aided by an illustrative drawing This, so far as I know, is original.

After trying several different ways, I discovered the following, which serves the purpose.

Figure 1 is the mechanical drawing of the prism from which we make the "eye view drawing."

Construct a parallelogram E, G, F, H, using the face dimension of hexagon A B, which is 9/16 in., for the length E H. The altitude of the parallellogram may be any suitable dimension, but in this case is 5/16 in. The angle K L may also be any angle best fitted for the purpose, the one chosen here being 60 degrees. Find centre of the parallelogram by drawing lines from E to F and G to H. The distance between points C and D (Fig. 1) is 1 1/8 in. From the centre of parallelogram point o: 9/16 in. on each side horizontally. This gives points I and J, which are the same as points C and D, Fig. 1. Next joint points I, G, F, J, H, E, thus completing the top end of the prism, with the desired slope.

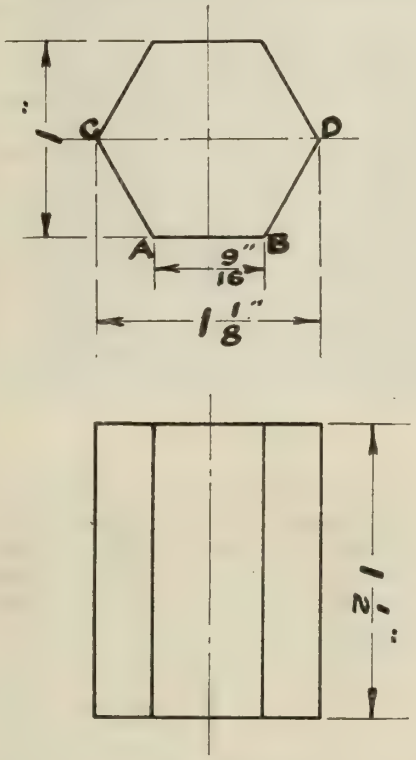


FIG. 1

To finish the drawing, carry down the necessary points to the desired depth, which is 1½ in., and the result will be a part top and a part side view of a hexagon prism.

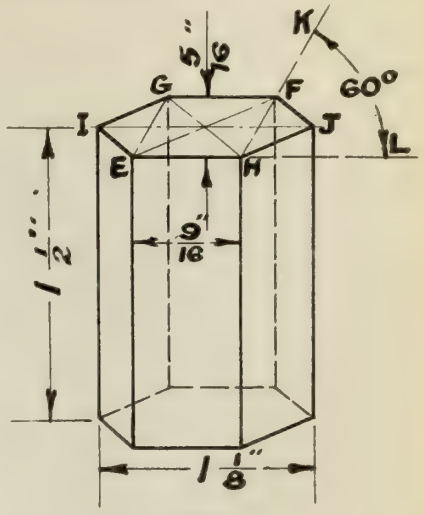


FIG. 2

Make haste slowly when opening an oxygen cylinder valve. There are two reasons why. In the first place, it is injurious to the high-pressure gauge to admit a pressure of 1,800 pounds into the Bourdon tube suddenly. The impact may burst the tube and ruin the gauge. In the second place the sudden compression of the air or gas in the regulator passage is accompanied by heat. The heat may be sufficient under certain conditions to destroy the regulator seat, thus letting the high-pressure oxygen into the diaphragm chamber and bursting the regulator.

A platinum substitute lately tested, according to the "Chemical Trades Journal," in Amsterdam, was an alloy of 89 per cent. of gold with 11 per cent. of platinum. This material, called "platino," withstood sulphuric, hydrochloric and nitric acids, and other reagents used in chemical work, and was unaffected by heating for half-an-hour in a smoky petroleum-gas flame. It proved equal or superior to platinum in ware for the chemist's laboratory, except for the large loss by corrosion when used in contact with a mixture of sulphuric and nitric acids.

Two French scientists have found that X-ray screens made of a compound of tungsten and cadmium give better results than platinum ones at far less cost.

The Booth Rotating Brass Furnace

A Type of Electric Brass Furnace in Which the Shell is Rotated. This Results in Less Zinc Loss Through Vaporization and a Longer Furnace Life.

By Carl H. Booth
Pres. Booth Hall Co., Chicago

ABOUT five years ago we were associated in the design of several electric furnaces for the production of special chemical compounds. These furnaces were cylindrical in shape and arranged to rotate about a central axis through which the electrodes projected. At the time it was suggested that this type of furnace could be adapted to the melting of non-ferrous metals, but there was no opportunity to carry on such work. An illustration of one of these furnaces is shown in Figure 1.

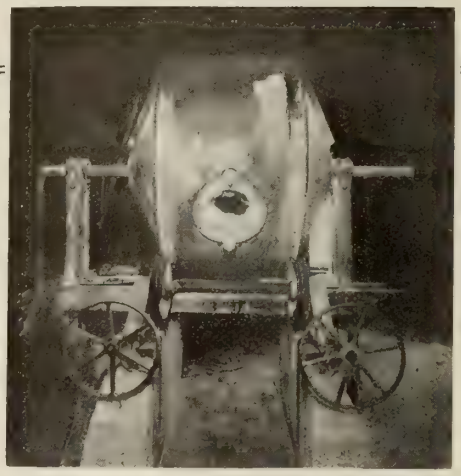


FIG. 1—ORIGINAL ROTATING FURNACE.

In these earlier furnaces a door was provided in the cylindrical surface of the shell and lining, for charging and pouring, but we experienced considerable difficulty in maintaining the lining around this combination spout and door. Further, in pouring the furnace it was troublesome and inconvenient to be obliged to place the ladle between the supports beneath the furnace. Consequently, in designing the present Booth Furnace, these difficulties have been overcome by placing the door in one end of the furnace, as shown in Figures 2, 3 and 4, and having a tapping hole in the other end, as shown in Figures 2 and 3. In this way the cylindrical surface of the lining and shell is unbroken by any opening. This permits the continuous rotation of the furnace, and consequently the absorption of heat by the charge from all parts of the lining, which means no local overheating and uniform wear.

Capacities

As a general rule, the quantity of non-ferrous metal melted at one time, or at one heat, is less than the quantities involved in the melting of steel and iron, and, therefore, smaller sizes of furnaces are desirable.

To meet the requirements of the small foundry, as well as the large foundry, and the smelters and refiners, Booth Furnaces are built in the following sizes:

Rater Holding Capacity	Maximum Holding Capacity
250 lbs.	350 lbs.
500 "	750 "
1,000 "	1,500 "
2,000 "	2,500 "
3,000 "	4,000 "

There are many small plants where heats of 50 to 350 lbs. are required, and the smallest size furnace shown above answers the purpose with great economy, whereas larger furnaces to operate efficiently must produce more metal than is needed. Further, there is also a great disadvantage in trying to pour a ton of brass into small castings and keep the metal hot. We know of a large company having a one-ton electric furnace where it is taking them 50 minutes to pour a heat into castings, and they are finding great difficulty in doing so. Further, the great variety of mixtures made by many small foundries requires a small, efficient unit, from which "short" heats can be taken, producing great flexibility of operation. On the other hand, smelters and refiners frequently require furnaces of relatively large holding capacity, which will turn out a considerable amount of metal per day.

Any one of the above furnaces will melt and bring to pouring temperature a charge of its rated holding capacity in an hour's time, when the furnace is hot.

Mechanical Details

The illustrations and drawings give a very good idea of the general design of the Booth Electric Furnace.

Figure 2 is a cross-section or diagram, illustrating clearly the principle of construction. As will be noted the furnace rotates on rollers, and is carried by two cylindrical tracks. The rollers are driven at the proper speed by a motor, so as to rotate the shell at a speed of two revolutions per minute. No gearing is required encircling the furnace. The current is carried to the electrodes by means of short pieces of flexible cable, which connect to the above-mentioned track, and the current is supplied to the track by means of shoes which press against them and form a sliding contact. The electrodes are regulated by means of screws shown, and on small furnaces are entirely hand-operated, but on the larger furnaces automatic electrode control is used, thus doing away with the necessity of close watching on the part of the operator.

In the small furnaces, the door is in one end only, but in the larger furnaces both ends are provided with a door.

Figure 3 is a photograph of a rear view of a 250-lb. Booth Electric Brass Furnace, in the foundry of Leitelt Brothers, Chicago. This shows the charging door open ready for charging. The latch which holds the door shut when the furnace is charged will be noted and also the electrode projecting through the door. A door of similar type with electrode projecting through it has been in use for a considerable period in the construction of the Booth-Hall steel melting furnace, built by our company. The contact shoes are shown in this view pressing against the track.

Figure 4 shows the same end of the furnace after it is charged and the furnace is ready to run. The flexible cables from the track to the electrode holder are shown, as are also the water-cooling connections for cooling the electrodes. It is not necessary to open the door until after the heat is poured. The door is then opened for charging.

Figure 5 shows a front view of the 250-lb. Booth Electric Brass Furnace, and illustrates well the cylindrical drum type shell and the track driven by the rollers. This also shows the bronze

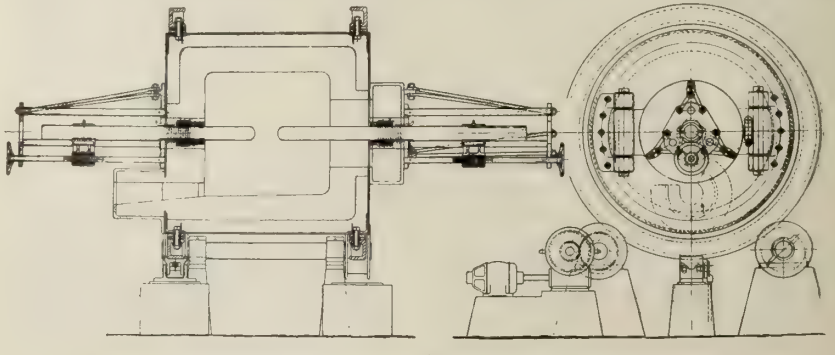


FIG. 2—CROSS SECTION AND END ELEVATION OF FURNACE.

shoes which carry the current to the track and the flexible cable connected with the electrode holder and the water connections. The pouring tap is shown directly beneath the electrode holder frame.

Figure 6 shows a side view of the furnace. The cable supplying the power to the furnace is shown on both sides, coming from conduits in the floor to the bronze shoes. These are the only connections necessary to carry the electricity to and from the furnace. The contractors are shown on the switchboard, together with push-button control for starting and stopping the furnace.

In pouring the ease with which the men handle the ladle up to the furnace, and the operator controls the furnace at the switchboard by means of push-button control, add greatly to economy in operation and to the comfort of the crew.

Lining

Probably the most important of all factors in reliable and efficient furnace operation is the lining. Especially is this true with the melting of non-ferrous metals, where a lining with many joints will have a decided tendency to absorb metal. In order to overcome this difficulty the lining provided with the Booth Furnace is made with as few joints as possible.

In lining the furnace the electrode supporting mechanism at either end of the shell is removed by simply unbolting same from the end plates. These are made as a unit and in taking them off they do not get out of adjustment or out of line, and therefore do not require any adjusting when put back in place. The shell is then lifted off the rollers by suitable hoist or crane, just as if it were a barrel and is turned on end so that the end plate of the furnace shown in Figure 3 can be unbolted and removed from the shell.

Figure 3 shows to some extent how this lining is made. The door is made of one solid piece of brick with a hole in the centre through which the electrode projects. The cylindrical part of the furnace is made of two cylindrical tiles, which fit together with a tongue and groove joint in the centre, this joint being filled with heat-resisting cement. The ends of the furnace are each lined up with four special bricks, joined together with cement and cemented to the tile. In this way we really have a large crucible electrically heated, but with walls of considerable thickness, and a minimum number of joints. Further, this lining does not require a brick mason to instal it, but can be put in with common labor. This special brick lining is backed up with a layer of heat-insulating material, so that when the furnace is at working temperature, the temperature on the outside of the shell is so that the hand can be placed upon it. Compare this with the large amount of heat in the neighborhood of a crucible or other fuel fired furnace, and it will show you how much easier it is to get men to work around a furnace of this character.

The time required for relining this furnace is 8 to 12 hours.

Charging

In starting the furnace the tap hole is plugged with moulding sand, the charge placed in the furnace, the door closed and the power thrown on. The electrodes are then brought together by means of the moving mechanism shown in the photograph and the amount of current flowing regulated by moving the electrodes closer together or further apart, as indicated by the meter on the switchboard.

Methods

If turnings, floor sweepings or grindings are used the rotation of the furnace is started at once and continues until the metal is ready to pour. We have never broken an electrode in operating in this manner. If ingots or heavy scrap is used, the furnace remains stationary until the ingot is partly melted, and then rotation is started and continued until the metal is ready to pour. We have experienced no difficulty in regard to breaking electrodes when this method is followed.

As the furnace is sealed up quite tightly from the time the power is on until ready to pour, we have obtained very good results as to metal temperature by keeping the power practically constant for a definite length of time. After the operator has poured a few heats, it is possible for him to determine the right temperature practically every time without opening the door and inspecting the metal in the furnace.

Pouring

In pouring the furnace, the pipe stands which carry the water connection simply lift out of the way without it being necessary to unbolt anything, and the men can go right up to the furnace with the ladle.

When the furnace is ready to tap the operator stops the rotation until the tap hole is above the level of the holder, and thus above the surface of the metal. The tap hole is then opened by means of a sharp-pointed steel rod. As the tap hole is simply plugged with moulding sand there is no sledging or pounding required, as we have found it can be very readily picked out if a small pointed rod is used. We have never had any trouble with the tap hole. After the tap hole is opened, the furnace is rotated down until the opening is below the surface of the metal, and the metal poured out into the ladle as illustrated. If it is desired to only remove a portion of the metal, the furnace is again rotated back and the tap hole brought above the level of the metal in the furnace.

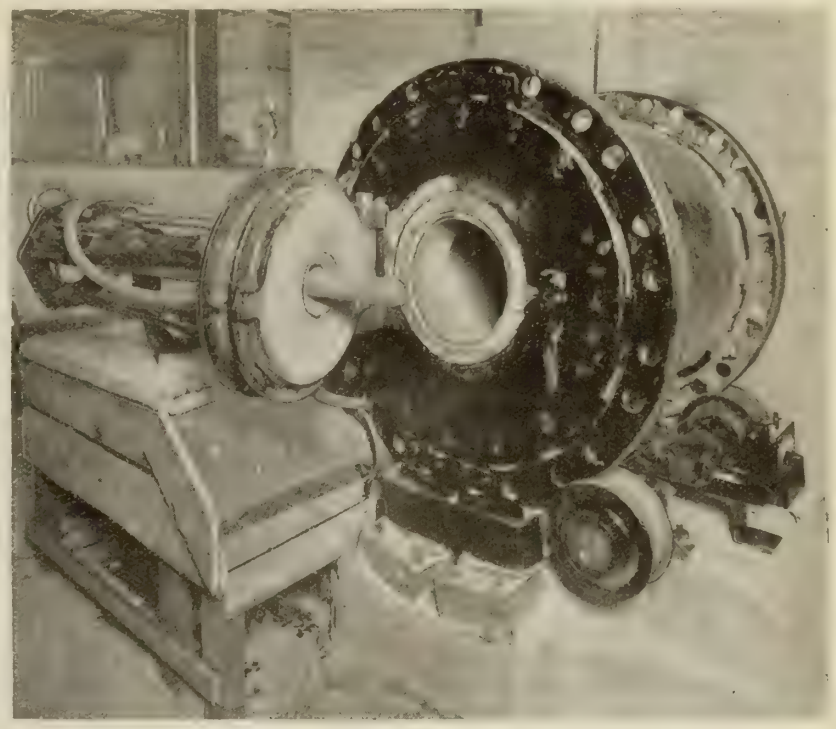


FIG. 3—SHOWING METHOD OF CHARGING FURNACE.

On account of the fact that there are no swinging cables connected with the electrode holders, it has been suggested that the furnace itself could be picked up from its rollers by means of a crane and the metal poured into ingots or castings. We have not attempted to do this as yet, but it seems to be entirely feasible.

Operating Records

With the small furnace which is in the plant of the Leitelt Bros., Chicago, we have poured about 130 heats, using a great variety of mixtures and pouring a considerable number of different grades of metal. We have used:

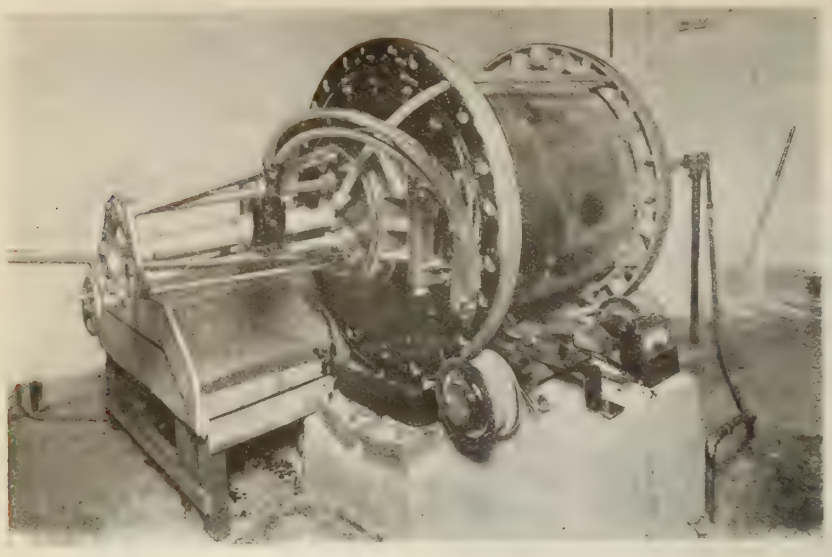


FIG. 4—ARRANGEMENT OF ELECTRODE GEAR.

Yellow brass turnings and borings; concentrates from floor sweepings; grindings; foundry scrap; copper wire; sheet copper; red brass ingots; yellow brass ingots; copper ingots; pig tin; lead pipe; pig zinc; German silver.

So that the furnace has been thoroughly tested on many classes of material.

Power Consumption and Shrinkage

In melting down turnings, borings and grindings with a hot furnace, 30 to 40 minutes is required per charge. With the small furnace shown a power consumption as low as 240 kw. h. per ton has ben obtained. The average would be between that and 300 kw. h. per ton.

With yellow brass turnings and borings which are fairly clean, but on which no attempt has been made to remove any contaminating material, heats have been run with a total shrink of 1½ per cent. These borings, when charged, were in the same condition as received from the seller. Of course the percentage of shrink will depend on the amount of oil, dirt, iron and other extraneous material present, but the actual metal loss has proven to be very low. Due to the active mixing action of the rotation, the heat is applied to the turnings and borings in such a uniform manner that there is no local overheating, and a quick melt with low metal loss is obtained.

In melting concentrates from floor sweepings, which contain a considerable amount of dirt and moisture, and which when melted in crucibles showed a shrinkage of 30 to 40 per cent., the Booth Electric Furnace over quite a number of heats averaged 17½ per cent. shrinkage.

In melting ingots and heavier brass scrap, a heat will average from 30 minutes to an hour in length of time, depending upon the kind of metal poured and the size of the charges. A 300-lb. charge of copper ingots requires about an hour to melt and pour, while a 300-lb. charge of yellow brass about 40 minutes. The shrinkage with yellow brass ingots averages about 1 per cent. and on red brass and high copper bronze under 1 per cent. With the furnace hot the power consumption will run from 250 to 350 kw. h. per ton.

One heat was made with a charge running about 50 per cent. zinc and 40 per cent. copper, totalling 250 lbs. 249 lbs. of metal were poured and the power consumption was 240 kw. h. per ton. This was in the latter part of the day when the furnace was hot, and the metal charged was all clean metal. The ladle was weighed as it was brought to the furnace, and then weighed after the metal had been poured into the ladle. Great care was taken on the part of the operators not to overheat the metal, and this is simply an indication of what results are accomplished where sufficient attention is given to melting. The heat following was a charge of 225 lbs. of red brass ingots, from which 224½ lbs. of metal was poured.

It is particularly difficult to keep account of the metallic shrinkage in a small furnace of 250 lbs. holding capacity, and consequently great care has been exercised. Arrangements were therefore made for a scale near the furnace, upon which the heated ladle was weighed when brought to the furnace and again weighed when filled with metal. Any drippings from the furnace were carefully collected and weighed and any slag coming out with the metal was skimmed from the pot before weighing, as even a small amount of one pound would mean almost one-half of one per cent. shrink. With a larger furnace, it would be much easier to make shrinkage tests without danger of as large a proportionate loss as with the smaller furnace. In other words, if one pound of metal poured did escape being weighed, it would not represent as much shrinkage as in the case of a small furnace.

Lining Wear

To date about 130 heats have been run and the lining on the furnace illustrated shows no perceptible wear. The lining is sintered upon its surface and appears to be in as good condition as when originally installed. This is the first lining installed in the furnace. The material of which the lining is made is such that it does not shrink, spall or crack, although the furnace is run on an average of 8 hours per day. Based on a great many years' actual experience in the operation of electric furnaces of many types, our engineers feel confident that linings of this type will last from 600 to 1,000 heats, and possibly longer, with proper care on the part of the operator.

Another important characteristic of this method of lining is due to the fact that there are practically no joints, which serves to keep the lining clean and prevents any considerable amount of slag or metal sticking to it.

Electrode Consumption

With furnaces of this type the graphite electrode is to be preferred, due to its greater conductivity, which permits the use of the smallest size of electrode practical for the current to be carried. On this furnace electrodes of 2½ inches diameter are used, machined and equipped with what is known as nipple joint. These are 30 inches in length. The electrodes enter the furnace through graphite sleeves. This opening is also protected by a water-cooling copper casting

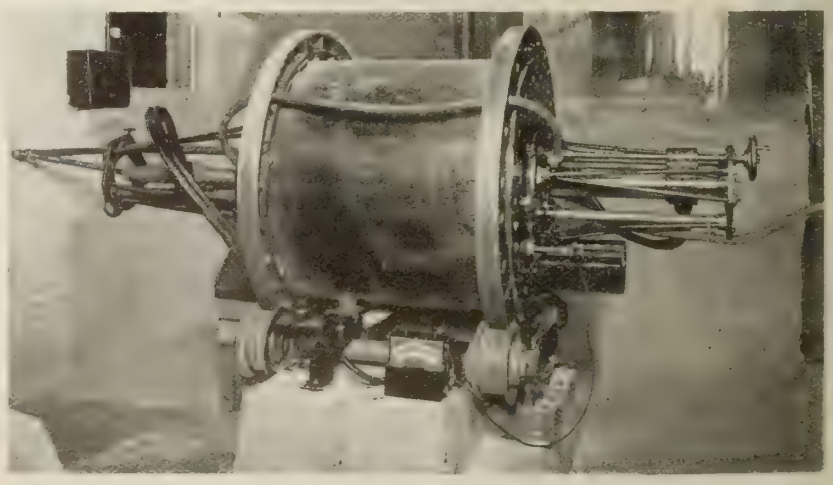


FIG. 5—GENERAL SIDE VIEW OF FURNACE.

which serves to protect the electrodes from burning at this point.

Even with the small 250-lb. furnace shown, the electrode consumption is low. If the furnace is kept in operation fairly continuously during an 8-hour day, the consumption will average about 3 lbs. per ton.

The electrode supporting mechanism has been so designed that it not only permits of adjustment in case electrodes are slightly out of line, but at the same time serves to protect the electrodes from breakage, due to the accidental falling of bars or other material against the end of the furnace.

Power Factor

A great deal of difference of opinion still exists among operating engineers as to the proper power factor best to be used in connection with electric furnace loads. With small furnaces of the type just described, our judgment is that as low a power factor should be adopted as can safely be permitted with the conditions met with at the point of installation. This can be varied to suit different conditions by modifications in the design of the equipment. If a power factor as low as 70 per cent. is permitted, the result will be that the furnace operator need not stay at the electrode hand wheel control to any great extent, but may be employed in getting his charge ready for the next heat, making suitable records and other miscellaneous duties. If, however, a higher power factor is required, the furnace can be readily operated, but will require more attention on the part of the operator unless automatic electrode regulators are provided.

It is our judgment that in case of installation of a battery of small furnaces, providing a sufficient advantage in power rate could be obtained by obtaining a higher power factor than 70 per cent., it would be best to instal automatic electrode regulators. There would also be compensation in reduced labor cost due to the fact that one man could take care of a large number of furnaces under such conditions.

Labor

On small furnaces of the size described, one furnace operator can conveniently handle three furnaces without the use of automatic electrode control. This would of course not include the miscellaneous labor for charging and making up the heats, but one extra man could easily take care of this.

With the 250-lb. furnace described by this paper, we can easily charge, melt and pour a ton of metal in 7½ to 8 hours. This same rate of speed is maintained for all sizes of Booth Electric Brass Furnaces. With the larger sizes, it will of course take a little longer time to charge and pour, but proper mechanical means can be provided for charging so as to reduce the time to a minimum. If the furnace is used entirely for melting turnings and borings and other small scrap the daily output will be slightly increased.

Advantages

1. In designing the Booth Electric Rotating Brass Furnace it has been the aim of the designers to produce a furnace which was efficient enough so that it could be built in small sizes suitable for adaption by the small brass foundry; at the same time such a furnace must be strong and rugged in construction, have few parts and be simple electrically, not requiring the supervision of an electrical engineer or other expert.

2. At the same time furnaces of this type can be built in large sizes and offer as many advantages to those plants requiring a large tonnage of brass, as is true with a small foundry.

3. The charging door of the furnace is located at the opposite point from the tapping. If a battery of furnaces is installed in a plant, it is a great deal more convenient, and economical both in the labor cost and in the handling of materials to have the charging operations carried on at one end of the furnace, entirely separate from the tapping and pouring. This also saves in floor space as the furnaces can be located very close together under such an arrangement.



FIG. 6—SHOWING SWITCHBOARD AND MOTOR FOR ROTATING.

4. In pouring the furnace the tap hole is opened without coming in contact with the metal, and as the furnace is rotated by the motor the metal pours out and can either be collected in ladles or could be poured directly into moulds or ingots brought up to the furnace by approved mechanical means. It is also entirely practicable to pick the furnace up off its rollers and carry it by means of suitable electric travelling crane over to the moulds and pour directly into the moulds. This method would be especially well adapted for pouring ingot moulds or the casting of slabs. After the furnace was poured it would then be returned and set on the rollers, charged and started in operation. Since there are no cables to be disconnected or other electrical connections made, this can be readily done.

5. The absence of overhanging cables and the simplicity of the electrical connections is one of the great advantages of the Booth Electric Furnace. This is readily apparent and is referred to again simply for emphasis.

6. Where a large number of Booth Furnaces are installed in one plant, we recommend the purchase of an extra furnace shell, which could be kept lined up ready for service. This will be particularly valuable in the case of plant operating on 24-hour basis, as it would save time in shut-downs. The method proposed would be: as soon as the lining of one of the furnaces in use was worn out, the furnace needing a new lining would be lifted off its rollers and the spare furnace set in place, immediately charged and started up without losing more than half an hour's time altogether. The furnace shell which was removed could then be allowed to cool down and new lining placed in it ready for further use.

7. The important reason why electric furnaces are being adopted by plants melting brass is because of the large saving made in metallic shrinkage. The construction of Booth Electric Furnace is especially noteworthy in this respect, and all advantages due to the movement of the metal are secured by the rotation of the furnace.

8. Where mixtures are used which might result in the formation of much gas pressure in the furnace, the charging door or doors need not be luted up so as to permit of the escape of the gas pressure without blowing out the end of the furnace, as we understand has been the case in a number of instances where sufficient openings have not been allowed. This can also be accomplished in a very simple manner by leaving the tap hole open for a short time in case it is desired to burn off the oil and dirt prior to the melting of the charge. In other words, with a charge of turnings and boring which are dirty and oily, the furnace can be left in a stationary position with the tap hole open. The furnace being turned around on its rollers so that the tap is located at the top position instead of at the bottom, which would be the position in pouring. This open tap permits the burning oil and fumes to escape. As soon as the operator notes that metallic vapors are coming off, the tap can be plugged up with moulding sand and the rotation of the furnace started.

9. The complete rotation of the Booth Electric Furnace results in more even wear of the lining, a greater absorption of heat by the metal from the same, which naturally results in an improved power consumption. These factors help

Continued on page 171

Canadian Machinery Drafting Course—Part XI

Continued From January 15th Issue. We Caution Students Against Some Common Pitfalls, Pointing These Out on the Plate. The Building Up of This Vise Should be Watched With Interest

By J. H. MOORE, Associate Editor Canadian Machinery

WE left off at the term, finish all over in the last section, so now let us go on to the subject of proper dimensioning. To say what plan to follow out is difficult, for every drawing office follows out the instructions of its chief, but for the purpose of this course we will decide to keep everything in inches. A practice often adopted is to call anything over 24 inches by the term, feet and inches, but as stated before we shall stick to the term inches only.

When micrometer or gauge measurements are required, all dimensions should be given to at least three decimal places. In some cases, closer dimensions would be essential, but for the average case three will be found to be sufficient, as that allows the working to one thousandth of an inch. Be careful where you place your decimal point.

For example, take 6·346. This method of placing the point near the top is not good practice. It should be written thus, 6.346. Note that the point is directly at the bottom and not near the top. In a case where the dimension is less than one inch, a zero should always be placed ahead of the decimal point. This avoids all confusion and makes for safety. We will suppose the dimension to be .346 in. We will further suppose that in tracing this point was rather weakly inked in, and did not show in the blue print. To further complicate matters, a speck of dirt got in between the 3 and the 4, with the result that the dimension showed up as 3.46. This may sound like a fairy tale, but the writer has found this condition to happen at the most unexpected time. Had the dimension read 0.346 it would have made things much easier. True, one might say—well, why not take it for .0346, still the possibility in such a case for error is not so great. When possible, all dimensions should be given so as to read from the bottom right side of the drawing.

Start dimensions from a finished surface or a predetermined centre line wherever possible.

Last but not least, watch your arrowheads and dimension lines. Never make dimension lines as heavy as the others, and be sure to carry them out to the proper point. Never let an arrowhead stop before it touches its dimension line, nor never let an arrowhead go over the line. Above all, make sure you put them in. This may sound like useless preaching, but it is an easy job to miss out arrowheads and dimension lines, easier in fact than one would imagine.

On plate No. 11 which we reproduce in this section, we have purposely made mistakes in order to point out the common pitfalls encountered by the tyro. We do this in order that he will not do likewise, but avoid them by having them pointed out so plainly.

We announced in section 10 of the course that we had secured various portions of a well-known miller for use. and readers can, no doubt, appreciate the value of such practical plates to work from.

It is not often that in a course of this nature actual design is allowed to be shown, but time goes on, and as this course advances readers will see how valuable the saving of each issue will be to them.

To commence with, we have taken the type of milling vise illustrated at Fig. 1. To those engaged in the machine shop industry, its appearance will be familiar, but to others not so engaged a careful study will be worth while.

In this plate we will consider the small details, the next the base, in the next the swivel base, and in the final plate, the assembling of all the parts. For this reason we would advise students to carefully follow out all instructions. First, we must change the dimensions of our plate on this occasion. Make it 16 in. x 16 in. to border lines, and leave ½ in. space all around. This leaves the paper actually 17 in. x 17 in.

Starting at Fig. 1, we notice the jaw of the vise. This piece should be easy for the student to lay out, so no comment or help is offered in this regard. We will, however, call attention to four points in connection with the drawing. Note the C's'k to illustrate countersink. Some offices practise this abbrevation, but personally, we believe it to be too short. Attention is called to the fact that only one arrow head and line reaches this notation, while it would be good policy to place another line leading to the other hole.

Next, three views are shown where two is all that is necessary to fully illustrate the nature of the piece shown on the end view (providing this view had been necessary), there is dotted outline of countersink screw hole. This is still another omission. Students will notice the f.a.o. sign. This is a very brief method of stating finish all over. Lastly, look at the underline which reads jaw wanted steel. This is poor policy to merely state steel. There are numerous grades of steel ranging from ordinary carbon steel to the high speed variety. Always state, if possible, the grade of steel desired.

Let us go on to Fig 2. Again we give the reader no help in the layout of this part, it being so simple. Note the only two views are shown, this being sufficient. On one of the holes in the plan view we have marked 17/32 in. but left out an arrowhead. On the other hole we have omitted the dimension entirely! While a workman would take it for granted that both holes were of similar size, still this is not good policy. A better plan would be to make a notation, as shown at Fig. 1 between the two holes and run lines and arrowheads to each hole. On view No. 2 is also illustrated a better method of showing the term finish all over.

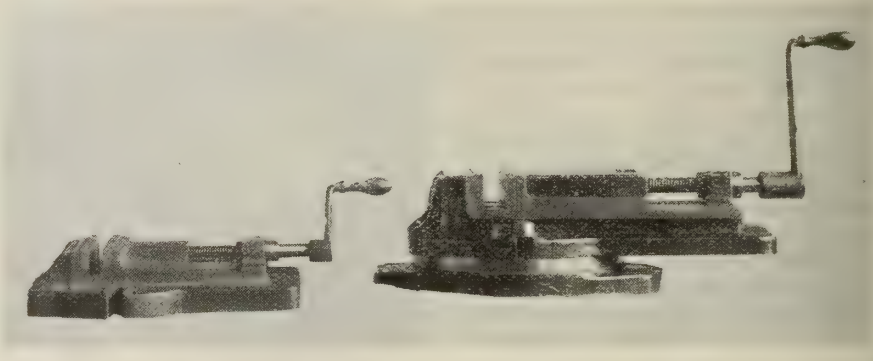


FIG. 1—SHOWING THE VISE, WITH AND WITHOUT THE SWIVEL BASE.

In the layout of piece No. 3, it is good policy in a view of this nature to draw your centre line first. Students will note the convenient system of showing a square thread. While this method is not absolutely correct it is permissible, and is used in a great number of drawing offices. Its chief advantage is speed, with ease of understanding what is wanted.

In stating the number of threads per inch, we have omitted to mention square thread. Be very careful on this point, for there are so many various standards of threads, the U. S. system, the V syster, and so on.

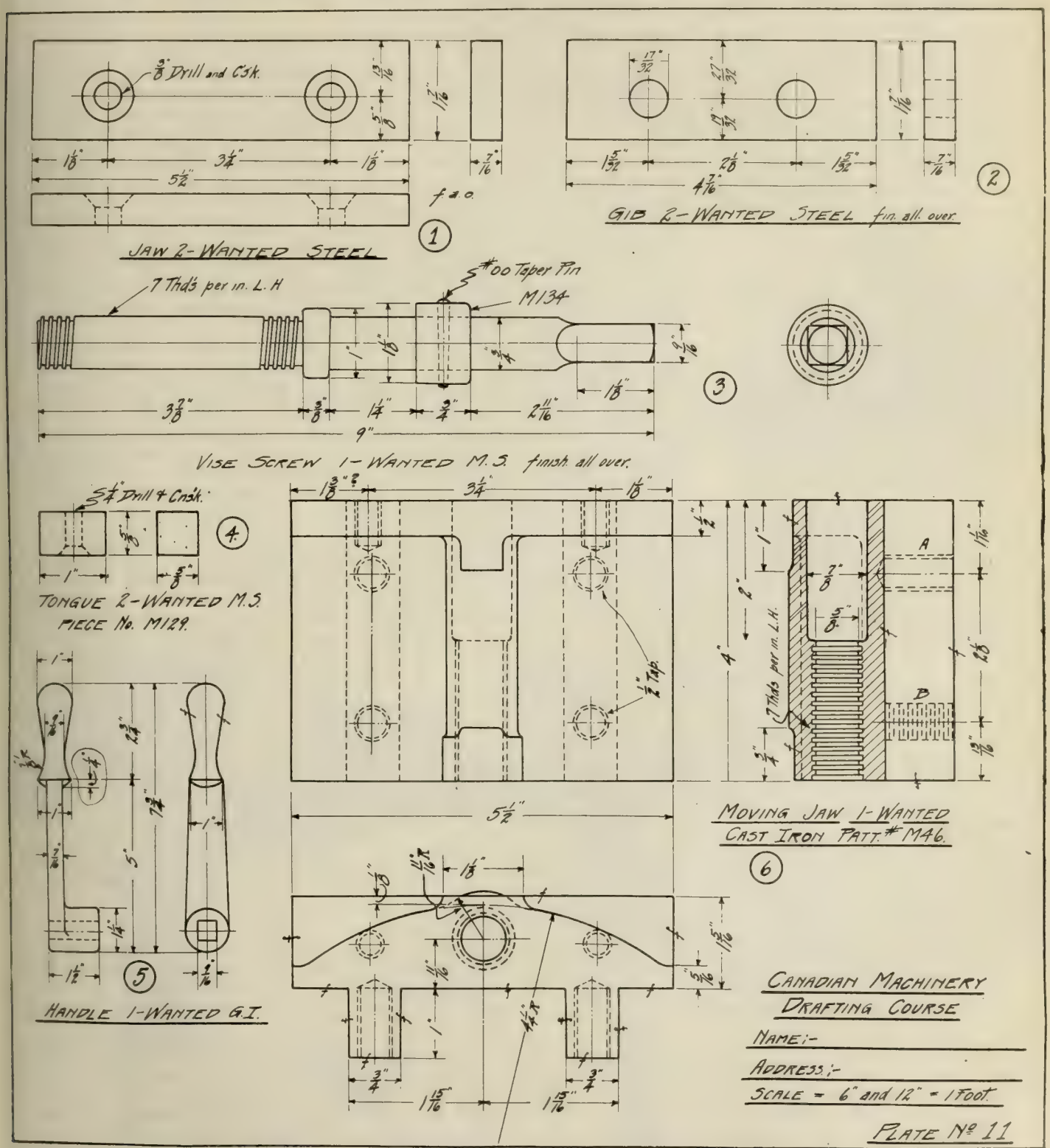
Next, the dimension of the diameter of the thread is left off. While, no doubt, one could look at another portion of the view and see the 3/4 in. dimen-

sion, still it is a risky proposition to take it for granted that this dimension is what it was intended. To those reading drawings, we can only say, never take anything for granted—find out to be sure. Better be sure than sorry.

Let us now refer to the note calling for a No. 00 taper pin. In some cases, this note would be considered O.K. by firms who believe in leaving the question of length to the machinist, but in the majority of cases not only is the size of the pin given, but also the length. The latter policy is much the best, for it leaves nothing to be conjectured about, but issues definite instructions. For example in the case illustrated the note should have read No. 00 taper pin 1¼ in. long.

Another point to be watched is the method we have employed in dimensioning the square end portion of this screw. We have carelessly marked 9/16 in. leaving it to the common sense of the machinist to see from the end view that the piece is square. Suppose there was no end view shown, what guarantee would he have that it was not 9/16 in. diameter, or even 9/16 x 3/4 in.? To overcome this danger, we can adopt two styles of dimensioning. First, we could write 9/16 in. sq. where we already have the 9/16 in. dimension, or better still, we should place the dimension lines on the end view and mark plainly 9/16 in. sq.

The last point on this piece No. 3 is our marking in full, the fact that the piece is finished all over. Thus we have



A CAREFUL STUDY OF THE PLATE IS ABSOLUTELY ESSENTIAL. WE HAVE PURPOSELY MADE SEVERAL ERRORS, WHICH MUST BE CORRECTED ON THE FINISHED DRAWING. ABOVE ALL SEND US IN YOUR WORK.

shown three styles f.a.o.—fin. all over—and finish all over. Either one is permissible, and it depends on what office you are employed in, what system is adopted. To those working on the bench and machine we can only add, watch these little details, if for nothing else than for curiosity's sake.

At Piece No. 4, the first point we wish to call attention to is the snaky line leading to the note ¼ in. drill and cnsk. This style of wavy line is used by quite a number of offices in place of the straight line, such as the one on Fig. 3, leading to the 7-ths. per in. L. H. Note it is merely a matter of taste which is used, some claiming that the straight style of line leads your eye quicker to the dimension, while others claim that the wavy line attracts your attention more than the straight line. We show both types merely for illustration purposes. Note also on this view that we have marked under the title the words Piece No. M129. This system of keeping track of the details by piece numbers is worth while explaining.

The Method Involved

Supposing a machine was being built consisting of some 400 to 500 parts. To keep track of these parts without some system of numbering would be almost impossible, and result in needless waste of time, so the following plan is carried out. Some letter is taken to represent the machine. In our case M is used to represent the word miller. As a rule the numbers start at the castings, and are numbered up all through the castings first, then the steel pieces, etc., etc.

In other cases, some firms start at the base of a machine, and number consecutively all the pieces as they come up from the floor as we might say. The method adopted depends on the drawing office, but it is the fundamental principle that really counts. Keep track of the pieces, with some symbol and number, thereby eliminating waste of time and needless confusion. Students will note that we have left off the notation fin. all over on view No. 4. This is done in some cases where the draftsman figures to himself that anybody would know that the piece should be finished all over, BUT—and it's a large one, the draftsman has no business to imagine that anyone should know what his intentions are.

Fig. 5 illustrates the handle for the vise, and its only finished portion is at the handle grip. This is represented by the small f's shown. A very simple detail, and yet one not receiving the attention it deserves, is the one showing ¼ in., and which we have surrounded with a rough circle form, in order to call attention to it. Note that we have not the space to place our dimension between the arrow lines, so we carry the dimension out to one side, but also carry out a dimension line, or shall we call it a dimension attention line, to the ¼ in. This is always good practice. In any case where a dimension is placed outside of the regular lines, lead a dimension attention line to it. While this may not appear such an important point in a simple drawing such as shown, it is a very vital detail when used on an intricate drawing of any nature. By the adoption of this system, confusion is avoided.

Cut out and send with drawing

Name .....

Address .....

Position .....

Firm's name.....

We also made an error on piece No. 5, by merely stating 9/16 in. at the square hole through the handle. Does this mean you have to machine a 9/16 in. square hole from the solid? We hear the machinist say, "We hope not," and this remark is certainly called for. The dimension should be marked 9/16 in. core, in order that the patternmaker can make arrangements to place core prints on the pattern, ensuring the hole being cored in the casting.

We next come to Piece No. 6. First, we would call attention to the plan view. Note that in the representation of the tapped hole of square threads we show only a double line. This is permissible in some cases, especially where we have a section such as shown in the side view, which illustrates clearly the nature of the thread. Again we have left off the fact that square threads are wanted. We do this simply to illustrate how easy it is to forget the little term, square. Referring to the sectional view, we call attention to the fact that arrows have been left off, and dimension lines not completed in order to warn students of their danger. We leave them to pick these points out for themselves.

In representing ordinary tapped holes two methods are often adopted. Each of these methods is shown in the sectional view. First, the plain double line system is often adopted, as shown at A on the view, and second, the better method as illustrated at B is used. While the latter takes a little longer, it is plainer and gives at a glance the information.

The front view of this piece has a very good illustration of what we meant by a dimension attention line. Note the dimension 11/16 in. radius. Here we have a case where, to place the dimension inside the dimension line would make it crowded, but by leading a line out as shown, it gives the dimension prominence, and yet is not hard to discover where it belongs to.

In concluding this portion of the course, we wish to give students a little advice. Do not merely copy plate No. 11. Study it. Figure why each piece is made the way it is. Study your projection. Watch all dimensions, and above all do not make the same mistakes on your plate that we have on ours. We have done so purposely to point out the common pitfalls, and thus keep others out of them. Ink in your work with care, and if you care to do so use tracing cloth. We do not make this a necessary stipulation, simply because we may have some students who do not care to go to the expense of having cloth. If you so desire, send work in on the regular drawing paper.

Lately, some of our students are adopting the easy (?) method of WRITING in their name and address on the title.

Such a practice should be avoided. Lettering practice is what the title is there for, so print in every item, do not write a word of it. Please watch this point in future.

Next plate, we will go further into the details of this vise. Send your work in promptly, and let us know how the course is interesting you.

German silver is manufactured in three general ways. It is composed of nickel, copper and zinc in varying proportions. The German method of manufacture is to melt all the copper to be used in the mixture, and two-thirds of the nickel and zinc, in a graphite crucible and then add the rest of the nickel and zinc. In the English method, the copper, nickel and zinc are melted all at one time, then more copper and zinc are added. Should the metal appear porous, a fire-clay pipe containing pitch is pushed into the metal mixture to deoxidize it. There are several American methods. According to "Indian Engineering," one is to melt a copper-nickel alloy and then gradually add the preheated zinc. In another method mone metal is used as a base.

The feasibility of using waste hemlock bark from paper-mill operations for tanning purposes has been demonstrated in recent tests made by the Forest Products Laboratory of Madison, Wis. It is asserted that the product is satisfactory to the tanner and can be prepared at a cost that will allow it to compete with leaf bark. The use of paper mill bark for tanning would mean a source of income for paper mills from a material which is now considered of little value, if any.



DEVELOPMENTS IN SHOP EQUIPMENT



STAR GAP LATHES

The Seneca Falls Manufacturing Company, Inc., Seneca Falls, N. Y., have just brought out two sizes of Gap Lathes 11 in. x 18 in. swing and 13 in. x 21 in. swing. In designing the "Star" Gap Lathes, the extra capacity feature of the "Gap" has been added to the quality, convenience and efficiency of the well-known "Star" Screw Cutting Lathes.

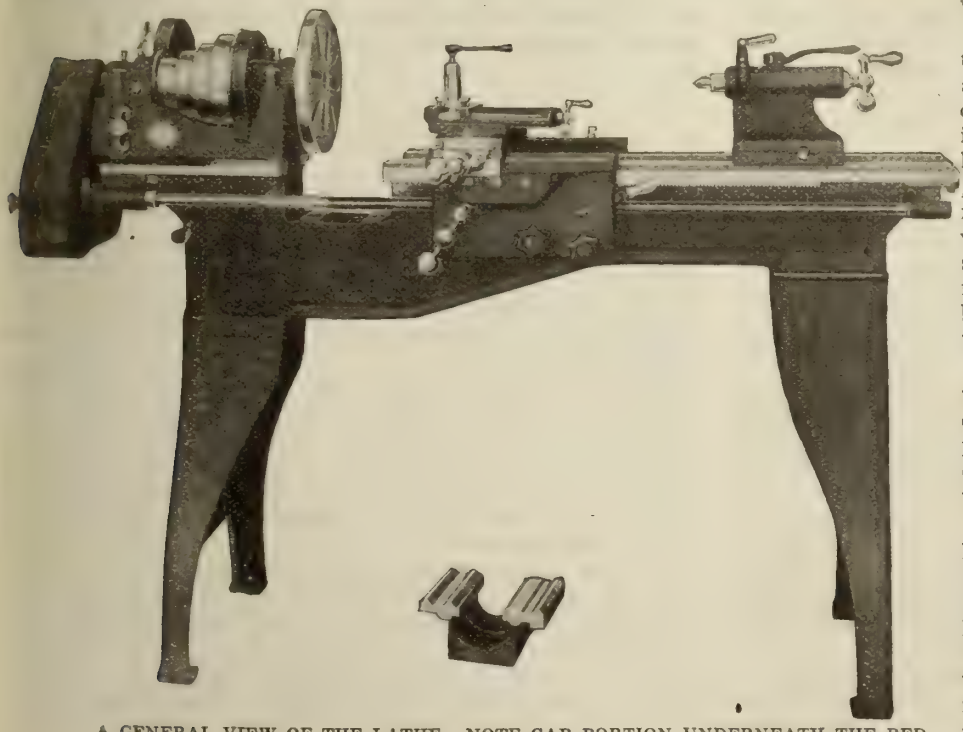
The bed is of the box section type, thoroughly braced by cross webs and made very heavy through the Gap section to insure usual "Star" Lathe accuracy. A bridge piece is furnished to close up the Gap when the extra swing of the Gap is not needed. Beds are made 5, 6, 7, 8, 10 ft. long.

The carriage has the cross slide placed at left hand for convenience. The cross feed screw is supplied with micrometer collar graduated in thousandths of an inch. The apron has safety device so that longitudinal feed and split nut cannot be engaged at the same time. Has extremely wide range for screw cutting all standard threads from 3 to 72, including 11½ and 27 pipe threads. Can be equipped with transposing gears or metric pitch lead screw for cutting metric threads.

An unusually large line of attachments, including raising block, quick change gears, taper attachment, motor drive, draw-in chuck, milling and gear cutting attachment, turrets, relieving attachment, etc., may be used on the "Star" Gap Lathes.

NEW SAW TABLE

Woodworking plants of all kinds will be interested in a description of a new saw table produced by the D. MacKenzie Machinery Co., Guelph, Ont. The table will take the same work as one of larger dimensions, although it is only 23½ in. by 30 in., the distance from saw to ripping fence is 12 in. by 13 in., and the floor space 3 ft. by 3 ft. 6 in. The machine is adapted to electric or gasoline drive, and each is furnished with belt, ripping fence, two mitre fences and 9-inch saw. It is a useful machine not only for furniture, piano and sash and door factories, lithographers, contractors, pattern shop, etc., but is also designed to meet the requirements of technical and manual training schools. The saw table will prove an important addition to the McKenzie line of power hack saws, sensitive bench drills, shapers, and 14 in. by 6 ft. and 8 ft. engine lathes.

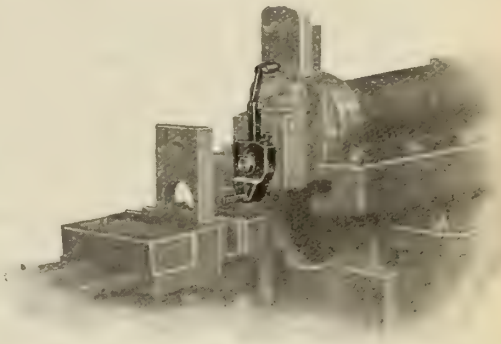


A GENERAL VIEW OF THE LATHE. NOTE GAP PORTION UNDERNEATH THE BED.

BRUNO SLOTTING ATTACHMENT

The H. H. Moore Co., Rochester, New York, have placed on the market what is known as their Bruno Slotting Attachment.

This attachment, or cutting tool holder, can be used on shaper or planer, and makes internal shaping of any description, such as dies, jigs, gauges, keyways, possible.



VIEW SHOWING FIXTURE AT WORK.

The attachment is simple in construction, made of high-grade steel, heat treated, hardened, and fully guaranteed. It is applied to the shaper as quickly as you can change a tool in a tool post, which makes it practical and efficient.

You will note that the tool is bolted to the Clapper in place of the tool post, allowing the use of very short, stiff cutting tools, as no projecting tool post is in the way necessitating the use of a long, slender, springy tool. The tool is provided with an adjustable friction arm riding on the head slide, which prevents vibration of the tool in operation at any speed. The cutting tool is made from round or square stock, and the tool can be turned in any position, to cut on bottom, sides or top.

These attachments are now in use in the most exacting shops, and reduce the cost of die work, approximately, fifty per cent. Large dies are handled as easily and successfully as small dies, there being no tool post in the way.

The attachment is made in three regular sizes. No. 0 taking ⅜-in. to ½-in. round shank tool; No. 1 taking from ½-in. to ⅝-in. round shank tool; and No. 2 taking from ⅝-in. to ¾-in. round shank tool. Each size is furnished with two cutting tools, sharpened and ground ready for use. The net weight of the attachment is 5 lbs.

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The Exchange Situation

VARIOUS views are taken in regard to the exchange situation. The man who has a shipment coming from United States that he must pay for, realizes that to him it means a straight increase in his purchase price of 10 per cent. or so, depending on the exchange rate on the date of delivery. To the man who is selling an article in competition with a similar line sent in here from United States, it means an added protection of ten per cent.

Britain's coinage is being more closely sliced than the Canadian, but to all intents and purposes Britain is not worrying about the matter, and is taking no steps to have the matter righted.

The "Wall Street Journal" takes this interesting view of the situation:—

"The United States is the only country that is not alive to the international situation. England is getting away with the world's business. The fall in sterling gives her a 25 per cent, protection against imports and a 25 per cent. stimulus to exports, but back of her is a country with still lower exchanges, and England, as mistress of the seas, is gathering up the cheap goods that Europe is starting to pour forth and is passing them over the world at handsome profits. She buys low in Europe, and will soon be selling at high prices in the States.

"In three years England will be the commanding commercial and trading power of the world, and as she stood as the bulwark of democracy and freedom, we shall not regret it. I rather think she is entitled to all she can get. She has been on the seas and in international trade for a long time, and she knows markets over the earth as does no other nation."

United States exporters recognize the situation. They can see that their sales are harder to push with the exchange handicap against them. Many of them, irrespective of any national move, are taking steps to have accounts in various countries where payments can be made at par in the currency of these lands.

It's small advantage to United States to have its money worth more than the money of other nations when outsiders simply stand back and wait for conditions to right themselves. Meanwhile the world will be inclined to buy where its dollar, its pound, or its franc will carry the greatest amount of weight in paying bills.

Graded Certificates

INFORMATION has been published concerning the Act grading certificates for a sufficient length of time to enable an estimate as to its reception amongst the engineering fraternity. Generally speaking, opinion seems to be favorable to the Act, although some objections are raised to individual portions of the Act and the regulations respecting it.

The point to which the greatest exception is made is perhaps that relating to the qualifications for a first-class certificate, both as regards practical experience and technical knowledge. At first glance the qualifications may seem somewhat severe, but in no other way can the status of stationary engineering be raised so effectively. The first-class certificate should be one well worth while having, and to achieve this, it must be a fairly hard thing to obtain.

When employers of engineering skill learn that the standards set by the Ontario Board are high and demand genuine worth on the part of the engineer, it will be materially to the benefit of the stationary engineer himself. His pay envelope will undoubtedly be fatter and his reputation more in keeping with his worth.

It may be argued that the first-class certificate will only be available to the limited few and that injury will be done to the older men of the present engineering world. This may possibly be true, but a remedy should not necessitate the lowering of the standard but rather a readjustment of the graded plant requirements. This could be done easily by the Board under Order-in-Council as soon as it were found necessary and with the experience gained during the coming year it will be more fitting to discuss this question later on.

It might be well emphasized that although the engineer cannot obtain a first-class certificate on his application form, much depends upon the manner in which his application form has been filled out, whether he obtains a second or third-class certificate. The application blanks have been issued for a definite purpose and this purpose, briefly stated, is to give the engineer every opportunity to obtain the highest grading possible.

Men Or Mushrooms?

IT is a very easy matter to walk along any of the downtown streets of our cities and see in the shoe-shine parlors a string of boys and young men getting their shoes shined. Very often included in the string are a number of youngsters in short trousers, and the percentage of those who have still to have their first shave is fairly large.

Now, shining boots is all right. Not a word against that. But what is the matter with these young dandies shining their own shoes?

If shoe-shining were confined to those who were not able to do the job for themselves, there would not be work for more than a corporal's guard of these foreigners in every community.

But there they sit, lads fourteen, fifteen and sixteen, generally with a cigarette butt growing in the side of their face, with a foreigner prancing around shining shoes for them.

Small wonder if one were minded to ask if we are raising a generation of men or a crop of mushrooms?

Are Getting Results From Their Efforts

Men Appreciate a Share in Direction of Industry—The Position of the Engineer in the Community

R. W. GIFFORD, of the Massey-Harris Co., spoke before the Toronto Section of the American Society of Mechanical Engineers on February 2, and gave some interesting facts relative to industrial councils and welfare work.

About one and one-half years before the close of the war a change in management occurred, and Thos. Findlay was made president of the company instead of vice-president as formerly. A need for more amicable relations was apparent, and Mr. Findlay determined to build up for his firm a reputation in labor matters equal to that obtained by the implements manufactured.

No matter what system is adopted by any industry a few main facts must be clearly recognized and rigidly adhered to. The most important of those upon which the Massey-Harris Company base their work are as follows:—

A square deal for every employee, and each case to be considered solely upon its own merits.

A fair day's pay for a fair day's work.

Reasonable working hours.

Pension systems, welfare work and opportunities for financial interest in business are also important.

The scheme of organization of the industrial councils, the welfare work, the cafeteria system and other phases of the work were all dealt with by Mr. Gifford and the interested reader might refer to CANADIAN MACHINERY for July 31, 1919, for further details.

Remuneration continues to be a live subject in any industry and naturally has occupied the time of the councils to some extent. Results are seen in the following figures. The *Labour Gazette* estimates an increase in the cost of living of 66 2/3 per cent. The average wage increase over the whole firm is in the neighborhood of 105 per cent. Hours have been decreased, and with success, for when the nine-hour day was first put into effect 98 per cent. of the estimated lost output was made up.

Mr. Gifford illustrated his paper by means of lantern slides showing various phases of the work, and also by means of a moving picture illustrative of the cafeteria. A discussion followed, in which a number of those present took part.

Calvin W. Rice, secretary of the Society, was the second speaker of the evening, and throughout his talk emphasized the changing relation of the engineer to the public, and especially the importance of his taking part in the affairs of the nation and of the municipality in which he lived. Heretofore the engineering societies, without exception, have, primarily, focussed their activities on the advancement of science, and in particular that part of it which appealed to the branch under consideration. In this was seen the reason for public indifference to the engineer, his work and his remuneration, and it rested with the engineer himself to find a remedy. If the engineer, through his societies and by individual effort, would make himself more active in civic and national affairs, recognition would come almost in proportion to his participation.

In passing it was remarked that while the cost of living had advanced so greatly, the compensation of the engineer in United States Government employ had only advanced 4 per cent., and in municipal employ, 12 to 14 per cent. The local engineering societies should affiliate with the local Boards of Trade or Chambers of Commerce, etc., and should take an active advisory part in municipal government. The ideal organization would also include student organization from the universities, these to be affiliated with the local bodies, and these latter in turn with the national societies. Mr. Rice gace much information relative to the functioning of the engineering organizations in the United States, and spoke of the war work carried on by their assistance.

How the Locomotive Whistle Came to Life

A Musical Instrument Maker Solved the Problem—Horseback Rider Used to Precede the Locomotive

By F. A. McLEAN

SURROUNDED on every side by wonders of the mechanical and electrical world, the majority of people are disposed to take them for granted and regard them more or less as if they had always been. As a matter of fact, there is usually an interesting story behind the invention of most of the things that are now considered essential to our everyday life.

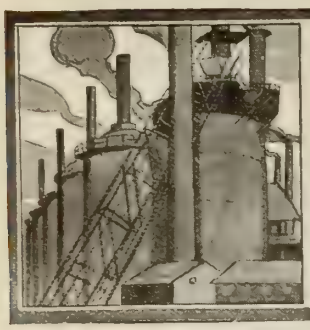
How many people, for instance, could tell offhand who invented the locomotive whistle or know that it came into being like many other epoch-making inventions and discoveries as the result of an accident. An apple falling on the head of Sir Isaac Newton, as he lay under a tree, is said to have started the train of thought which led to the promulgation of Newton's law. Bell stumbled onto the telephone accidentally while working on an apparatus to improve the hearing of the deaf. The phonograph was born while Edison was working on an entirely different invention. A lazy boy gave us the first automatic valve motion for a steam engine, while Elias Howe is said to have conceived the sewing machine needle in a dream, so that it is not at all strange that the invention of the locomotive whistle was also brought about by an accident.

On May 4th, in the year 1833, Stephenson's locomotive the "Samson"—a successor of the famous "Rocket"—ran into a farmer's wagon containing fifty pounds of butter and eighty dozen eggs, on a level crossing between Thornton and Bagworth, England. Had the high cost of living been a topic of discussion at that time, or had butter and eggs been worth as much in those days as they are now, perhaps Stephenson's career as a railroad builder would have been cut short.

At any rate, as a result of this spreading of butter and eggs around the landscape (and perhaps as an aftermath of the death of William Huskisson, a Cabinet Minister, who was killed by Stephenson's Rocket on September 15th, 1830, and thus had the unfortunate record of being the first man ever killed by a locomotive) a meeting of the directors of the railroad was called to see what steps could be taken to prevent accidents in the future.

In 1825, when the Stockton and Darlington Railway was opened, for the first part of the trip, a man on horseback had preceded the locomotive, warning people to get out of the way, but during the latter portion of the trip Stephenson ordered him out of the way and speeded his engine up to fifteen miles an hour. The Samson being a heavier and more powerful locomotive than the famous Rocket and other earlier models, sending a mounted man ahead of it was now out of the question, so Stephenson's suggestion that a whistle blown by steam could be used, was welcomed by the directors.

Acting on Stephenson's advice, a musical instrument-maker in the town of Leicester produced a steam trumpet which was about eighteen inches long and about six inches across the bell, and resembled a huntsman's horn. This horn was tried out before the board of directors and accepted. It must have had a weird sound, and no doubt was effective, as we are told that the Reverend Sydney Smith, a witty divine, was wont to say that "Stephenson's whistle always reminded him of the squeal of a lawyer when the De'il first got hold of him."



MARKET DEVELOPMENTS



Runaway Market Coming in Steel Trade Soon?

Prices Mounting Rapidly and Many Sales Going Through Record New High Marks in Selling—Inquiries Coming in Much Better for Machine Tools—Scrap Iron Comes High

NO person in the trade would care to become responsible for the prediction that we are approaching a runaway market in the steel industry, but it does look as though the agency were lacking that at this time could come forward and put a peg in the premium market. Quotations for odd lots are getting farther away from a cost plus basis. It is very often a case of what can be secured, based largely on the urgency of the sale, and the ability of the seller to deliver the goods. One report has it that plate tonnage has been placed by Canadian buyers as high as 4.50 Pittsburgh. Local warehouse prices were also advanced this week on plate and sheets.

Machine tool inquiries are reported as improving this week. It had been thought that the exchange situation was holding up considerable business, and that inquiries were held back pending some improvement in this. Apparently this is not the case, as several dealers say it does not stop sales. The only effect is to give Canadian material and goods a preference and to boost the sale of used machinery.

An announcement is made of an increase in American-made carbon drills, and it is not unlikely that the Canadian-made article will find it necessary to take similar action.

Scrap iron is in great demand at present, and it is doubtful if much of this could be secured under $40 a ton, which is a fancy price. Some of the dealers state that they look to see it worth as much as pig iron. Foundries want it, and there is a scarcity. During the war a great deal of it went out of the country for keeps in the shape of base plugs, etc., and much of it was used in war machinery.

EXCHANGE RATE BOTHERS TRADE IN THE MONTREAL MACHINE FIELD

Special to CANADIAN MACHINERY.

MONTREAL, February 5.—The all-absorbing subject of the present day appears to be the complex problem of exchange and its effects upon the business of the country is one that cannot but impress those who in any way have transactions with American houses. It is undoubtedly true that much business has been diverted to Canadian firms who are in a position to take care of the needs of the buyers in this country. Not only is it a big handicap in carrying on business but it has the tendency to hold up contemplated expansion in many directions. Where material must come in from the States great difficulty is frequently met in getting the purchaser down to the point of closing a sale, as the high exchange rate means considerable additional outlay in the buying of equipment. Action has been taken in many cases by American manufacturers to overcome this objection, and bank accounts have been opened in some of the leading Canadian cities whereby it is possible to meet the requirements of those in need of material without assuming the burden of the excessive exchange. While the present conditions are, in a measure, to be regretted, there is, nevertheless, a favorable side to the problem. Just this week CANADIAN MACHINERY was approached by a representative of a machine tool house in the States, as to a suitable local well-equipped plant that would be in a position to take care of their Canadian and British trade, by manufacturing here, thereby overcoming the question of the high exchange rate and duty charges.

Acute Condition in Steel

There are still no signs of relief in the general steel situation, and consumers are still pressing the dealers for delivery of materials, but the dealers in turn must abide by the wishes of the producers, who are unable to adequately meet the present trade requirements. The warehouse conditions are going from bad to worse, and little can be done to replenish supplies as material delivered can find a market almost before it is out of the cars. The situation is becoming more and more acute, and the existing tension will be greater before it is less. The general conditions are reflected in the higher base prices effective this week on plates. While $3 is quoted as the ruling figure, the leading mills have only advanced to $2.75, but this price only applies to delivery at mill convenience, which may be reasonably placed at from six to eight months. If a customer must build a tank or a stack immediately he could probably get the desired material by paying a good premium over quoted prices. This is by no means an uncommon procedure. Local dealers are deferring any advances but intimate that those quoted can only be considered as nominal and must only be taken as a guide for indefinite delivery. The clouds of uncertainty are becoming denser every week, and looking into the future is becoming more and more difficult.

U.S. Firms May Manufacture Here

An interesting condition that is arising out of the seeming complexity of international exchange is the attitude taken by some American business houses to solve the problem of diverted orders that would, in the ordinary course of events, be placed with United States firms. It was announced recently that some American manufacturers were taking steps to counteract the heavy exchange rate by dealing with the Canadian buyer direct. This method of striking a balance has apparently given note to another, and this is exemplified in the scouting process of some American tool manufacturers in the effort to find some local engineering plant that

j equipped to make their line. One merican firm has a representative in ontreal this week casting about with is purpose in view. There continues be a fair demand for general purpose uipment, but as one dealer stated, the certain delivery has impressed many ms with the imperative need of mak- g the best machinery on hand. The ght revival in the demand for used ols is a barometer of current condi- ons. The market is showing the after- ath of war in the greater distribution British-made tools, particularly of the aller variety of machines, accessories nd supplies.

Scrap Metal Market

There is still a passive condition ex- ibited in the old material market, with usiness on the quiet side. Considerable ctivity is shown in local sales, the foun- ries taking regular supplies for current se. No attempt is made to accumulate arge supplies, and as a matter of fact his could not very well be done as there s little surplus of cast iron scrap. Dealers are holding to prices quoted, but state that same should be taken as ominal quotations only.

MANY INQUIRIES FROM WIDE FIELD

Business Reported as Very Satisfactory —Some Prices are Going Up Again

TORONTO.—Improvement is reported in several lines of the machine tool and supply business. Inquiries, accord- ing to reports received by CANADIAN MACHINERY in this district, are com- ing in from a well-distributed line of in- dustries. Some are for new concerns that are just commencing business. They are in the market for a long list of machinery. In other cases existing con- cerns are adding to their equipment. It all helps to make up a good-sized volume of inquiries and orders.

Some of the dealers appeared to think that buyers were holding back during the last week or two, waiting, among other things, to see if anything were go- ing to come of the exchange situation that would make prices any more favor- able for them. "Exchange is stiff," re- marked one manager to-day, "but it really is not a determining factor in the placing of business. I cannot recall an instance offhand where a customer has declined to buy because the exchange has stood in the road. There is no doubt, though, that it is helping the sale of Canadian and used machinery."

There is talk of some price advances in the supply market. The lines that may be changed are hack-saw blades and chain blocks, although no action has been taken yet.

Prices are Moved Upward

Sheet and plate were both marked up in the local warehouse lists this week. Sheets, No. 28 box annealed, are now sell- ing at 8c per pound, and No. 10 at 7.50. Plates, ¼ inch and up, are now priced at 6.50, and 3-16 in. and up, 7. These prices are simply a reflection of the higher prices being asked at the mills, where all base prices are up above the high prices of a week or so ago.

Even at the advanced prices that are prevailing the mills are not showing any tendency to accept business. This rather does away with the theory that was held by some of the dealers a while back that mills were refusing business, waiting for higher prices to prevail. If they had been doing this they would have a great chance to come out into the market now and sign up all sorts of business at a very respectable premium. As a matter of fact it is not possible to book business for plates, sheets or tubes at any price. It had been held for some time that premiums would bring out mill capacity when they were offered, but there is nothing in sight to substantiate such a view. There are plenty of rumors around as to the prices that are being offered and paid for decent shipment of material. Of course there must be some- thing allowed for the imagination in the spreading of these reports, but CANA- DIAN MACHINERY heard of one case this week where as high as 4.50 base Pittsburgh was paid for plate.

There has been a change made in the method of selling cold-rolled steel. For- merly it was sold at a list price plus, while now it is quoted at 6.25 with extra for sizes.

Warehouses report that there are many inquiries just now, and that there is no difficulty in disposing of all the material they are able to secure from the mills.

The Small-Tool Market

Makers of American drills have ad- vised the trade of an increase in the price of carbon drills, and it seems like- ly, according to reports in the trade, that Canadian makers will make a similar move. American carbon drills have been sold here at 50, 10 and 5 off, while the price now is 50 off. The Canadian-made drill has been sold at 40, 10 and 5 off, and although there is no announcement out yet, it would occasion no surprise were the price to go to 40 off.

Dealers report that business is excep- tionally good and that inquiries and sales are coming from a large number of in- dustries. Most of the business is in the form of small orders, and in one sense these small orders are more desirable than the larger ones because in the lat- ter there is apt to be a persistent demand for some special price arrangement in order to land the business.

The Canadian National Railways are out with a very large specification now, covering some thirteen pages, composed mostly of milling cutters. This is for the purpose of tooling up the equipment that has been placed in the St. Malo shops.

The Scrap Metal Market

The scarcity of cast iron may be said to constitute the only feature in the scrap metal market this week. The foundries all over the country are after it, and one dealer made the prediction that he would not be surprised to see scrap iron going higher, or as high as pig iron before very long, and pig iron is quite a respectable price, too. This condition is largely an outcome of the war, as before that there was always plenty of scrap iron in the country. During the war, however, there was a very keen demand for this line as it was used for making base plugs, and lots of it went into war machinery, etc. The result was that the country was raked fine of its cast scrap, and there has not been a supply coming in since the war to level off things. It is doubtful if the dealers who have any scrap could be induced to sell it under $40

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that a wide variety of prices are being quoted and that prices are being rapidly advanced in some quarters. A runaway market is believed to be at hand owing to lack of stabilizing influences.

—

The U. S. Steel Corporation have announced a 10 per cent. increase in wages to common labor and adjust- ments in keeping to skilled labor. No present intention is evident to adding this to selling prices.

—

Transportation has been the chief factor in holding down production for the last fortnight, from the mines, by-product coke ovens and steel mills.

—

Toronto warehouse prices for plates and sheets were advanced again this week.

—

It is possible that cast iron scrap will reach a price as high as pig iron. The country was raked clean of this kind of scrap during the war, and the gap has never been filled since.

—

Makers of American carbon drills announce an increase. They have been selling at 50, 10 and 5; the price now is 50 off. Canadian makers may announce an increase, but nothing is known definitely yet.

—

The Canadian National Railways have sent out specifications for a large order of milling cutters for the St. Malo shops.

—

Inquiries are showing a decided improvement for machine tools, the inquiries being from a wide field and various lines of industry.

BELGIANS HAD BUSINESS TO PLACE BUT WANTED IT ALL "AT A PRICE"

Special to CANADIAN MACHINERY.

NEW YORK, February 5.—While the Eastern machine-tool markets continue fairly active, no new projects of importance have come to light in the past week. There is continued buying by some of the large interests such as the General Electric Co., American Locomotive Co., Willys Corporation, and other companies that have been active buyers for some weeks past.

An important consolidation of ship repair interests has been effected by the Lord Construction Co., New York and the Weehawken Dry Dock Co., Weehawken, N.J., under the name of the Lord Dry Dock Co., which has a capitalization of $10,000,000. A new dry dock and ship repair plant will be constructed, plans for which had been under way for some time by the Weehawken Dry Dock Co. It is planned to have the plant ready for service in eight months. Equipment for various metal and woodworking shops will be required.

The French commission sent to the United States to make selections of machine tools from the surplus stocks of this Government, has arrived, and will purchase up to $25,000,000 worth of such equipment. Financial arrangements have been made whereby French 10-year bonds will be deposited in payment. The commission is made up of ten persons, who will remain in this country until their work is completed.

A Belgian commission, headed by Lieutenant Jean Jean, has been in this country for several weeks on a similar errand and has been only partially successful in finding the equipment it desired. This commission came with lists of tools desired by various Belgian manufacturers, and the tools which the Government had to offer did not completely fill the requirements. After the Belgians had selected from the Government surplus all of the tools that their countrymen could use, there still remained unsatisfied requirements totalling about $2,000,000 in value. The War Department asked American machine-tool manufacturers to make bids on this equipment, and indicated a wish that the American manufacturers sell at prices approximating those which the Government had quoted. As these prices were only slightly in excess of the 1914 valuations of such tools there was a lack of response from the American manufacturers. As a matter of fact only two offers were made by American manufacturers and these included commissions which the American manufacturers believed were due to their Belgian agents if any such transaction was entered into. Consequently the Belgians will return home with considerable equipment still to be bought, and the belief prevails in Washington that most, if not all, of this equipment will be bought in Germany.

The War Department has disposed of a considerable part of its war surplus. Sales in 1919 amounted to $4,979,633.84, which represented a recovery of 59 per cent. of the purchase prices. The total sales of all commodities during the past year by the Director of Sales office for the War Department amounted to $552,748,555.60, an average recovery of 73 per cent. of the cost price.

RUNAWAY STEEL MARKET HAS BEEN STARTED BY INDEPENDENT INTERESTS

Special to CANADIAN MACHINERY.

PITTSBURGH, February 4.—There has been another and radical change in the price outlook for steel. The prospect that the market would be stabilized by the independents on some regular basis has already practically disappeared. The independents had previously renounced Steel Corporation leadership by refusing to sell at the March 21 or Industrial Board prices, to which the Steel Corporation has adhered, but there remained the possibility that they would advance merely to the January 1 prices, those ruling before the Industrial Board reductions, or even to the war control prices, and stop there.

It has been made clear in the past week that the independent producers are not doing anything of the sort. They are quoting a wide variety of prices, while some are not quoting any prices at all, indicating clearly that they are waiting for higher prices still to develop.

Plates, bars, wire products, Old Country goods and sheets have all sold at higher than the war control prices, in larger or smaller quantities. A common mill price for wire nails is $4.25, against $3.50 under the war control. Plates in moderate-sized tonnages have sold at 3.50c to 4c, against the war control price of 3.25c. Bars have brought approximately the same prices, the war price having been 2.90c. Sheets have shown a wide range of price, mill sales being made up to 6c, when the war control price was 5c, and the Industrial Board price, at which the Steel Corporation sold its first half output, is 4.35c.

Runaway Market

These developments mean not that a runaway market is likely to come, but that a runaway has already started. When there is demand in excess of the offerings, when prices have departed from a stable and easily quoted level, and when producers show no disposition to hold prices down, it is a runaway. Prices will advance until buyers can no longer pay advances, and then there will be the reckoning. It is quite impossible to attempt to predict how long the runawa will last, for that depends not merel upon the actual relation between re quirements and offerings, but also upo what is in the minds of buyers, for th buyers may help to put the market u on themselves. They have already don this, indeed, for some have made bid to mills in hopes of tempting them t enter orders, and have shown that the overrate the demand prospects. The are, for instance, reckoning upon a rail road raise this spring and summer fa in excess of what is likely to develop The railroads are not going to be reall large buyers, at least at the outset, whe the Government control is relinquishe March 1.

The runaway may be over by nex July or it may last through next winter The end is hardly likely to come at a intermediate time, for if the market ha strength enough to get through the sum mer it would presumably be able to ge through the fall without difficulty. The extent of the runaway is equally in doubt. The 1899 runaway saw maximum advances over the low points of 1898 as follows: Sheets, 86 per cent.; shapes 125 per cent.; plates, 175 per cent.; bars 175 per cent.; billets, 175 per cent. The outcome of the runaway was unfortunate, and since then the steel manufacturers have endeavored to avoid a runaway, except that in 1917 it was only the Steel Corporation that endeavored to hold prices down, the advances by independents being stopped eventually by the prospect of Government price control, afterwards realized.

Wage Advance

Last Friday the United States Steel Corporation announced a general wage advance, effective February 1, amounting to 10 per cent. in the case of common labor, with adjustments in keeping for skilled labor. Most of the large independents have already announced a corresponding wage advance, and all will necessarily have to make the advance. It is interesting to observe that at this time, while it is the independents that advance steel prices, it is the Steel Corporation that takes the initiative in advancing wages, and the Corporation has since announced that it has "no present intention" of advancing prices in connection with the wage advance. Even if it did advance prices at the same time as wages, it would be out the wage advance as to approximately a half-year's full output, as it has sold fully that amount at the March 21 or Industrial Board prices.

The war period wage advances began with that of February 1, 1916, and ended with that of August 1, 1918, there being afterwards, October 1, 1918, what amounted to a wage advance for men working more than eight hours, as the basic eight-hour day was then instituted, time beyond eight hours being rated time and a half. The common labor rate in 1915 was 19 cents an hour, the successive advances carrying the rate to 42 cents, while the eight-hour day made the actual pay for twelve hours' work fourteen times 42 cents, $5.88, or about 49

cents an hour for the time actually on duty.

The present 10 per cent. advance raises the basis rate for common labor to about 46.2 cents an hour, making $6.47 for a twelve-hour day, against $2.28 in 1915, or 184 per cent. advance, the pay being almost tripled. The ten-hour day is increased from $4.62 to $5.08, against $1.90 in 1915. The amount of twelve-hour labor has been further reduced in the past few months, more men working ten hours and eight hours than formerly, and possibly it is the expectation that the twelve-hour day can gradually be eliminated altogether. As there has been a fair supply of labor in the past few weeks it is possible that with the present wage advance there will be such accretions as will enable more work to be put on the shorter hours.

Production

Production has increased very slowly, if at all, in the past fortnight, the restraining influence now being insufficient transportation, which has prevented any further increase in Connellsville coke output for about a month, and has enabled the by-product ovens to operate only a trifle better, while it has also threatened finishing mill operations by forcing finished product to back up against the mills. Winter weather should be past in a very few weeks, however, and then the railroads will undoubtedly function much better. While much is being said about the railroads needing more cars, and about many cars being out of repair, the main cause of transportation being slowed down is the effect of bad weather upon the working forces. The weather will correct that, and it is thought also that many men will work better when the lines are transferred from Government to private control March 1.

Pig Iron

The pig iron advance that was interrupted more or less by the holidays has been resumed in full force. Foundry and basic have advanced to $40 valley, and Bessemer to $41, malleable being $41.25. In foundry and malleable the furnaces have practically nothing left to sell but second half output, and those that are now selling for that period assert that they are merely accumulating "backlog" business, thus presaging further advances. The sellers seem to have things entirely their own way, and how long this condition will continue is problematical.

U. S. SCRAP METAL

The scrap market has been particularly active during the past week and prices in some cases have made considerable advances. An interesting feature is seen in the advance in No. 1 machinery scrap, which at centre has advanced in price above pig iron. Following are reports from various U. S. centres:

PHILADELPHIA. — The activities of the small buyer have served to maintain the strength of the local market. Several thousand tons of heavy melting steel sold to one customer for $26.50 and 1,000 tons of railroad malleable sold for $29.50.

BROCKVILLE TO TRY NEW SCHEME

Citizens Called in Meeting Decide to Start Campaign for New Industries

Brockville.—Local support of local industries was the chief topic of discussion at the citizens' meeting called by Mayor Lewis with an attendance of some 350 ratepayers. The institution of a campaign to raise the sum of $5,000 annually for three years to pay with an equal sum which the Town Council and Public Utilities Commission will be asked to provide for the maintenance of industrial propaganda work was decided upon by the meeting.

There is now a surplus of 8,000 horsepower in the St. Lawrence Hydro-Electric System, with which Brockville is now hooked up, and if this were made use of the chairman of the Public Utilities Commission stated that the rates would drop from $25 to $18 per horsepower. This will be utilized to attract American industries here.

In connection with the meeting it was decided to organize an investment company to sell bonds to local subscribers for the purpose of investing the proceeds in industries which decide to locate in Brockville. Mayor Lewis announced that applications had been made to Toronto for provincial funds to erect 15 houses under the housing commission plan.

PIG IRON MARKET

Heavy selling of iron for last half delivery still continues. A large tonnage of basic is being sold. Following are the reports from U. S. points:

CLEVELAND.—Large sales of foundry and malleable iron are reported to have reached a total of 175,000 tons for the last week in addition to 50,000 tons of basic at the prevailing price of $40. Foundry iron, 1.75 to 2.25 silicon, is selling at $40 furnace, although higher has been paid.

NEW YORK. — Foundry grades here also lead the market, and as in other centres purchases for second half delivery have predominated. Sales totalled 50,000 tons.

ROTATING BRASS FURNACE

Continued from page 161

to bring down the cost of melting and upkeep charges.

Since this type of furnace is new, and we have only had a short time from which to obtain operating data, we cannot get proof from actual records just what the cost of these items will be. The important fact remains, however, that the small furnace described in this paper was successful from the very first heat, and has been in daily operation without shutdown from the time the power was first turned on, and the lining does not show any appreciable wear. We are confident that, after a suitable length of time has elapsed, the power consumption and other data obtained will show that there is a great advantage to be obtained in rotating the furnace completely.

10. The rotation of the furnace not only preserves the lining and secures a low power consumption, but at the same time serves to mix the metallic charge, making it more uniform without requiring much supplementary stirring. Except in the case of mixtures with high lead content, the rotation of the furnace will sufficient mix the charge so that it is not necessary to stir same either in the furnace or in the ladle. This is quite an advantage and results in a more uniform product.

11. In the past the construction of electric furnaces has been along lines which require the use of special electrical appliances and equipment. This Booth Electric Furnace is a departure. It is entirely practical to operate it using the ordinary 110-volt single-phase service which can be obtained from most public service companies.

12. All details of the furnace equipment are rapidly being standardized so that quick shipment can be made of furnaces, as they are shipped completely assembled and the production and installation is a simple matter.

In case automatic electrode regulator control is desirable, it should be pointed out that only one regulator would be required, and this would reduce the investment cost materially.

13. In the design of large-size furnaces of this type, we have plans perfected for completing the equipment so that it can be operated using either two or three-phase alternating current instead of single-phase. This would be important in many cases where public service companies are not in position to handle single-phase loads over 75 k.v.a.

We are convinced that the time is ripe for the adoption of an electric furnace for the melting of non-ferrous metals. For melting of steel and metals requiring a higher temperature, the electric-arc type furnace has proven to be the most commercial type of equipment which has yet been developed. The disadvantage of the arc type furnace for melting metals at lower temperature has caused inventors to develop furnaces using other methods. These methods require special electrical equipment, however, which must increase investment cost. The Booth Electric Furnace has been put on the market because, as engineers, we believe that an arc-type electric furnace was practical for this purpose and could be built at lower cost than any other type of equipment, and was so simple electrically that the average brass foundryman could operate it without requiring expert handling. The results obtained to date with this first small furnace are convincing and prove that the principle of design incorporated into our equipment will be successful in securing all these advantages which are sought and claimed for electric brass melting furnaces without the disadvantage of high investment for special equipment and the necessary supervision which the same entails.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	70 00	60 00
Spelter	11 50	10 75
Lead	10 25	8 75
Antimony	12 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ¼ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.5(
Nuts, square, tapped	add 1 7(
Nuts, hex., blank	add 1 7(
Nuts, hex., tapped	add 2 0(
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and (
Boiler rivets, base ¾" and larger	$8 5(
Structural rivets, as above	8 4(
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

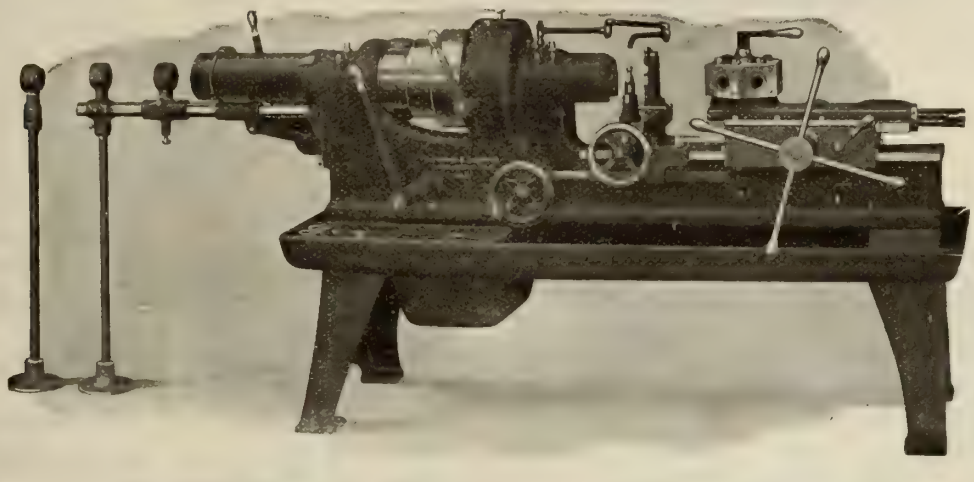
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We can supply you from stock immediately.

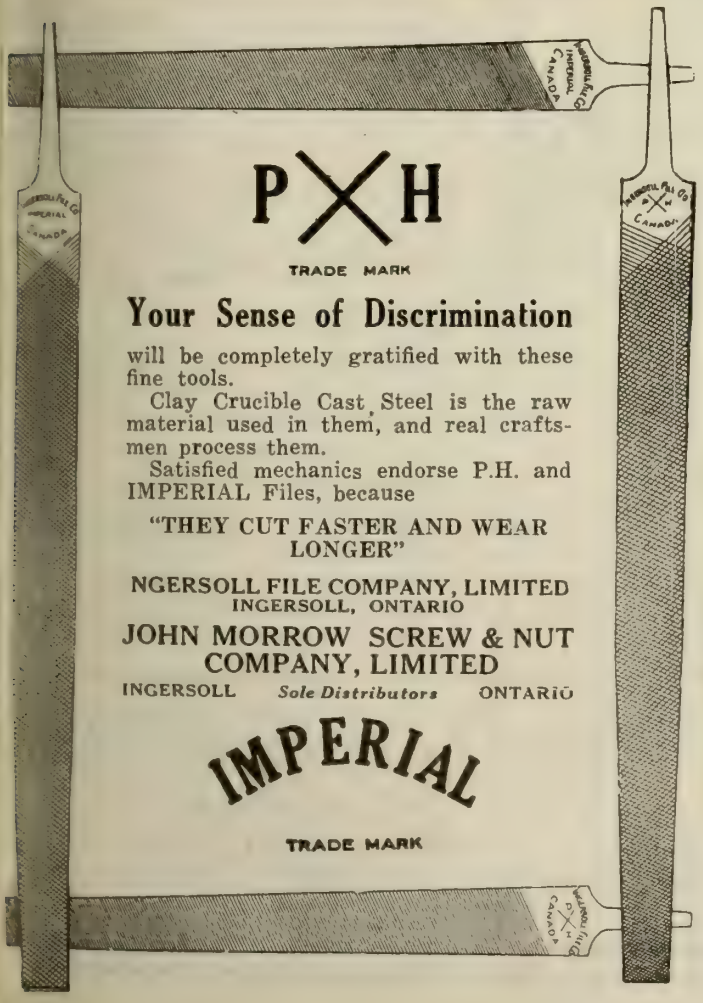


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WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

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Your Sense of Discrimination

will be completely gratified with these fine tools.

Clay Crucible Cast Steel is the raw material used in them, and real craftsmen process them.

Satisfied mechanics endorse P.H. and IMPERIAL Files, because

"THEY CUT FASTER AND WEAR LONGER"

NGERSOLL FILE COMPANY, LIMITED
INGERSOLL, ONTARIO

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INGERSOLL *Sole Distributors* ONTARIO

IMPERIAL

TRADE MARK

Acid Electric STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal

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Phone Victoria 1482

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 75
Sheets, black, No. 10	6 50	6 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 25
Premier, 10¾ oz.	....	9 65
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

GEOMETRIC

Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps.

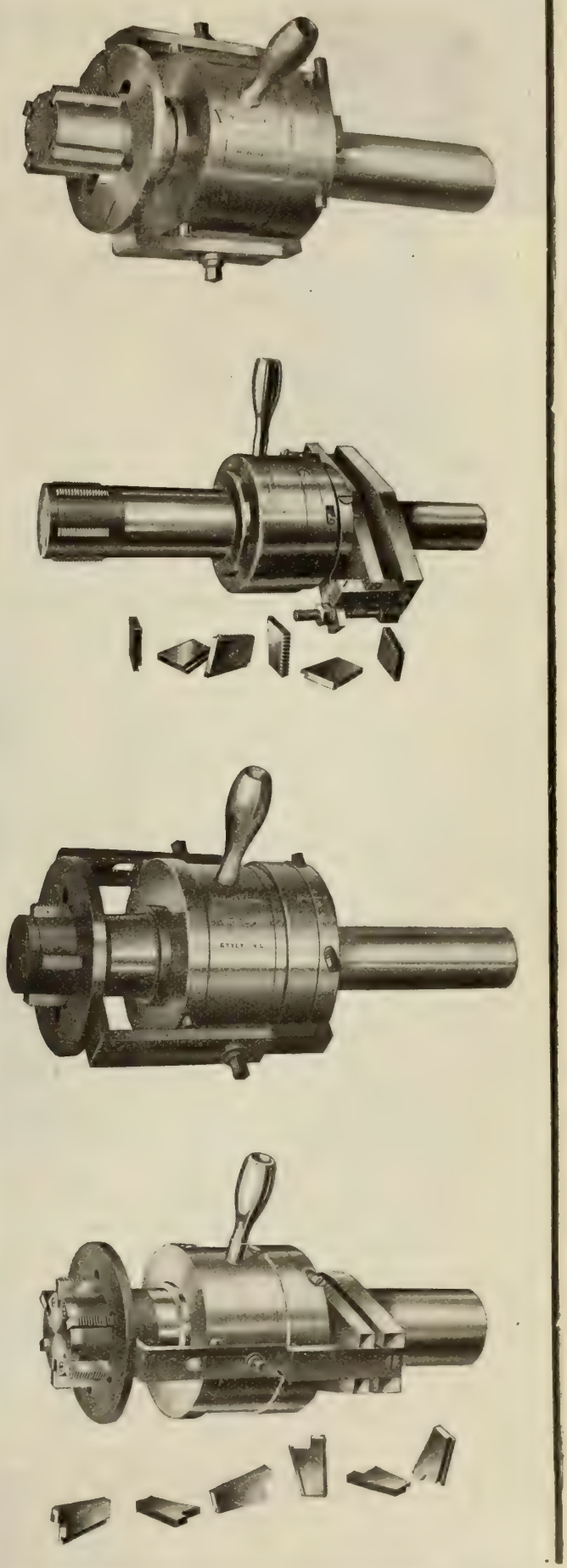
The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

The Originators
and the
Largest and Best Known Manufacturers
of
Automatic Threading Tools

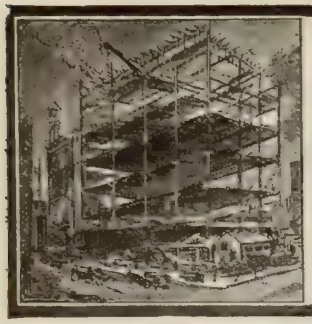
For cutting all classes of screw threads, internal and external, of any diameter and form.



The Geometric Tool Company
New Haven, Conn., U.S.A.

CANADIAN AGENTS:
Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



TRADE GOSSIP

Foundry to Start.—A foundry company of American and Canadian capitalists, of which J. Gill Gardner, of Brockville, is the president, will this spring commence a plant on the Murray property in Brockville, which is to become an industrial area. At the start 125 hands will be employed.

The Chicago Flexible Shaft Company opened a New York office, February 1st, for the distribution of their furnaces, forges and heat-treating equipment. This office will be located at 350 Broadway and will be in charge of J. W. Lazear, formerly with the Brown Instrument Co. of Chicago.

Changes at Hamilton.—The Canadian Fairbanks-Morse Co. announce that Mr. R. V. Donaldson has been transferred from London to take charge of their business at the Hamilton branch. Mr. Dave White, who has been with the Canadian Fairbanks-Morse for some time in Hamilton, has started in business for himself in that city.

Warehouse at Windsor.—The contract has been let for the erection of a warehouse and showroom on Pitt Street E., Windsor, for the Canadian Fairbanks-Morse Co. The building will consist of two floors and basement, 50x100, with allowance for the addition of three more stories in the future. Work will be started on this at once as the company is desirous of securing the use of the premises as soon as possible.

Will Re-open Plant. — The Smith's Falls Malleable Castings Co. will shortly re-open its plant on the river front there after being in idleness for the last five years owing to the slump in malleable casting business. The company hopes to run the factory at capacity and to employ 200 men. The company has kept in operation a smaller plant in the north end of the town where 100 men are continuously employed.

New Light System. — Superintendent Williams, of the Canadian Pacific Railway, anounced that an automatic electric light system of signals is to be installed this summer on the 65 miles of Canadian Pacific railroad track between London and Toronto. The new system will save oil and labor. Mr. Williams also stated that practically a quarter million dollars will be spent by the C. P. R. on improvements in the division during the summer of 1920.

Kingston Industrial.—Mr. J. S. Sibbitt, former first vice-president, was elected president, and Mr. R. J. Bushell, was re-elected secretary-treasurer and manager of the Kingston Industrial Association. The other officers elected were: First vice-president, James Henderson; second vice-president, J. J. Wilmot; directors, Thos. Doyle, A. E. Day, C. Rogers, E. Cooke, E. Bradden, A. Weller, R. J. Moore, J. A. Wilson, James Baxter, H. J. Simpson, Herbert Orser and J. L. F. Sproule; auditors, C. F. Adair and J. B. Quinn.

WILL REPRESENT CANADA IN SCOTLAND

Lt. J. Vernon McKenzie will Study Canadian Conditions Before Leaving for Glasgow

Lieut. J. Vernon McKenzie, of the editorial staff of the MacLean Publishing Co., has received the appointment of Canadian Trade Commissioner to Scotland. Mr. McKenzie is a graduate of Toronto University and of Harvard, and prior to going overseas had a very wide



LT. J. VERNON McKENZIE,
Canadian Trade Commissioner to Scotland.

experience in Canadian and American newspaper circles.

It is the intention of Mr. McKenzie to make an extended inspection of Canadian industrial fields before taking over his duties at Glasgow, in order that he may have as much first-hand knowledge as possible of conditions in Canada as they relate to export trade to Scotland.

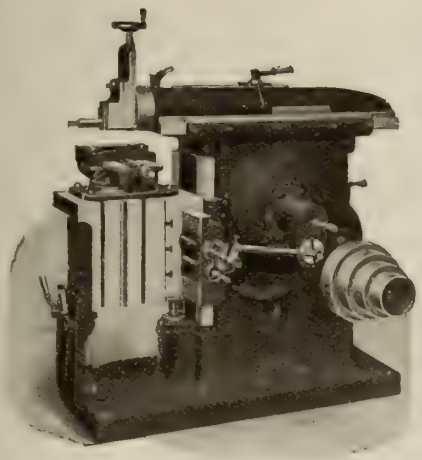
Guelph After Six. — The Industrial Committee of the Guelph Chamber of Commerce met and dealt with the application of six American firms who are anxious to locate their Canadian branches in Guelph. The landing of two or three of the firms for the city looks very promising. A sub-committee was appointed to deal with the formation of a Guelph Realty Company. Committees to look up detailed information on the following subjects are to be appointed: Power factor sites, taxation, water, transportation and education.

Duty on Autos.—The duty on automobiles and automobile accessories imported into the United Kingdom from the United States and other foreign countries is 33 1/3 per cent. ad valorem; but when imported from Canada and other countries of the British Empire there is a deduction of a third made in the duty—that is to say, the duty is 22 2/9 per cent. Second-hand automobiles are dutiable at the same rates. Special regulations are in force respecting the temporary importation of automobiles into the United Kingdom for touring and other purposes.

Foundry to Rebuild.—Fire which broke out in the main building of the Kyle Malleable Works, Merrickville, gutted the interior of that part of the foundry completely. Total destruction of the entire plant was prevented by the well-directed efforts of the volunteer fire brigade and for some time it was questionable whether they would succeed in saving the remainder of the building. Mr. Kyle states that he will have the works in operation again in three weeks. He does not intend to rebuild the building to its original height—three stories—but will construct a more modern plant, housed in a one-story structure. The loss was heavy but is fairly well covered by insurance.

Patents Issued.—The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout & Maybee, 156 Yonge street, Toronto, from whom further particulars may be obtained: Emile A. Fourneaux, the production of black upon textile fabrics; Alfred A. Lockwood, obtaining copper from its ores; John W. Myatt, loose-leaf books or binders; Auguste J. Rossi

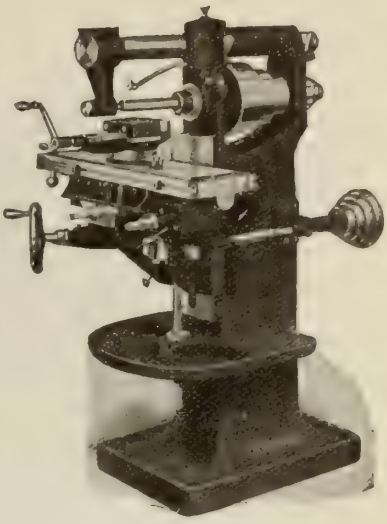
Steptoe Shapers and Milling Machines



are built with a knowledge gained through seventy-four years' experience in the manufacture of high grade machine tools.

Shapers: 14 in., 16 in., 20 in., 24 in. equipped with ordinary belt drive or single pulley drive through gear box.

Milling Machines: 10 in., 15 in. and 19½ in. by 6¼ x 12, hand or power feed, with or without back gears. Can be equipped with vertical attachment.



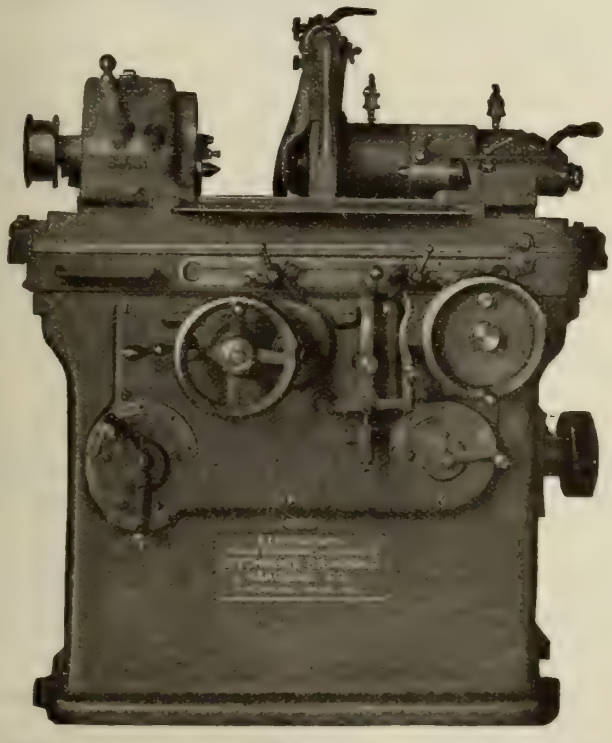
Get particulars from

Garlock-Walker Machinery Company, Limited

32 Front St. West, Toronto

MONTREAL - - WINNIPEG

"Everything in Woodworking and Metalworking Machinery



Fitchburg Plain Cylindrical Grinders

are carefully designed to meet the great variety of cylindrical grinding requirements. It will meet all the present day demands for accuracy and high speed production and, owing to its compact construction, **occupies just half the floor space of the larger cumbersome machines.** It is most rigid and powerful. Construction is on the unit system, each unit being entirely independent of any other and can quickly be removed from the machine. Lubrication throughout is designed to reduce wear and friction to a minimum.

Made in following sizes:

6 x 20	6 x 30
8 x 36	8 x 54
12 x 36	12 x 54

Equipped with all automatic feeds and arranged for motor drive on request.

Ask us for complete specifications on this machine.

Fitchburg Grinding Machine Co., Fitchburg, Mass.

Garlock-Walker Machinery Company, Limited

32 Front St. West

Montreal TORONTO Winnipeg

If interested tear out this page and place with letters to be answered.

and C. J. E. Schroeder, paints; Louis E. Barton, composite titantic oxide pigments and methods of producing the same; Henry C. Minns, testing device for the ignition systems of internal combustion motors; Fred D. S. Robertson, process of extracting potassium from its insoluble compounds; John Russell, button-hole stitching machine; Predigest Food Co., Limited, manufacture of animal feeds from kitchen garbage and the like; Alfred T. Kwajel, magneto-electric machines for engine ignition purposes; John Yetton and W. E. Brockett, holders for wire staple belt fasteners; Philip T. Jackson, fluid control apparatus.

Toronto's Growth.—The report of the Toronto Industrial Commissioner for 1919 showed the following new industries located on city property during the year: Blackford Calf Meal Co., Canadian John Wood Mfg. Co., Chase Motor Truck Corp., Ltd., Clark Dental Mfg. Co., Columbia Graphophone Company, Consolidated Wafer & Cone Co., Ltd., Crane, Limited (valves), Diamond State Fire Co., General Fire Extinguisher Co., Great Lakes Oil Refining Co., Ltd., Herbert, Alfred Co., the Charles E. Hires Co., Ltd., International Metallurgical Co., Larned, Carter & Co. (overalls), Merchandise Sales Co., National Electrical Products Co., Neptune Water Meter Co., Select Lingerie Co., Sims, Till Mfg. Co., Ltd., Sunbeam Chemical Co., of Canada, Limited, Taylor Instrument Co., Veterans' Mfg. Supply Co., Ltd., Ward Baking Co., Wolverine Limited. Firms located on harbor properties are: Anthracite Briquette Co., Baldwin Canadian Steel Corporation, Barrett Co., Ltd., Canadian Ice Machinery Co., Coleman Lamp Co., E. Fielding & Sons, Fish Coal Co., Nukol Co., Ltd., Ontario Oakoal Co., Peckover, Ltd., Wm. F. Sparling Co., Toronto Structural Steel Co.

MARINE

Owen Sound.—Mr. Angus A. Cameron, chief engineer of the C. P. R. steamship fleet, was in Owen Sound looking after new steam winches which are being made there by the Wm. Kennedy & Sons Co. These winches are for mooring purposes and will be placed aboard the three older steamers—the Manitoba, Alberta and Athabasca—during the winter. The new equipment will result in a big improvement in handling these boats.

The Mead Morrison Mfg. Co., East Boston, manufacturers of hoisting and conveying machinery, have purchased the plant of M. Beatty & Son, at Welland, Canada. The Canadian plant occupies about nine acres of land and heretofore has been engaged in the manufacture of hoisting and dredging machinery. It will be operated by the Boston company as a Canadian branch and such alterations and additions will be made as are required to adapt it to the new work.

APPOINTED MANAGER OF VICTOR SAW WORKS

F. J. Macdonell has been appointed manager of the Victor Saw Works of Hamilton, Ont., in place of H. W. Holmes, who recently resigned. Mr.



F. J. MACDONELL,
Manager Victor Saw Works.

Macdonell intends covering the Maritime Provinces and Western Canada. J. A. Evans, who has acted as office manager for the firm for the past seven years, has now joined the sales force and will look after the Province of Ontario.

STEEL CO. OF CANADA HOLDS CONFERENCE

Salesmen From All Over the Dominion Attend the Gathering at Hamilton

More than 100 representatives from all parts of the Dominion attended the eighth annual sales conference of the Steel Company of Canada, Limited, held for four days at the Royal Connaught Hotel, in Hamilton. Owing to the unavoidable absence of President Robert Hobson, the representatives were welcomed by Vice-President Cyrus A. Birge and Charles S. Wilcox, chairman of the board.

A feature of the general discussions that took place was the opinion expressed unanimously by various speakers that 1920 will offer splendid opportunities for business. One of the difficulties, it was stated, is going to be to get production owing to scarcity of raw materials. The opinion was freely expressed that this condition is likely to prevail throughout the entire year.

The business sessions on Tuesday, Wednesday, Thursday and Friday were in charge of George Spence, Western sales manager; H. T. Diplock, of Montreal, the Eastern sales manager, assisted by George A. Simpson, C. E. Harrison and Thomas Moore, of Hamilton, and D. J. Black, of Montreal.

On Tuesday evening a banquet was tendered the visitors. On Wednesday evening a dance was given to the office employees and more than 150 couples spent a most enjoyable evening. On Thursday evening a theatre party was held and on Friday visits were made, both to the Hamilton works and the Canada works.

BRANTFORD ROOFING PLAN NEW EXTENSIONS

Outlay For New Additions This Season Will Amount to Some $50,000

THE Brantford Roofing Co., Ltd., of Brantford, Ont., are entering into improvements on quite a large scale. They are erecting a new boiler and engine room of concrete construction, with brick walls, measuring 30 by 40 feet. In this building will be installed a new 66 in. x 14 ft. return tubular boiler, together with necessary pumps, etc., etc.

They are also erecting a new coating tank room of concrete construction. This building will be 36 ft. x 50 ft., and have a 60 ft. brick stack. Four boiler tanks will be installed in this portion of the plant.

The concrete storage bin will be 18 ft. x 80 ft., so arranged that a 20-inch belt conveyor will take the material to its proper source. The handling capacity of this conveyor in its entirety will be 40 tons per hr.

Schultz Bros., of Brantford, are handling all the work on these buildings, while J. H. Hall & Sons, Brantford; Waterous Engine Works, Brantford; Guyton & Cumfer, Chicago, and the Jeffreys Mfg. Co., Montreal, are supplying the necessary machinery.

Taking the whole thing into consideration, the machinery and buildings will cost around $50,000.

PERSONAL

A. A. Roelofs, formerly special representative of the Precision & Thread Grinder Mfg. Co. in the Ohio territory, has been advanced to manager of the Chicago office.

J. B. Smythe has resigned as superintendent of A. O. Norton, Limited, Coaticook, Que., which he has held for 12 years, and will take a short vacation before resuming in some other line.

D. G. Anderson has moved to Pembroke from Ottawa to take over the management of the Steel Equipment Co. factory. Up to the present Mr. D. P. Cruikshank has been in charge, making trips from Ottawa for several days each week to look after affairs, but hereafter he will give more time to the sales end of the business.



Plant of

THE JOHN MORROW SCREW & NUT CO., LIMITED

AT INGERSOLL

Where the famous Morrow High Speed Drills are manufactured. This is the pioneer plant to produce Twist Drills in Canada.

Every user in Canada who wants "production" **(More holes with less regrinding),** should use these Drills. There's a difference your operator will tell you of with satisfaction. Every Morrow Drill is guaranteed. Each tool gives **you** the proper service you should get **and more.** Order **now.**



Also manufacturers of Set Screws, Cap Screws, Semi-finished Nuts. Sole distributors of P/H and Imperial Brand Files. "They cut faster and wear longer."

Works at

INGERSOLL, CANADA

The Week's Events in Montreal Industry

The Davey Machine and Repair Company, 1227 Ontario St. East, Montreal, are now making the Davey patented tool holders.

Furniss, Clarke & Co., 364 University St., Montreal, has taken on the lines of the Talbot-Stead Tube Company Ltd., of Birchills, Walsall, Eng.

W. M. Neal, who has been general secretary of the Canadian Railway Board, now the Railway Association of Canada, has been appointed to the position of assistant general superintendent of the Quebec division of the Canadian Pacific Railway.

The Montreal plant of the National Electro Products Company, on Morreau Street, has just been completed. The company has been making exhaustive tests during the past few weeks and are now manufacturing commercial oxygen and hydrogen for the trade

The first instalment of machinery and power equipment that will be used in connection with the new plant of the St. John Dry Dock and Shipbuilding Company, at Courtenay Bay, has been delivered to the site. This shipment consists of four carloads and will form part of the twenty carloads that will be required to fit out the plant. The machinery, when unloaded, will be stored in an adjoining warehouse until the buildings are ready to receive it.

As a direct result of the greatly increased business that has been steadily piling up with Great Britain and many of the British colonies distributed throughout the world, the executives of the Gillette Safety Razor Company of Canada, at their annual meeting held last week, have decided to extend their present manufacturing facilities, and to this end have purchased adjoining property to the Montreal factory that will provide an extra 13,000 square feet of floor area. While temporary use of this property will provide for immediate needs, further expansion is contemplated.

At the luncheon given by the Engineering Institute of Canada on the first day of the convention, a discussion on the growing necessity of new methods in the construction and maintenance of highways was a feature of the session. It was suggested that some federal system of co-ordination be adopted to build roads on regular plans throughout their length so as to adequately meet the requirements of modern motor traffic. The rapid extension of motor traffic made it imperative that a standard road should be maintained on the main highways, and that everything should be done to encourage some co-operative plan of permanent and uniform roadways.

At the annual meeting of the Montreal Board of Trade held last week a resolution was passed endorsing the action of the council in their efforts to have the Government to remove the present Business Profits' War Tax. It is the opinion of the members of the board that the present tax is detrimental to the development of the country, and that if such revenue is still necessary the same should be derived by some more general method of taxation. Another feature of the business of the meeting was the unanimous endorsation of any action that would promote closer trade relations with the British West Indies. The officers for the ensuing year will be George Sumner, president; Hon. Lorne C. Webster, vice-president; Arthur Lyman, treasurer; and Stanley Cook secretary.

CANADIAN RAILWAY CLUB HOLD MERRY TIME AT ANNUAL DINNER

THE seventeenth annual dinner of the Canadian Railway Club was held on the last night of January, at the Windsor Hotel, Montreal. About 300 were present at the tables and all did justice to the food (and drink) placed before them. The dinner was presided over by J. Hendry, president of the club, with Lewis C. Ord as toastmaster. The Hon. Arthur Meighen and Rev. George Adam were the guests, and with them at the head table were: W. M. Neal, late secretary of the Canadian Railway Board; W. H. Winterrowd, H. H. Vaughan, J. M. S. Carroll, R. M. Hannaford, Jas. Coleman, W. H. Sample, T. C. Hudson, W. McNab, A. A. Goodchild, W. A. Booth, A. A. Maver, Wm. H. Robb, W. A. Kingsland, Norman Holland, and G. M. Wilson.

In proposing the toast to "Our Railways," W. H. Winterrowd gave a brief resume on the history of railroad development in Canada from the time that the first train was put in operation 92 years ago, up to the present time, particularly emphasizing the effective special service rendered by the railroads during the past five years. The reply to this toast was ably given by W. M. Neal, formerly general secretary of the Canadian Railway War Board, and recently appointed as assistant general superintendent of the Quebec district of Canadian Pacific. His brief address was largely taken up by a review of the achievements of the Board in getting the effective co-operation of the various railroads under the auspices of the C.R.W.B., whereby there had been great saving in labor and operating costs. Mr. Neal gave numerous figures to illustrate his remarks.

The toast to "Our Guests," which was proposed by T. C. Hudson, was responded to by the two chief speakers of the evening, the Hon. Arthur Meighen, Minister of the Interior, and Rev. George Adam. In his address, Hon. Arthur Meighen spoke on the gradual, but progressive, development of Canadian railroads, and defended the policy of the Government in their acquisition and control of additional mileage. He emphasized the changing industrial conditions that were virtually forcing the Government to take over the Grand Trunk. In speaking on this matter he said: "I pass the subject up only with the statement that that acquisition, like the previous one, was not brought about through any restless ambition to become great railway operators and owners, but it was the result of our railway crisis, the result of some mistakes and, indeed, of the very evolution of railroads. But a country that has contributed 640,000 men in the great struggle for liberty that has ended in triumph does not need to quail before the task of managing thousands of miles of railway even under a Government system."

The short reply by Rev. Geo. Adam was appropriately humorous in character, but with a human touch that went direct to the hearts of the entire audience. He dwelt on the factor of distribution of wealth and the direct bearing it had upon the life of a nation, the strength of which was a question of happy and contented homes rather than the taxable value of the country's wealth. In closing, the speaker said: "There is also a need for the distribution of ideas. Every child of rich and poor should have the same right to receive from the distribution of ideas through the medium of education. The only hope of Canada's future greatness lay in the distribution of her ideas on a larger scale than ever before."

The toast to the "Railway Supply Men" was proposed by W. H. Sample and replied to by H. H. Vaughan of the Dominion Copper Products, and J. M. S. Carroll, sales manager of the Canadian Consolidated Rubber Company.

Interspersed with the food and drink for the physical and the intellectual man, the entertainment committee had provided an excellent program that appealed particularly to the eye and the ear. Several of the leading artists from local theatres were engaged to relieve the pressure that had gathered from a year's sojourn with railroad and other problems.

ILLINOIS HOBS

NONE BETTER CAN BE MADE



It is not our ambition to make all the Hobs used in industry; only to make the best.

ILLINOIS TOOL WORKS, CHICAGO.

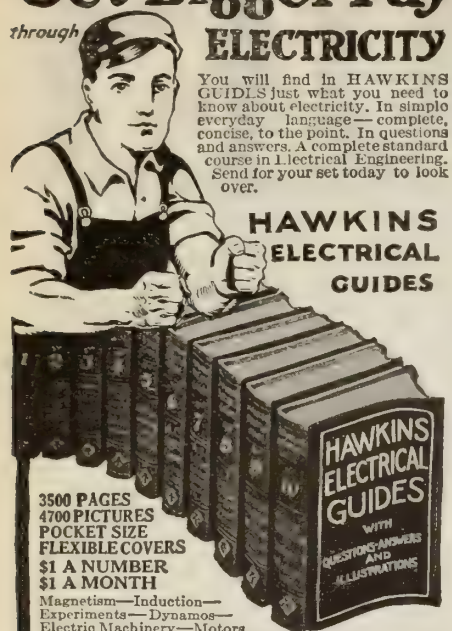
Detroit Store—
Woodward and Warren Aves.
A. C. Towne, Inc.
17 W. Swan St., Buffalo.

S. J. Pfaff
Pioneer Bldg., St. Paul.
Rose Tool and Supply Co.
111 Market St., Pittsburgh.

Louis G. Henes
75 Fremont St., San Francisco.
Title Insurance Building,
Los Angeles.

Indianapolis Office
616 Fletcher Sav. & Trust Bldg.
New York Office
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ARE PLANNING TO ASK FOR AN INCREASE OF BRITISH PREFERENCE

AT the annual meeting of the Canadian Association of British Manufacturers and their representatives, which took place at the Walker House on January 28, a lively discussion arose as to the future attitude of the association towards representatives or agents who may enter into any agency agreement with manufacturers or wholesale exporters whose principal works or places of business are situated in a country which was hostile to Britain during the war. The debate had its origin in a suggestion made that a clause of the constitution, prohibiting representatives of British manufacturers having similar connections with firms of or in former enemy countries from membership in the association, should be deleted. After many arguments had been advanced it was resolved to submit the proposed alteration in the constitution to a "postal vote."



GEORGE A. MARSHALL,

President of the Canadian Association of British Manufacturers. Mr. Marshall is a partner in the firm of Marshall, Son & Bunney; president of the Kerr File & Tool Co., Ltd., and proprietor of the Perfection Sanitary Brush Co.

Mr. John Wilson, the retiring president, in his address made an announcement which was well received, to the effect that an arrangement had been reached with the Federation of British Industries by which commercial intelligence could be exchanged between members of the Canadian Association and the British manufacturers. The Federation of British Industries, Mr. Wilson stated, had a membership of over 19,000 firms representing $20,000,000,000 of capital engaged in British industries. It would now act as the London representative of the members of the association, which, he declared, now number 85, representing about 400 British manufacturers. The London office of the F. B. I., situated at 39 St. James' street, London, S. W. I., would now be available for members of the association visiting in London as a means of getting in touch with such members of the Federation as they might wish to see.

Want Preference Increased

With regard to tariff matters Mr. Wilson said that the association was in close communication with the Minister of Finance with a view to increasing the British preference on such items as iron and steel, paints with spirit base, fire brick and other clay products, etc. He invited the members to submit all their tariff difficulties to the Executive Council, so that it might present them to the proper authorities, as the Dominion Government had agreed to receive a deputation from the association when the proposed tariff investigation is held. The Executive Council had also, he said, passed a resolution requesting that the Department of Overseas Trade of the British Government take immediate steps to appoint the necessary inspectors in Great Britain in order that the certificates required by the Canadian Government in respect to imports of potted meats might be forthcoming for shipment to Canada from British firms.

The election of officers for 1920 resulted as follows: President, Mr. G. A. Marshall; vice-president, Mr. J. Harris; council, Messrs. A. C. King, C. W. Beal, James Haywood, R. D. Harding and Harold A. Wilson.

CANADIAN MACHINERY MEN SHOULD GET IN TOUCH WITH CUBAN BUYERS

A SUBSCRIBER of CANADIAN MACHINERY in Havana, Cuba, writes to this paper as follows:

I was very glad to see in my office down here several copies of CANADIAN MACHINERY AND MANUFACTURING NEWS, and I have given some of our old copies away to people who are interested in buying machinery from Canada.

I am writing you in the hope that you may be able to interest Canadian machinery people in the Cuban market. At the present time there is a very heavy demand for locomotives, new and rebuilt; rails, 60 and 75 lb., inspected, complete, with splice bars and bolts; galvanized barbed wire, 6 in., 12 gauge, 4 points to a barb; and many other odd lines. A prominent British machinery house (Albert Maloney, of 12 Amargura street, Havana), enquired for the above.

I am enclosing a list of prominent machinery dealers in Havana. Any Canadian firms who have machinery for sale might write direct to any of these firms, or let the trade commissioner here know at once what they have for sale and he could put the enquiry in the hands of some firm here who requires that article. As you probably know, the Canadian Government Merchant Marine has inaugurated a very good direct service from Halifax and St. John to Havana.

Canadian exporters to Cuba must always bear in mind that United States goods enter Cuba with the advantage of 10 to 40 per cent. reduction of the general tariff rates, with the exception of the following goods on the free list: Natural fertilizers, agricultural hand tools, ploughs, hemp, flax, jute, coal and coke, bricks, barbed fencing wire, newsprint and wood pulp.

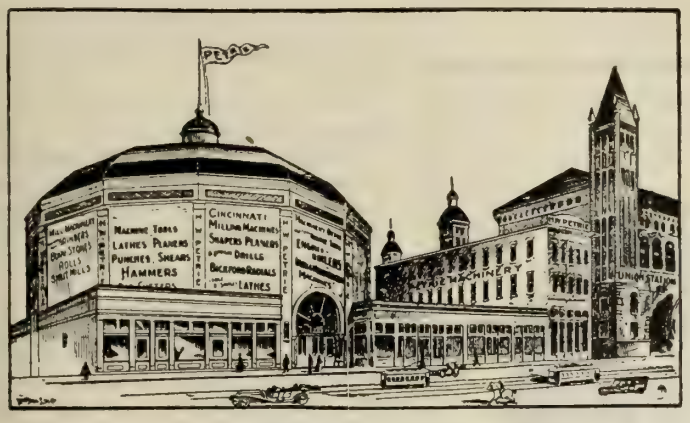
Continued on page 114

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Wisconsin Electric Co.
Racine, Wis.
Hyatt Roller Bearing Co.,
Metropolitan Tower, New York, N.Y.
American Pulley Co.,
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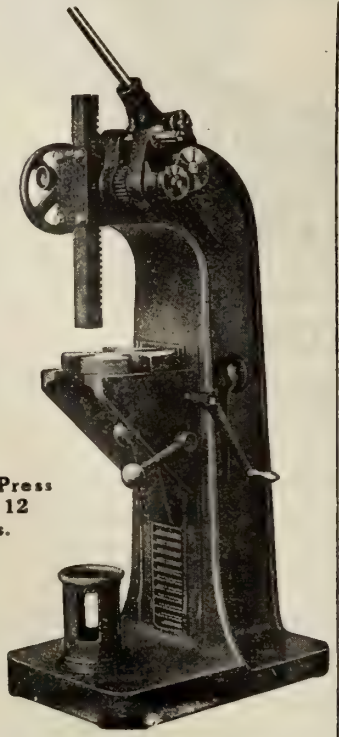
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MACHINERY MANUFACTURERS
Continued from page 112

I would be pleased if you would do your best to interest Canadian machinery houses in the Cuban market.

Here is a list of the principal machinery importers of Havana, Cuba:

Hijos De H. Alexander, Lonja de Comercio, 10 Piso.

J. F. Berndes & Co., Cuba 64.

Casacarter, S. A. (agricultural), Obrapia 61.

Oscar B. Cintas, Oficios 29-31.

Cuban Machinery and Supply Co., Obrapia 32.

R. J. De Orn & Co., Conacha y Marina.

Ellis Bros., Inc., Cuba y Lamparilla.

Gaston, Cuervo & Co., Habana 94.

General Machinery and Trading Co., Cuba 58.

Havana Marine Railways, Inc., San Pedro 2, Altos.

Jimenez, Rojo y Padro, O'Reilly 5.

V. V. Lebedjeff Engineering & Supply Co., Cuba 27.

Lombard & Co., O'Reilly 9½.

Machin & Wall Co., Ricla 8.

Victor G. Mendoza & Co., Cuba 3.

Albert Maloney, Amargura 12.

Quinones Hardware Corporation, Aguiar y Empedrado.

Thrall Electric Co. (electrical), Monserrate y Neptuno.

U. S. and Cuban Allied Works Engineering Corporation, Cuba 51.

Jose L. Villamil, Santa Clara 5.

Zaldo & Martinez (electrical), O'Reilly 26.

Zayas Abreu Commercial Co., San Ignacio y O'Reilly.

P.S.—It might be of interest to mention that the Canadian Trade Commissioner here is H. A. Chisholm, Teniente Rey 11, Rooms 501 and 502.

SALES CONVENTION OF CANADA METAL

The ninth annual sales convention of the Canada Metal Co. was held at Toronto during the week of January 19th, forty-five of the salesmen being present for the occasion. Mr. Harris, Sr., president of the company, gave an address of welcome to the representatives and then turned the meetings over to Mr. Harris, Jr., who pointed out the value that could come from a sales conference if all co-operated. Monday evening, the entire staff had dinner at the Queen's, Mr. Harris, Jr., on this occasion taking the opportunity of presenting everyone with a life insurance policy to mark the company's appreciation of the largest year's business in its history. During the conference in the following days, trips of inspection were made to some of the large newspaper offices where the company's metal is in use, and also to the John Inglis Co. plant, where they could see the use to which the firm's babbitt is put in marine engines.

In the sales competition, the prizes went to Mr. L. J. Martin and Mr. Willis. Mr. White, from the Western field, won a special prize of a $150 gold watch. Mr. Garrett, also a Westerner, was second to Mr. White in this particular competition.

The making of nails at the Harris plant was also witnessed by the salesmen. Nails, varying in size from ⅜ in. up to 8 ins., were made on the different machines. At present the output of the nail department is 50 tons every 24 hours.

An event of rather an historic nature, particularly to the citizens of the City of Montreal, took place on the evening of January 30, when the new home of the Mechanics' Institute was officially opened. In his speech, Sir Alexander Bertram, the principal speaker, remarked on the worth of the mechanic in the community, stating that his life was one of accomplishment and production, and enumerated many of the wheels of progress created and kept going by the brain and hand of the skilled workman. In reviewing the development of the institute, W. Rutherford, the president, stated that the organization was first founded 92 years ago, but that the work was temporarily interfered with at the time of the rebellion of 1837. A Government charter was received in 1845 and a permanent home secured ten years later at the corner of St. Peter and St. James Streets, which location has been its home for the past 64 years. The new building on Atwater Avenue is ideal in every respect, and nothing has been overlooked in providing maximum comfort and convenience for the mechanical student and reader.

The most successful annual gathering in the history of the Engineering Institute of Canada was held last week at the Windsor Hotel, Montreal. The membership registration for the three days was over 650, and these were from all sections of both the United States and Canada. The feature of the business meetings was the reading of many engineering papers, and emphasis was laid on the essential need of special training in the different branches of engineering activities. At the dance held on Tuesday night over 400 guests were present, music being rendered by the Great War Veterans' Orchestra. At the smoking concert given on Thursday evening an excellent programme was given by a number of artists from local theatres. The officers for the year are Commissioner R. A. Ross, Montreal, president; Brig-Gen. C. H. Mitchell, Dean of the Faculty of Applied Science at the University of Toronto, and W. G. Chace, Winnipeg, vice-presidents.

Mr. F. Rodger Imhoff, New England representative of the Precision and Thread Grinder Manufacturing Company, has recently been made Field Engineer.

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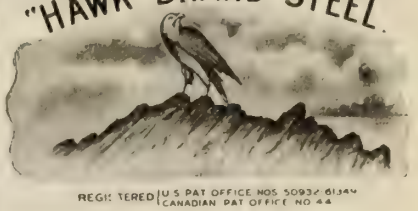
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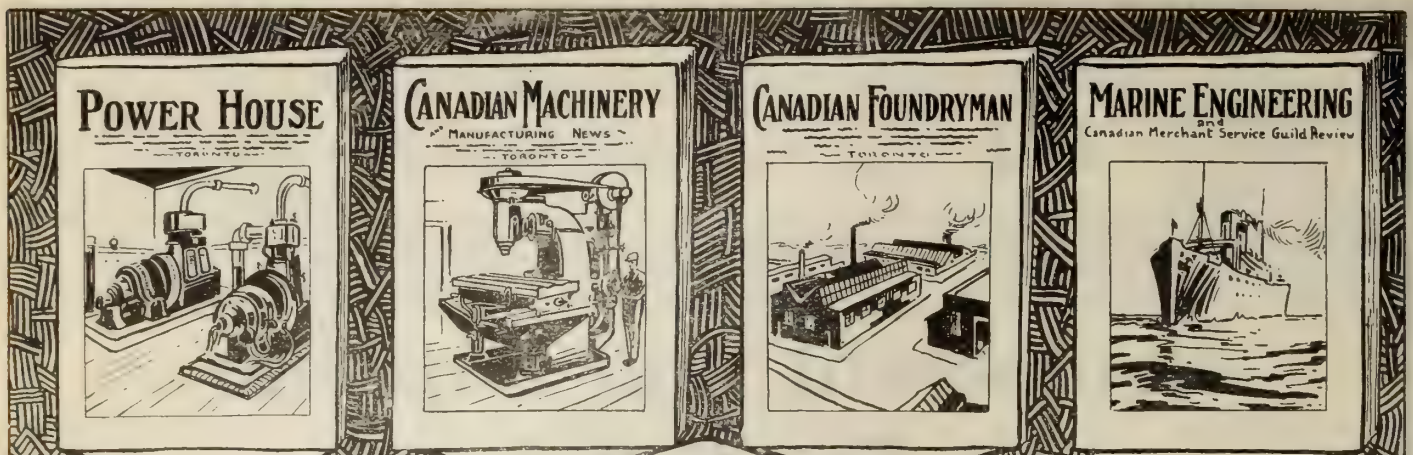
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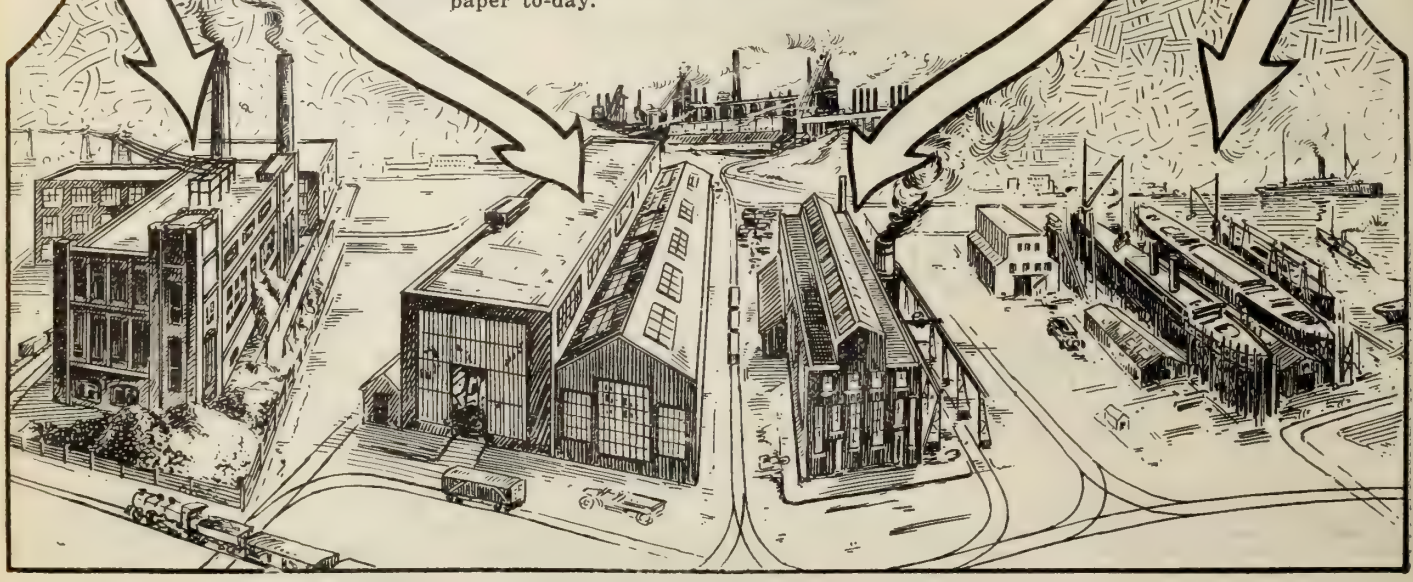
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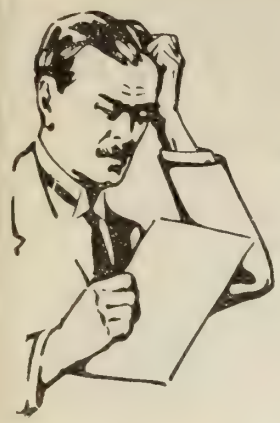
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Generator K.W.	Volts	R.P.M.	Turbine K.W.	Lb. Press.
300	220		300	150 lb.
1000	240	1500	1000	
		60 Cycles.		
100	2300	3600	100	125 lb.
100	480	3600	100	150 lb.
2-100	220 440	900	2-200	
250 KVA	2300	3600	250	150 lb.
250 KVA	600	3600	200	175 lb.
300	2300	1800	300	110 lb.
300	2200	3600	300	140 lb.
300	600	3600	300	140 lb.
312 KVA	2300		300	
375	4150		400	
375	600	3600		125 lb.
400	2300			
400	2200	3600	Parsons No. 47.	
500	600	3600		140 lb.
500	480	900	500	
500	600	1800		150 lb.
500 KVA	440			200 lb.
500	480	3600	500	150 lb.
500	440	3600	730 HP	160 lb.
500	2300	3600	500	125 lb.
2500	2200	1500	2500	150 lb.
6500	6600	750	6500	175 lb.
500	4000 2300		500	150 lb.
625 KVA	440	3000	500	
625 KVA	440	3000	500	
800	480		800	175 lb.
870	158	3600	870	
3-1000	600	1800	3-1500 H.P.	150 lb.
1000	600	3600	1250	140 lb.
1250	600 2300	3600	1000	150 lb.
1500	2300	1800	1500	
1875	2200	1800	1800 KVA	
2000 KVA	2200	1200	2000	150 lb.
3750 KVA	2400	3600		150 lb.
4000	2300	1200		200 lb.
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7500	4500	1800	7500	185 lb.

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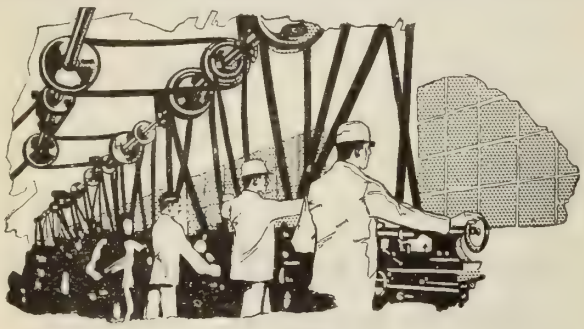
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AMERICAN STEEL SPLIT PULLEYS

They combine maximum strength with light weight and are guaranteed to reduce belt slip and air resistance to a minimum.

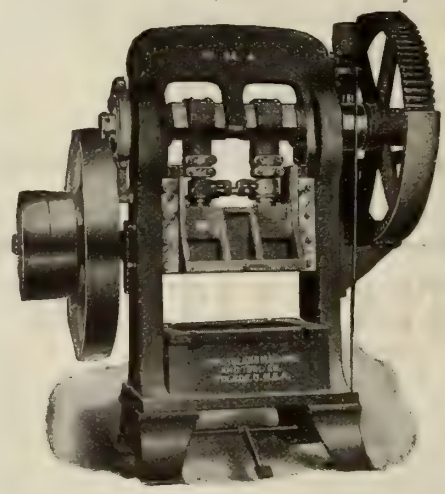
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We have in stock for immediate shipment the highest grade Bar Iron, Black and Galvanized Sheet Iron, Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

Machinist's Tool Chests



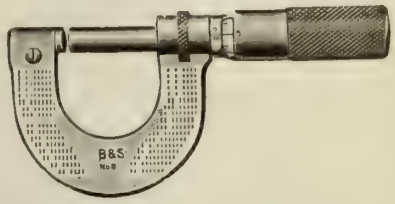
Time and again skilled machinists have remarked on the strength of construction and compact design of our Tool Chests. Have us give you full particulars.

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A rivet a second, sizes up to 3/16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

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Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

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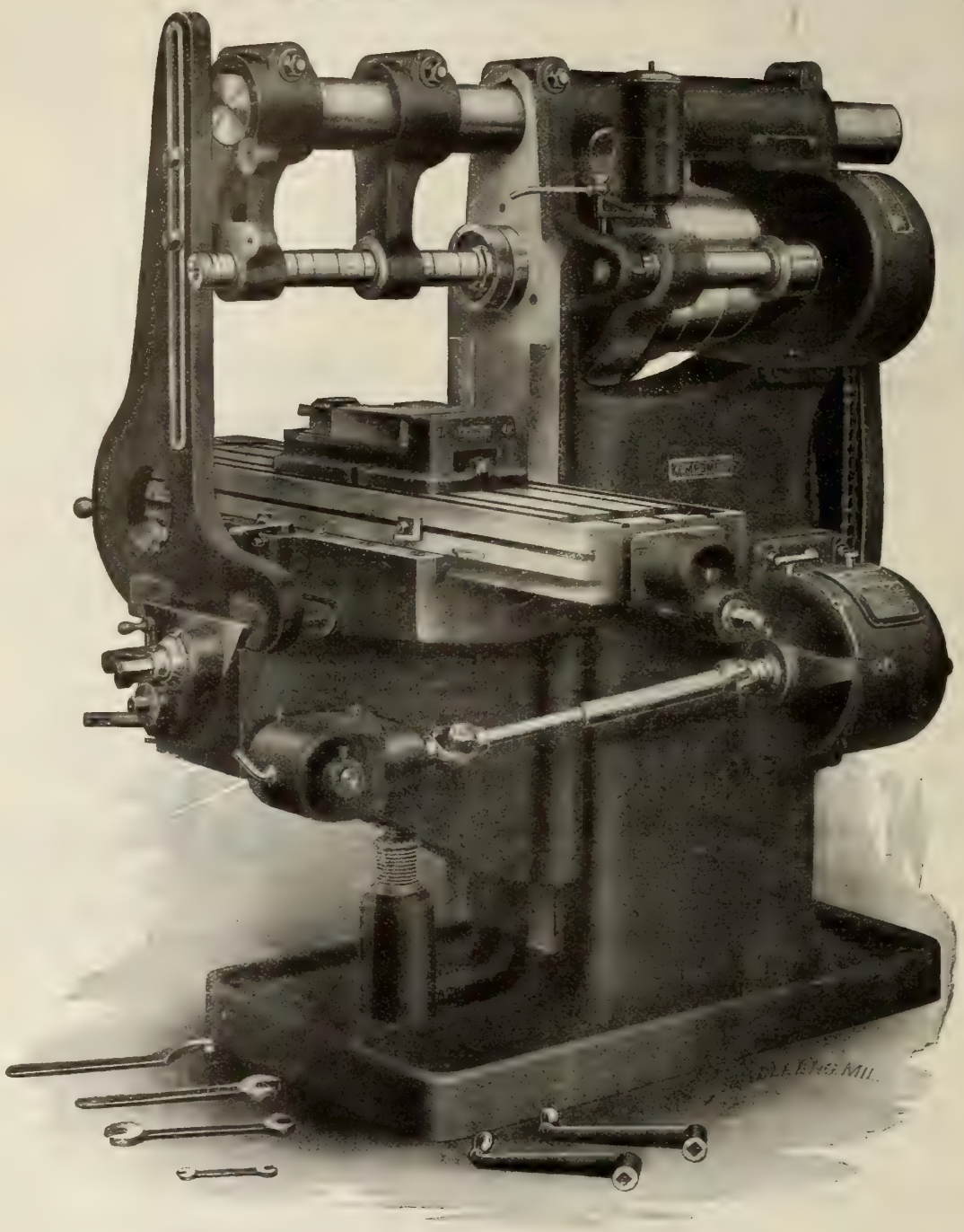
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Double Back Geared.

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

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Hold Tite Nut Lock

Simple Method of Applying

FIRST

Knowing the Size Bolt—
Use Same Size Nut Lock
Place Over Bolt — THIS WAY



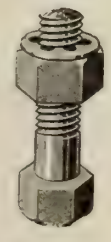
SECOND

Screw Another Nut Down onto
Nut Lock and Depress It
THIS WAY



THIRD

Remove Second Nut and Nut
Lock will Look
THIS WAY



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Spur, Bevel, Spiral, Herringbone and Intermittent

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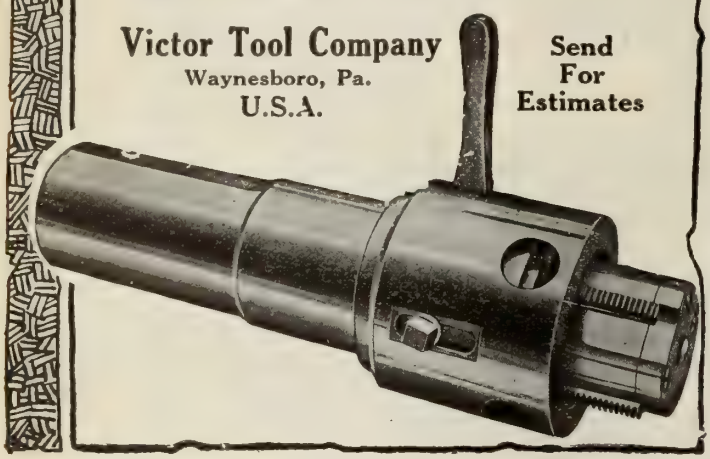
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The Miller for Small Work



A small machine takes up less space, requires less power, is easier to operate and is more accurate.
The Paramount Miller of its size.
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It has been adopted as standard by many firms that found it a long way better than guess work.

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C. E. Johansson

This illustration shows the only set of gages ever made with divisions to the millionth part of an inch. About 3000 hours' work of several of the most skilful gage-makers in the world were required to produce it. The variations do not exceed two ten-millionths of an inch. C. E. Johansson says:

"When I first made gages with divisions to the ten thousandth part of an inch, manufacturers said they were wonderful but that they didn't have to work so close. But after a while, they found it well to adopt my standards and then later the gage-makers found that they required still finer set to check up ten-thousandths and so I made sets with divisions to the hundred thousandth part of an inch. Then when I read in the American magazines that some were now talking of the millionth of an inch, I thought I would produce a little set in millionths, and so I further improved my measuring methods so that I could measure to the ten-millionth part of an inch.

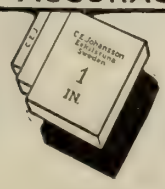
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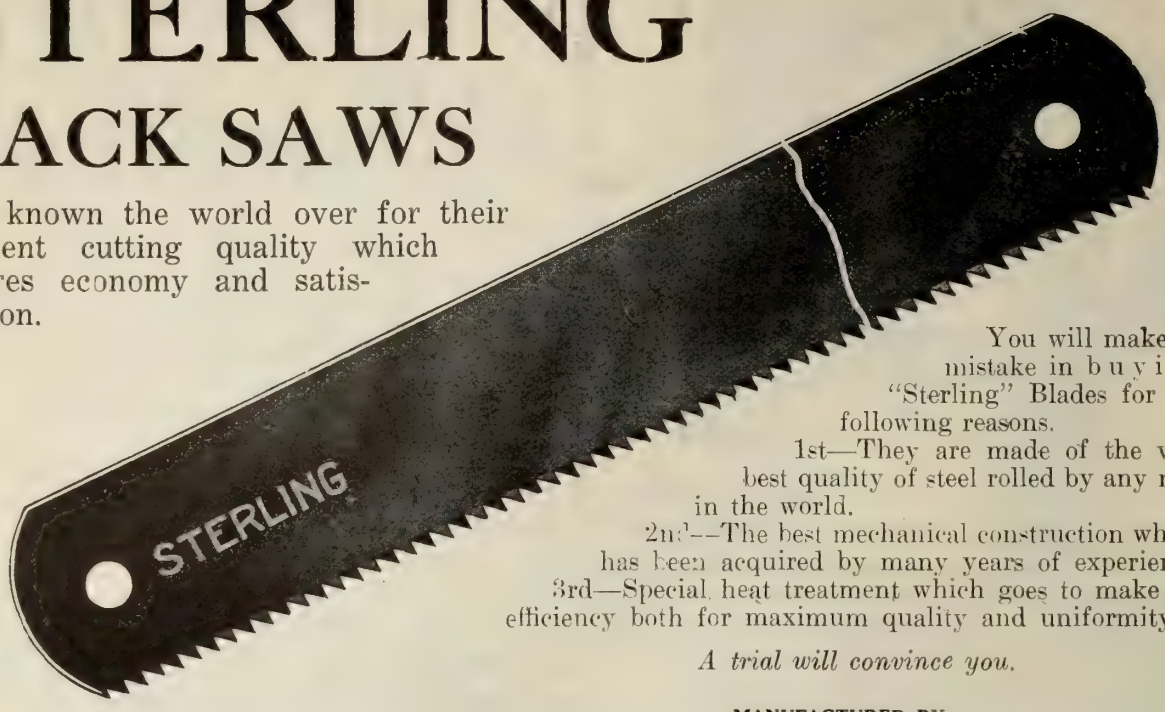


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Are known the world over for their efficient cutting quality which insures economy and satisfaction.



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ELEVATING TRANSMITTING CONVEYING
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That ensures a big measure of efficient and economical

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The belting comes in rolls of 500 ft., but we can supply any portion of this or one or more rolls at a moment's notice. Stocks carried at all points given in addresses below.

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With Bowser Equipment One Man Does the Work with Less Time and Effort —and Without Loss

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Do away with the back-breaking, disagreeable labor in storing and handling oils.

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Write us for literature, showing why Bowser Systems are a paying investment

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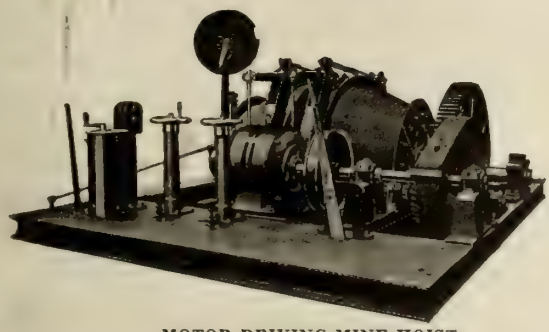
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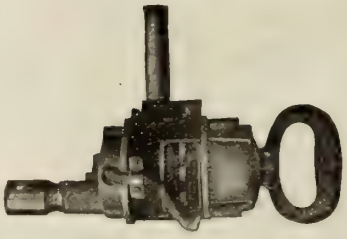
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Save Time, Labor and Money



They can be attached to any lamp socket.

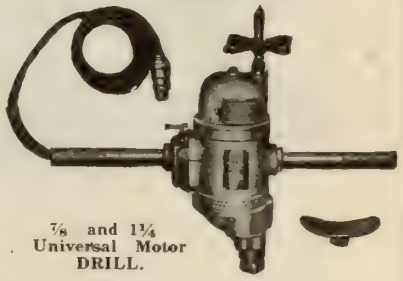
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All motors wound for 110 or 220 volts.

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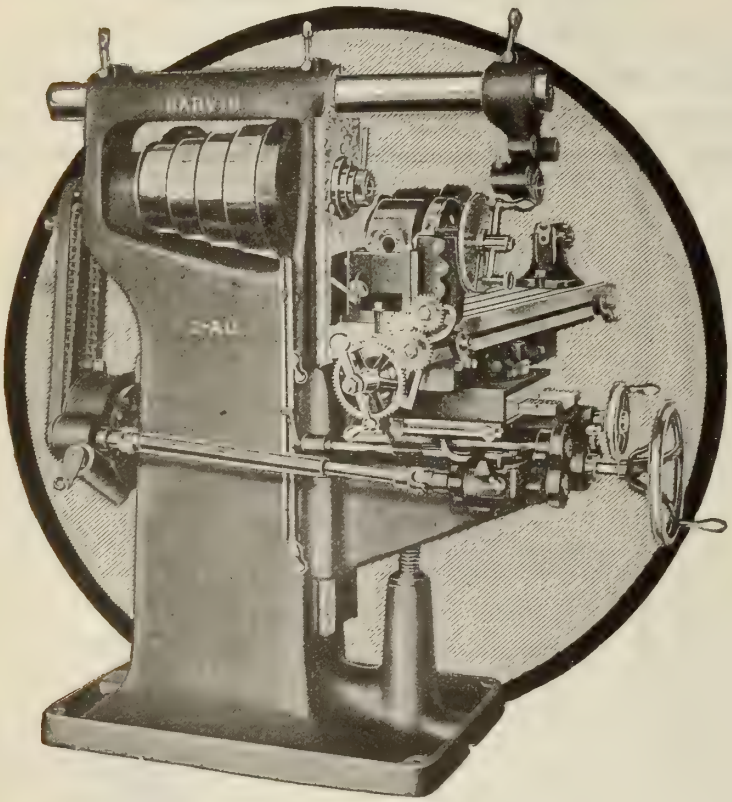
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YOU must take advantage of up-to-the-minute machine tools to produce at a profit. New features are always to be looked for in Garvin Milling Machines first. Garvin engineers have led the way from the beginning.



The Garvin 2A Universal Miller —an ideal for all-around service —has many points of distinction. Power feed, with reverse and automatic trip, is provided in all directions, table, in and out, up and down. The power feed movements are all controlled by one handle. The table is wide and proportionately deep. It can be swiveled clear around in line with the spindle.

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These are but a few of the distinguishing marks of the mechanical excellence of the entire and varied line of Garvin Millers. You are not ready to make a final choice of a milling machine until you have seen the 340-page Garvin Catalogue.

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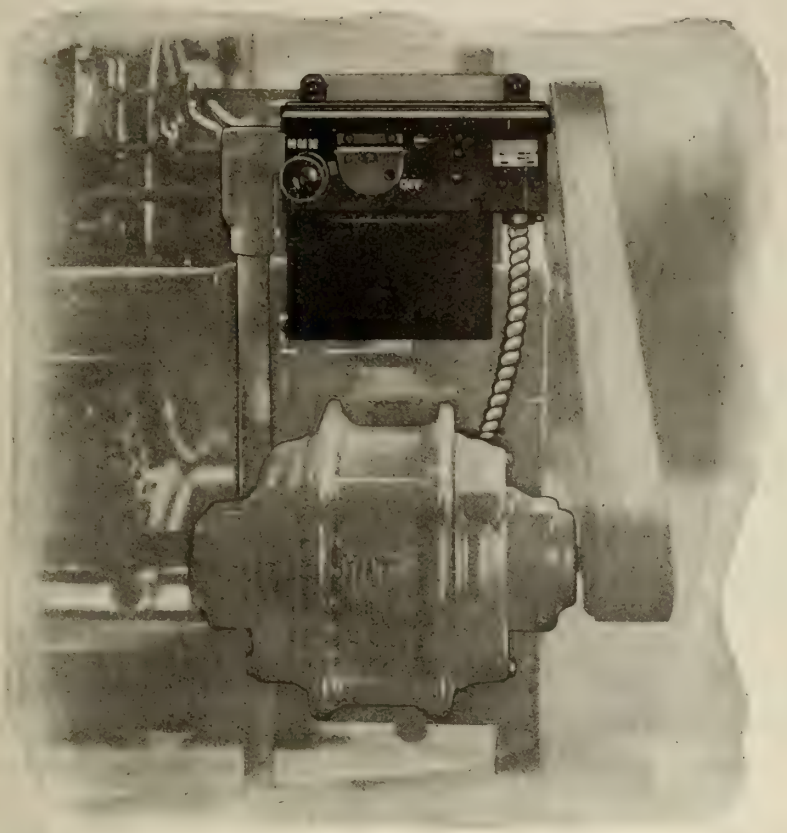
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Type I Oil Starters

Safety

All mechanism and live parts are entirely enclosed — fuses are dead when switch is in open position — may be locked in open position. This means absolute safety.

Motor Protection

Starters are of **Oil switch construction,** equipped with enclosed fuses for overload and short circuit protection.

Special design enables fuses of approximately full load running current to be used, **which will not blow during starting period.**

It is equipped with low voltage release which immediately disconnects the motor on power interruption or any considerable drop in voltage.

Handle cannot be left in starting position.

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The Conduit Type I Motor Starter is compact and easily mounted on any flat surface.

It is equipped with interchangeable knock-out plates arranged to receive 1½", 1", ¾" or ½" Conduit.

Both movable and stationary members are identical, interchangeable and reversible, reducing maintenance work to a minimum.

The liberal design of conducting parts insures long life.

Ample space in the case for making connections.

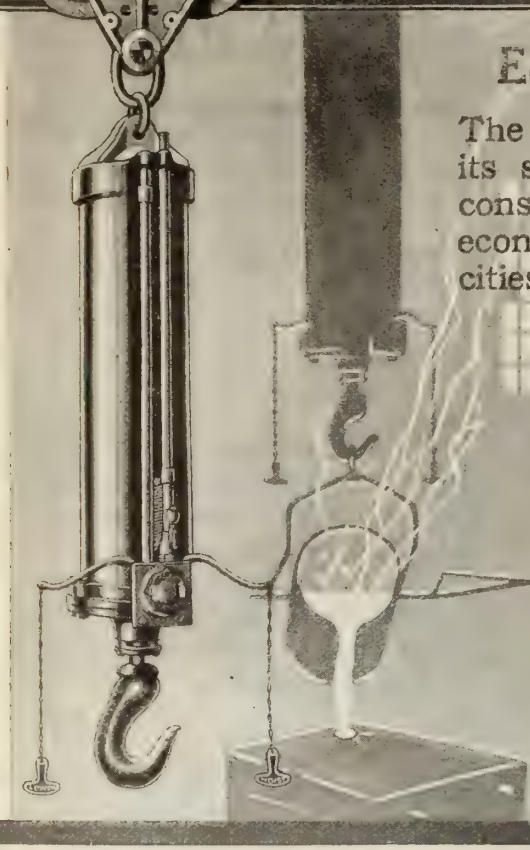
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Economical—Safe—Dependable

The Curtis Air Hoist has been so perfected in its speed regulation, design and mechanical construction that it is the simplest, safest, most economical hoist for light and medium capacities. It effects a decided saving in man power.

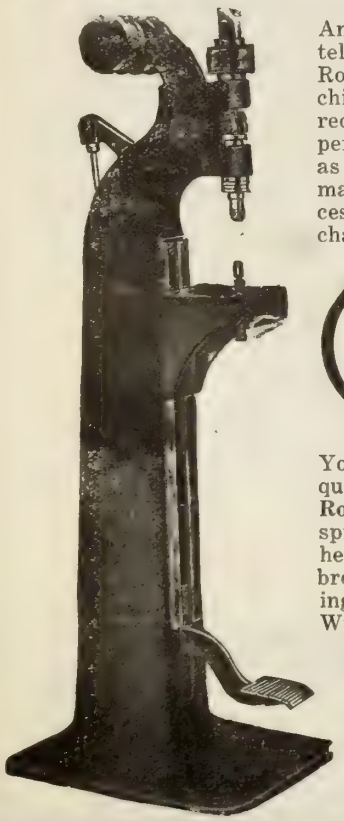
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CURTIS AIR HOISTS have been successfully adapted to meet a wide variety of needs in hundreds of the leading industrial plants throughout America.

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No Skill Required



Anybody with ordinary intelligence can operate this Rotary Rivet Spinning Machine. No special skill is required. It is a tool that perfectly fits labor conditions as they exist to-day. A woman could operate as successfully as the skilled mechanic who went to the front

The GRANT is Noiseless

You are assured of perfect quietness wherever the **Grant Rotary** is running. And it spins a perfect polished rivet head every second without breaking or marring the casting. Rivets tight or loose. Write for details.

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Holland Ave.
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ACCURACY



Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
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Send us your rush orders.

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This plant has everything to facilitate the speedy and economical production of the standardized line of Trahern Pumps.

Count upon the new Trahern factory to be a very valuable servant of yours

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GEO. D. ROPER CORPORATION
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Trahern PUMPS

Milwaukee Milling Machines

Increase Production on a Low Upkeep

BECAUSE of the numerous meritorious features that Milwaukee Milling Machines embody, increased production on a low upkeep is obtained. They accomplish most accurate results and are easily operated, due to the convenient location of all levers and handles.

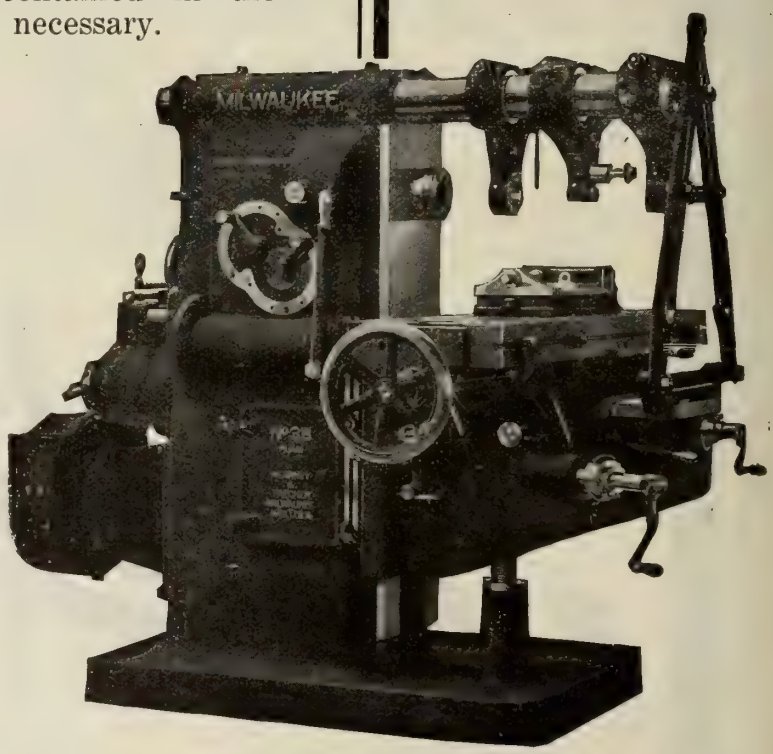
The column is a one-piece, box section casting with few and small openings, reinforced with heavy vertical and horizontal internal walls. The base is made pan-shaped to catch splashing oil and chips.

The double overarm provides for positive alignment of the arbor and prevents it from being pounded out of line when using large, coarse pitch cutters on rough, heavy work. This makes it possible to use cutters at a greater distance from the face of the column.

The spindle has a large flange forged on the end. This flange carries keys for driving large face milling cutters, that are attached directly to the flanged end by means of four bolts, and also for driving the hardened steel arbor drive collar. The arbor drive collar protects the end of the spindle from injury, so that when face milling cutters are attached they run true. The reverse for the spindle is self-contained in the machine; no overhead apparatus is necessary.

All gears and bearings in the column, feed box and pulley bracket are automatically flooded with lubricant that is pumped to the top of the machine and distributed by a perforated pipe. This pump operates whenever the drive pulley rotates.

Every Milwaukee Milling Machine is equipped with a cutter lubricating system which is an integral part of the machine and is not added as a separate item. The cutter lubricating system operates only when the spindle is running.



Complete facts, regarding Milwaukee Milling Machines, will be found in our catalogue. Write for a copy, TO-DAY.

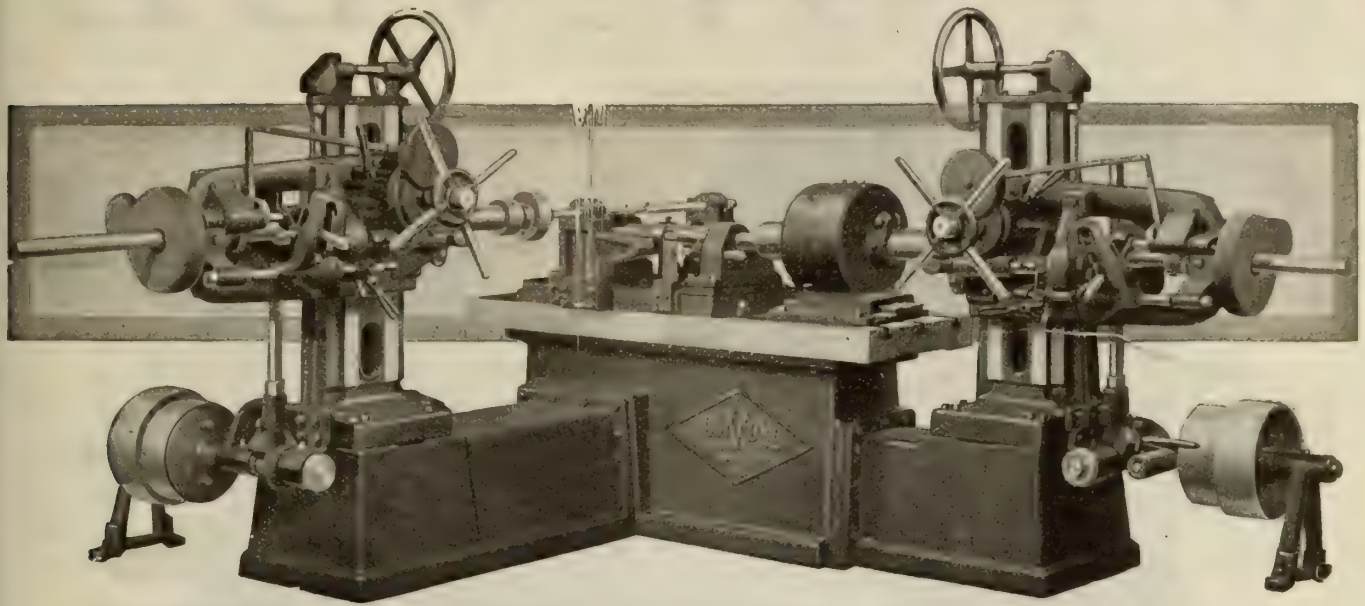
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Rockford Horizontal Boring Machine

For Automobile Manufacture

This tool is unusually rapid and accurate in the boring of crank cases, transmission cases and rear axles. Has two heads at right angles to each other. Spindles bore longitudinal and cross holes in work simultaneously.

Send us blue prints of your boring work and we will give you figures on the "Rockford's" ability on it.



THE ROCKFORD DRILLING MACHINE CO., ROCKFORD, Ill.

CANADIAN AGENTS
RUDEL-BELNAP MACHINERY CO., MONTREAL and TORONTO

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France: Italy and Colonies, Monti & Oscuro, Milano, Italy. Scandinavia, Rylander & Asplund, Stockholm, Sweden. Spain and Portugal, Casamitjana, Hermanos, Barcelona, Spain. Australia, Selon Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

Cuts the Cost of "Upkeep"

Our grease lubricants and cutting compounds give the best results under continuous service. They reduce the cost of "upkeep" by making your shop more efficient, your production more rapid and your work more accurate. They save time and money because they do not rust, grime or separate. They are scientifically right—the joint product of trained chemists and lubrication engineers.

OUR SERVICE DEPARTMENT

offers valuable advice on lubrication and cutting problems without obligation on your part. Write them.

CATARACT
REFINING COMPANY, LIMITED
Toronto, Ont.

ACME CUTTING COMPOUND

Specially prepared for work on turret lathes, profilers and milling machines. Also for stamping and press work on lightweight materials.

MYSTIC CUTTING COMPOUND

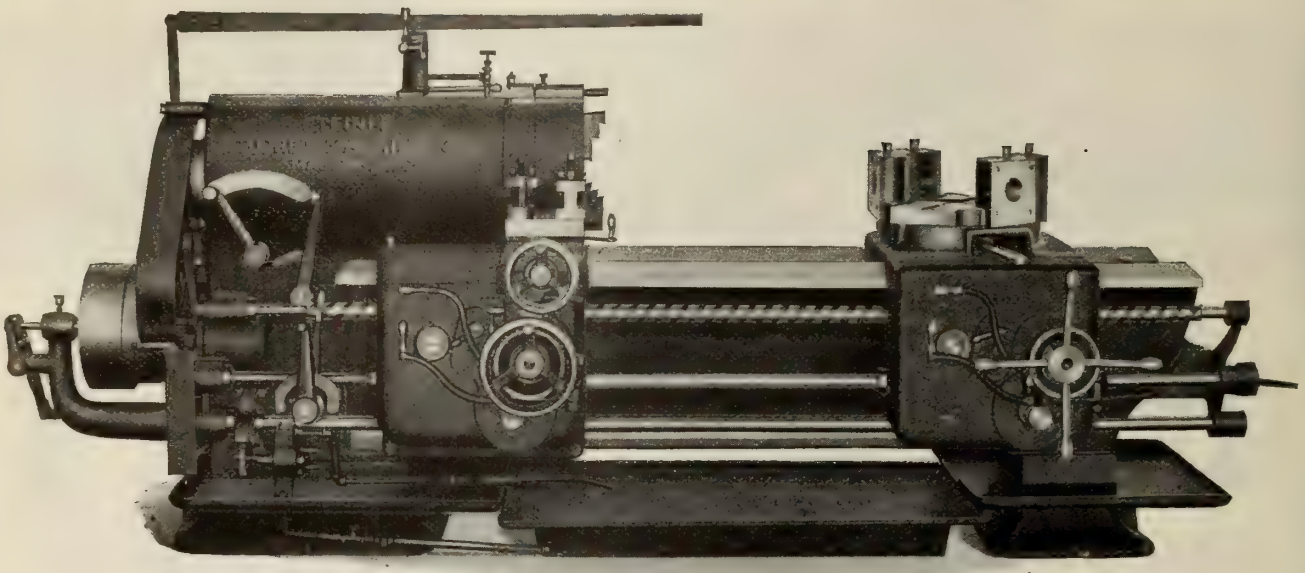
Designed for the larger types of automatic, drill presses, saws and turret lathes, insuring the greatest accuracy of work. Order a barrel to-day for a test.

Also "Alpha" and "Special" and other lubricants.

SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

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STEINLE



Full Swing Side Carriage Turret Lathes

A machine that doesn't produce is a continual thorn in the side of the efficient shop manager, who is responsible for the showing his organization has made at the end of the year, when the profit and loss accounts are investigated.

DON'T PUT UP WITH A SLACKER
Get the Machine That Gets Out the Work

The Steinle heavy duty general purpose lathe is a master producer. It is giving entire satisfaction to the scores of users who find it necessary to secure a machine which can be relied upon to boost the profit side of the ledger by consistently producing duplicate work rapidly, accurately, and economically. It can make profits for you in the same manner, so why not send us your blueprints and allow us to quote on your requirements?

STEINLE TURRET MACHINE COMPANY
Madison, Wis., U. S. A.

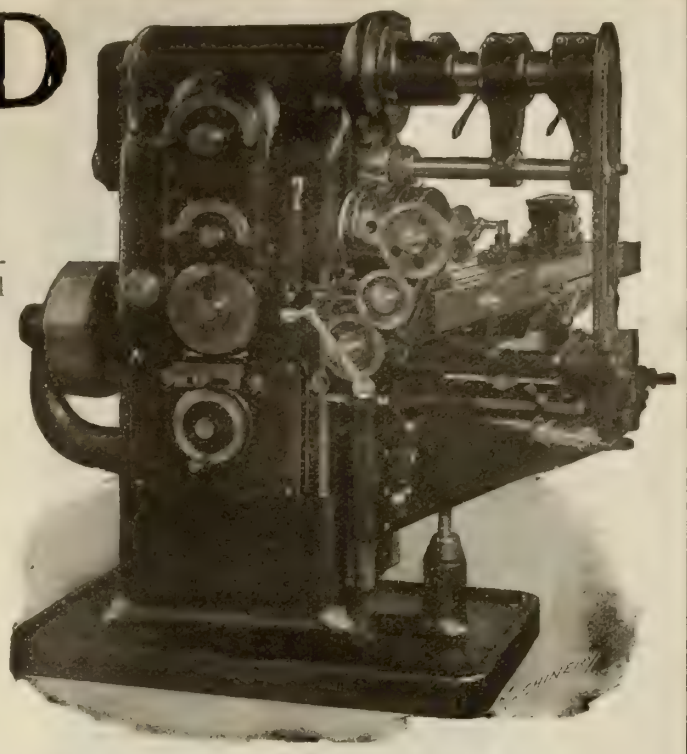
ORIGINATORS OF THE FULL SWING SIDE CARRIAGE TURRET LATHE

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California.
FOREIGN—Leo. C. Steinle, 53 Victoria Street, London, England.

Saves Time, Labor, Expedites Production

ROCKFORD Milling Machine

Its speed, simplicity of operation and great utility Assures Big Profits in whatever work it is used.



And another profit-making feature of the "Rockford" Miller lies in its unusual capacity to do all classes of work.

In the tool room, in the shop, in the manufacturing or jobbing establishment this "Miller" is beyond comparison.

Has Power to Spare

Put the power of the "Rockford" to the severest tests. It's built to more than meet the demands likely to be made upon it. It is the pace-maker of the machine shop.

Look into the merits of this machine. Write to us without delay.

ROCKFORD MILLING MACHINE COMPANY, ROCKFORD, ILL.

Canada: Rudel-Belnap Machinery Co., Toronto, Ont.

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Don't Keep It--Sell It

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY

Classified Advertising Section

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FOR TRUEING GRINDING WHEELS

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Tools For All Mechanical Purposes

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Sole Canadian Agents for

THE JOYCE-KOEBEL COMPANY, INC.

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Small Rotary Table Sand-Blast

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Auxiliary Equipment for the Big Shop.

42 in. diameter Table, Self-contained—Hygienic Sand-Blast.

Cleans Steel, Grey, Malleable, Brass and Aluminum Castings, Stampings, Forgings, Heat Treated Parts, etc.

Small floor space—Small Air Consumption and Small Cost.

Ready to operate when attached to air line, uses Sand or Metal Abrasive.

It's a new one in the "PANGBORN" Line that embraces

"A Type and Size for Every Requirement."

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HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS

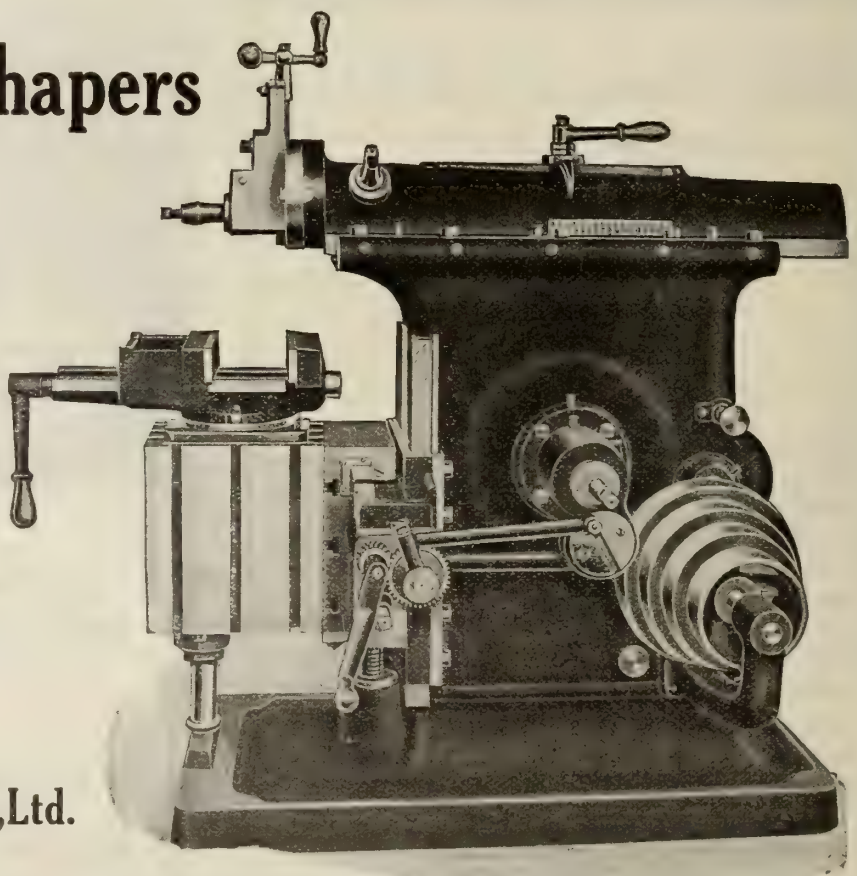
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Rae Crank Shapers

Designed throughout, down to the last detail for strength and durability. Metal is used unsparingly in the section where rigidity is essential.

An unusually useful machine, with a carefully graded range of speeds and a convenience of adjustment and operation which adapt it to a wide variety of work.

We shall be able to describe this interesting tool in detail if you write to us.

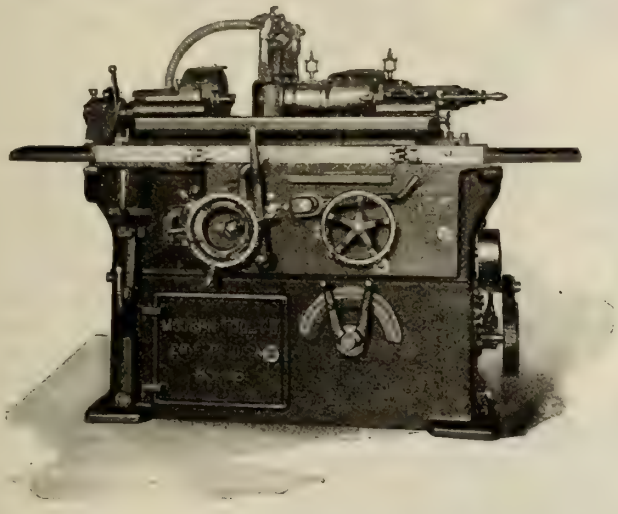


Rae Machine Tool Works, Ltd.

Hamilton, Canada

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MODERN
Plain Grinding Machines



Something to think hard about

A FEW THOUGHTS FOR SHOP EXECUTIVES WHO THINK IN TERMS OF EFFICIENCY AND SATISFACTION

WHY MORE THAN 700 MODERN GRINDERS ARE IN USE IN ONE FACTORY

Eight years ago one Modern grinder was installed in a certain factory that its capabilities might be compared with then better known makes.

In August and September last, we advertised the fact that this particular factory had in daily use "more than 500 Modern Grinders."

Shortly thereafter began a constant stream of orders for Modern Grinders—proving conclusively that Modern was best of all.

To-day in that factory there are more than 700 Modern Grinders of all types manufactured by us.

WHY? **The answer is short but tells a lot to executives who analyze and think. There are just two reasons: Perfect satisfaction is one. Superiority over all others is second.**

What about your own Grinding Problems? Moderns will satisfy you, too.

MODERN TOOL CO., Erie, Pa.

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Canadian Agents. RUDEL-BELNAP MACHINERY CO., Limited, TORONTO and MONTREAL

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We're "Bulls" *on* Canada



PROSPERITY, rising stock values and a vast amount of "Loose" money,—all these have led to the biggest year of speculation Canada has known—1919. The trading in Montreal exceeded all previous records, and "Everybody's doing it." Stenographers and bank messengers are making a few dollars; financiers and plungers are making their millions. And, don't you forget it, many are losing, too.

In this leading article in the February 1st MACLEAN'S the mania for "taking a chance" is discussed and R. Laird Briscoe tells why there are not many losers—yet. Two men have made $6,600,000—this article tells how simply it's done. One typist bought a $2000 car with a $100 bill. It's really very simple when you know how—**IF** you guess right.

J. K. Munro Says:

THERE will be an election before Fall—it's among the probabilities. Sir Robert Borden took the Premiership with him to South Africa. What will he do with it when he returns? Why didn't he nominate a successor before he left? Why could Sir Thomas White have the job if he wanted it, and why wouldn't he make a good leader to go to the country?

These and other questions are discussed and answered in Mr. Munro's snappy, vigorous, pithy style.

Balking the Bolsheviks

A CANADIAN woman had some extraordinary adventures in Roumania with the Bolsheviks. She is Mme. Pantazzi, and was Miss Ethel Greening, of Toronto. She tells how she and her husband escaped death's door by the narrowest of margins—not once but several times. Incidentally, she tells more of the wonderful adventures of that Admirable Crichton of cosmopolitan free-lances, "Klondyke" Boyle—also Canadian as MacLean's readers know.

Flaherty of Belcher Island

THIS is where the natives wear duck feather kimonas, in a part of Canada which even the geologists and explorers didn't know existed until a few years ago. Of course, you would expect the discoverer to be an Irishman—and in February 1 MACLEAN'S you can read how Flaherty found his island, and what he discovered there—the richest iron ore deposit in the world, but—can it be transported to market?

Other Features are:

"Breed," by Archie P. McKishnie.
"The Thread of Flame," the Basil King serial.
"His Majesty's Well-Beloved," the concluding instalment of the Orczy serial.
"Canada Has a Movie Future," by Allan Dwan.
"Spanish Doubloons," more of Camilla Kenyon's rollicking adventure story.
"Mr. Phipps of the 'Old Firm'," by A. Appleby Terrill.

MACLEAN'S is issued Twice-A-Month

starting with this issue. An important point to remember. If you want to keep up with things **nationally Canadian,** you'll have to get the MACLEAN'S Twice-A-Month habit.

Over 350,000 Canadians Read

MACLEAN'S

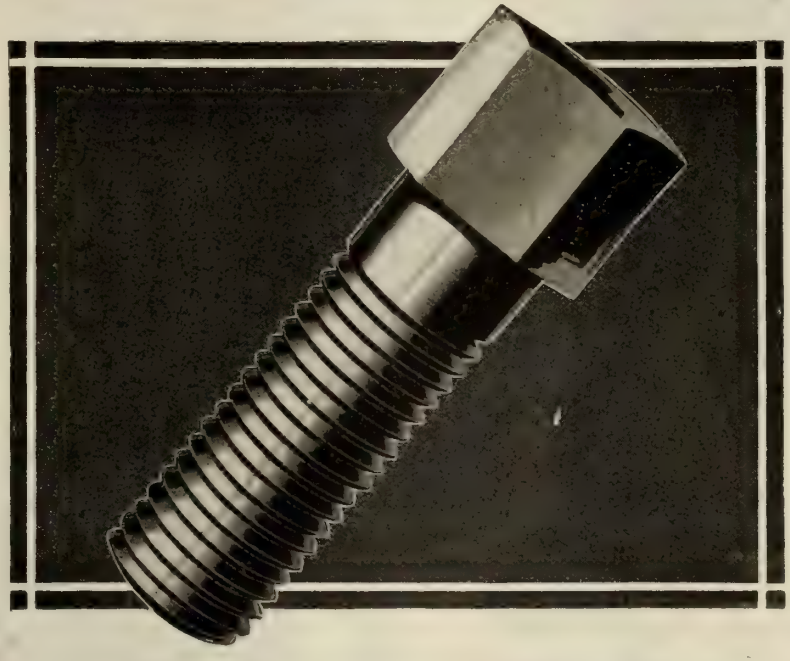
"CANADA'S NATIONAL MAGAZINE"

February 1st Issue *Now on Sale At All News Dealers* ***20c.***

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S.A.E. Plain and Castellated Nuts
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Special Screw Products
To Specifications

THE NATIONAL ACME COMPANY

MONTREAL, P. Q.

De Courcelles G.T.R.

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Gears with Generated Teeth

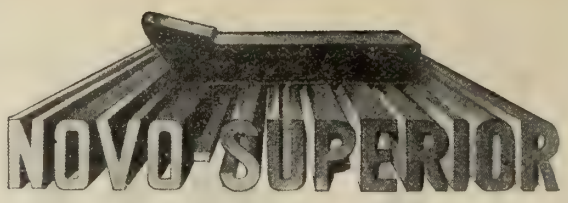


This Helical pair have accurately Hobbed teeth and are case hardened and ground in the bore.

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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters
Files, Etc., Music Wire for Springs, Steel Balls.
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Sole Agents for

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H. BOKER & CO., Inc.
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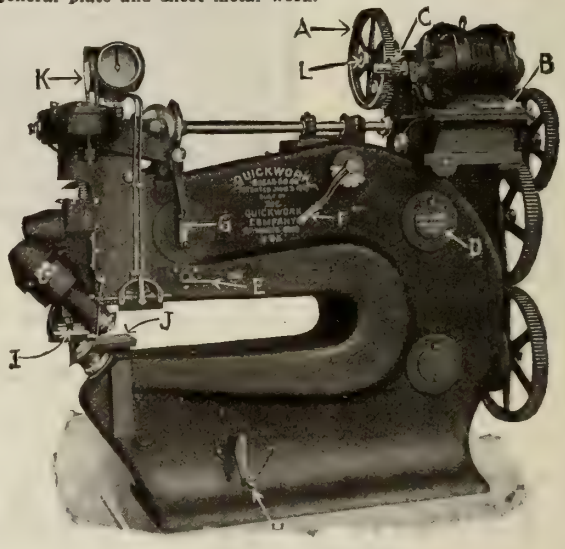
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MADE IN 7 SIZES.

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



Patented June 3rd, 1913.

SAVES 50% TO 90%

Eliminates Oxyacetylene Cutting and Plate Planing.
Write for Catalogue No. 60.

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Cable address: "QUICKWORK."
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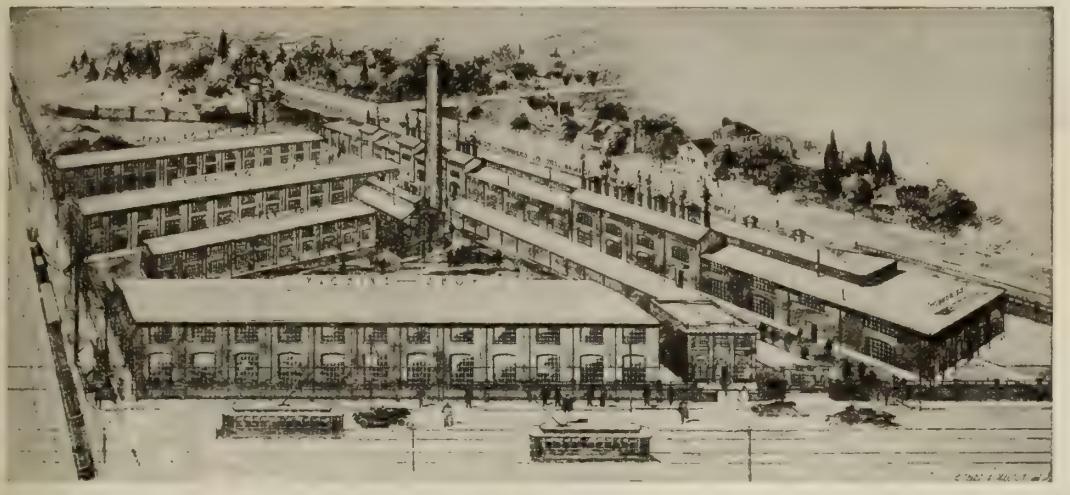
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Steel, Chrome, Manganese and Nickel Steel Castings

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Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

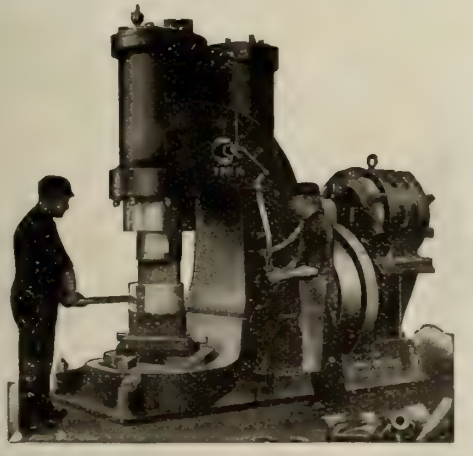
"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

The Nazel Air Hammer

(A Self-Contained Unit)

Noted for Its Blow and Control



The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

Nazel Engineering & Machine Works

Dept. F., Philadelphia, Pa.



MATTHEWS OF PITTSBURGH

Durably Made Steel Letters and Figures

For Marking on all Kinds of Metal

MATTHEWS Steel Letters and Figures are hand-made from high quality Pittsburgh steel, properly tempered to assure hardness. They give long service under hard conditions.

Matthews line of steel stamps includes a wide range of letters, figures and symbols—for concave, convex or flat surfaces.

MARK YOUR NEXT ORDER "MATTHEWS MADE"

JAS. H. MATTHEWS & CO.

3946 FORBES STREET - PITTSBURGH, PA.

Steel Lettering, Dies and Stamps

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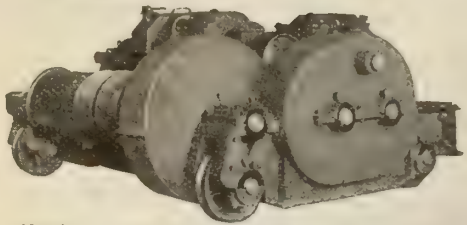
CANADIAN MADE

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Electric and Hand Traveling Cranes

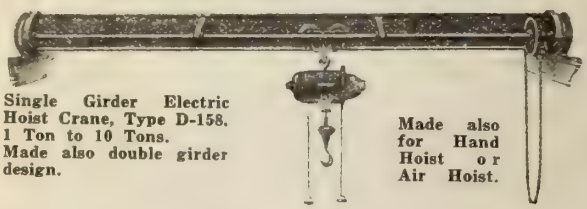


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

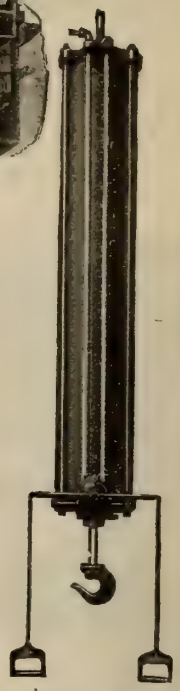
In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.



Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

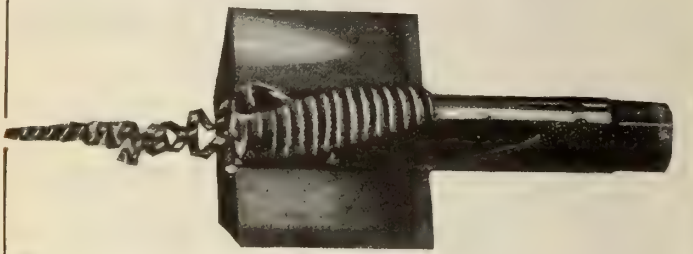


Type No. 20 Air Hoist.

Northern Crane Works, Limited

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(Patent Applied For)

A SCIENTIFICALLY CORRECT

CUTTING TOOL

makes tapping a pleasure

The Most MODERN,
The Most EFFICIENT,
The Most ECONOMICAL.

Send for a "SEMPLE" Sample Tap. Made in any thread
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Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

Hartford, Conn.

Tell him to step right in — He sells



CLEVELAND

THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

Agents for Europe, CLEVELAND TWIST DRILL CO. (GREAT BRITAIN), Ltd., 36-37 Upper Thames St., London E. C. 4

MALLEABLE AND CAST IRON PIPE FITTINGS

The Brand That Has The Quality

"Quality" and "Reliability" are two essentials demanded of *Cast Iron* and *Malleable Fittings*, by all sanitary and heating engineers.

Time and money are lost by improperly made fittings. All our cast iron and malleable fittings are properly recessed and every fitting bears the above trade-mark of quality.

We make a complete and full line of both flanged and threaded fittings from ⅛-inch up, and can make deliveries from stock, both standard and extra heavy.

When ordering from your jobber be sure you buy---"the brand that has the quality." They are different. A trial order will convince.

International
Malleable Iron Company, Limited
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"MORRIS" TRIPLE-GEAR CHAIN-BLOCK



It is essential that your hoisting equipment be selected with the utmost care if you would attain the highest efficiency in handling your material.

Progressive concerns throughout the world have standardized on "MORRIS" hoists because of the efficient and dependable service they give.

The "MORRIS" Triple-Gear Chain-Block is particularly adaptable where a close-lifting, speedy hoist is required.

Every detail in the design of "MORRIS" Triple-Gear Chain-Blocks has been developed with a view to obtaining the highest efficiency and greatest durability.

The success which has been met in this direction can be gauged by the fact that the "MORRIS" Triple-Gear Chain-Block is accepted as the leader in its class. "MORRIS" Chain-Blocks are built to meet every hoisting requirement.

Catalog on Request.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited

TORONTO NIAGARA FALLS MONTREAL

Hoisting and Conveying Equipment of Every Description

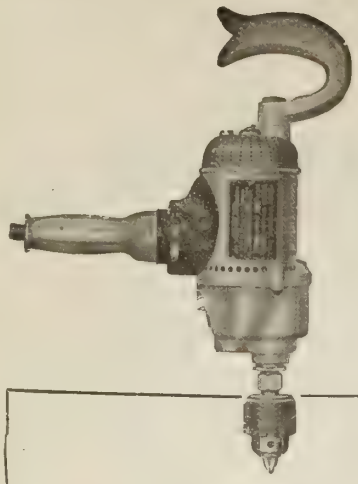
Electric Cranes
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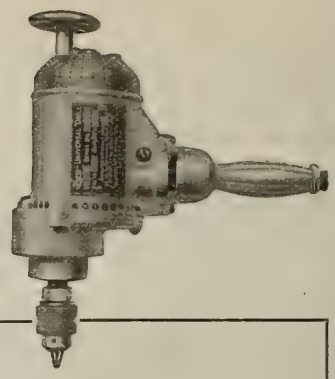
Chain-Blocks
Trolleys

Floor Cranes
Elevating Trucks
Winches, etc.

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ELECTRIC DRILLS



For Continuous Service Under Severe Conditions

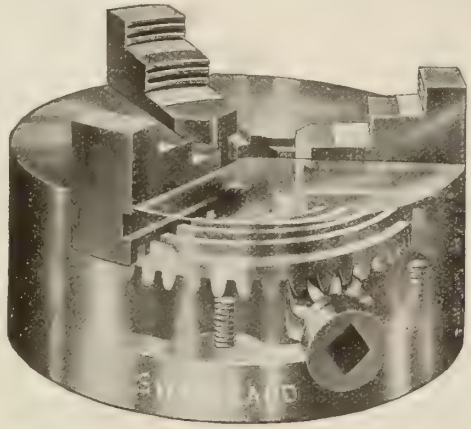
Light, powerful and non-stallable, "Thor" Portable Electric Drills have offset spindles—which permit operating in close quarters—a variety of speeds, S K F Ball Bearings, four contact point switches, D.C. or Universal Motors and other distinctive advantages to recommend them. It will pay you to investigate the "Thor" line. Standard equipment on all classes of work.

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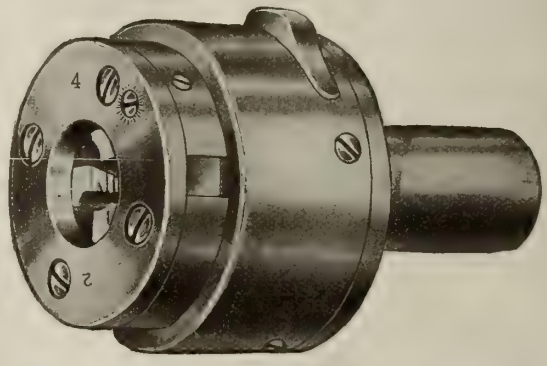
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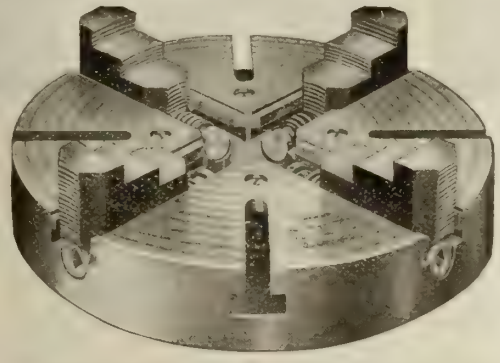
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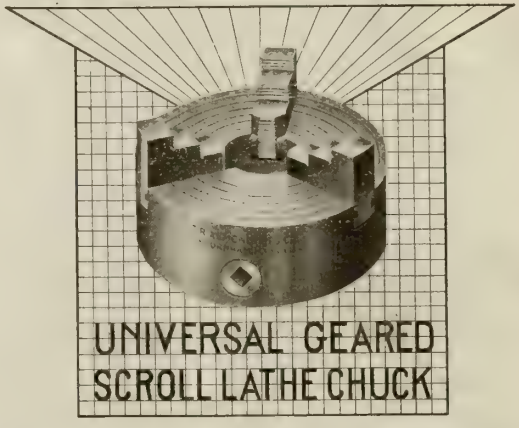
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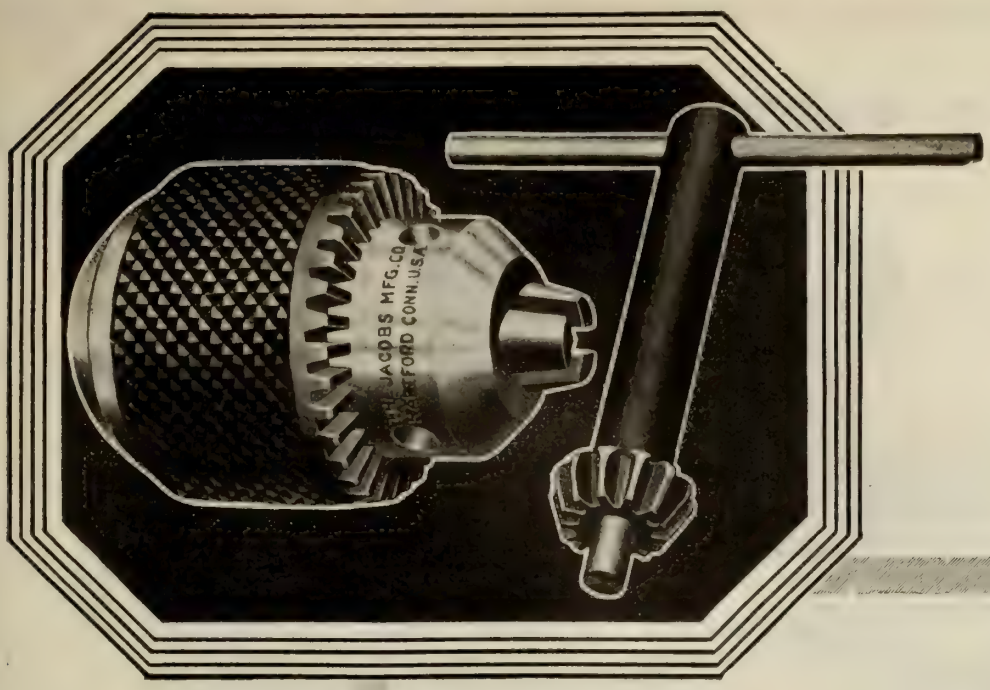
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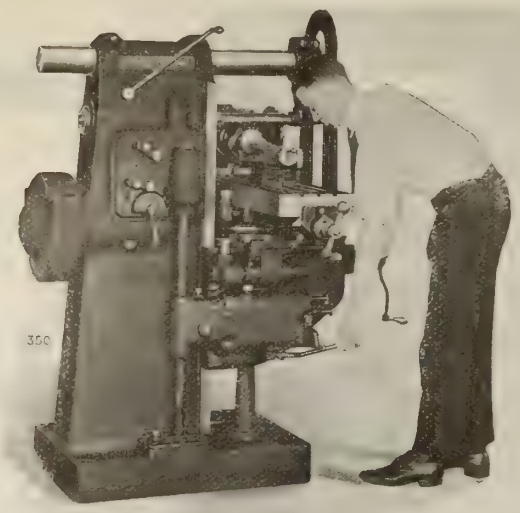
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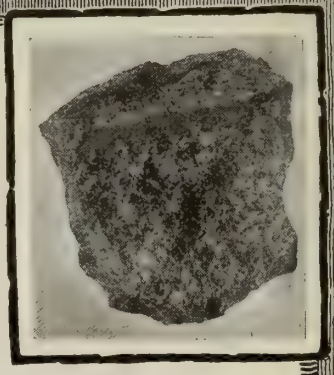


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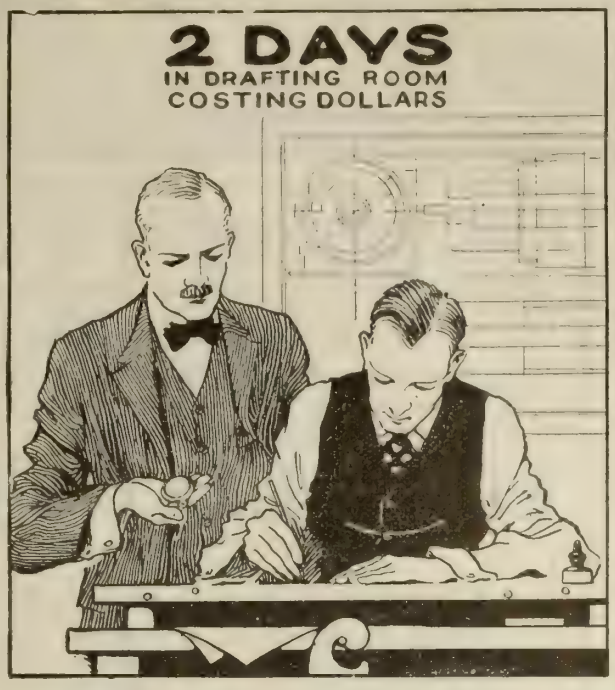
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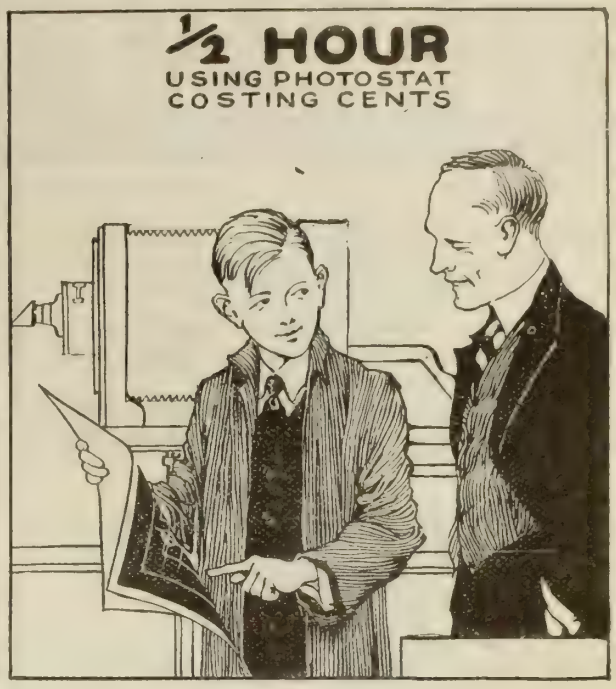


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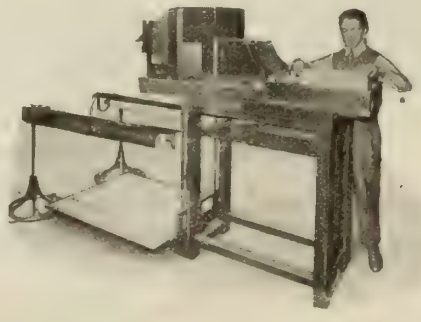
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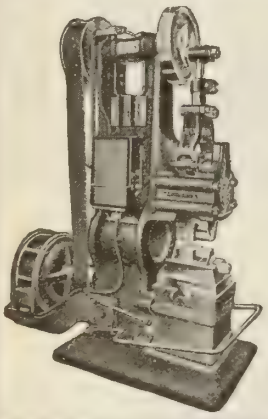
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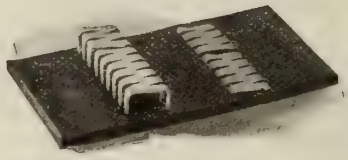
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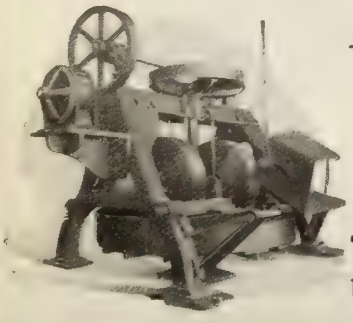


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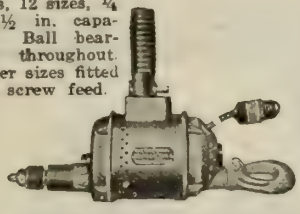
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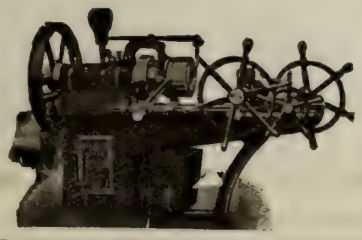
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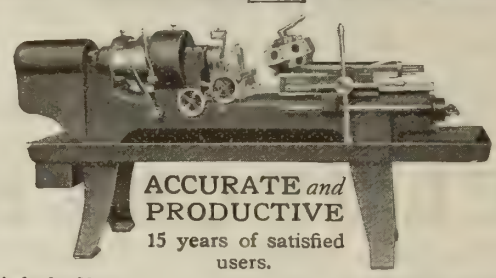
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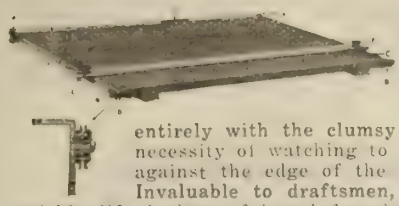


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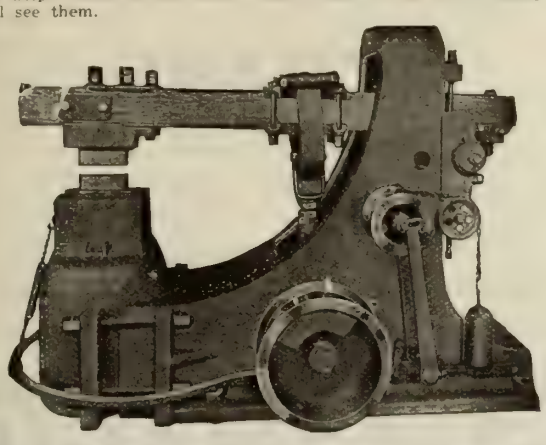


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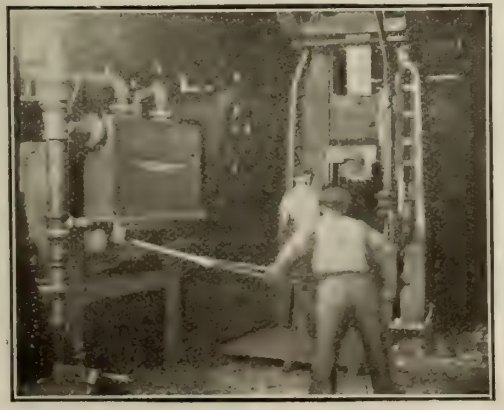
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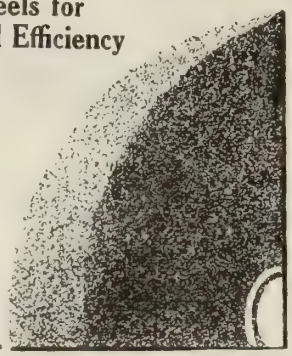
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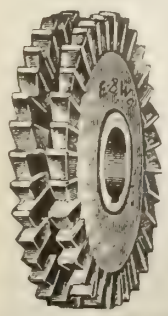
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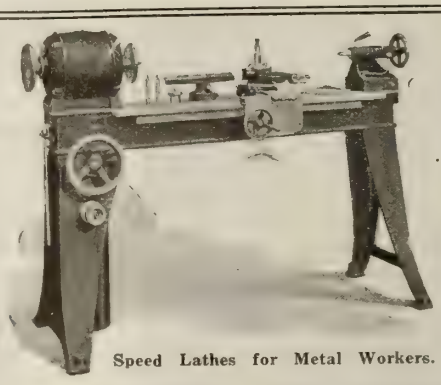


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Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
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Franklin Mfg. Co., Syracuse, N.Y.

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Electric Steel & Metals Co., Welland.
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Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glassco, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co. Inc Bay City, Mich
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hawlinge Bros., Chicago Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.,
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

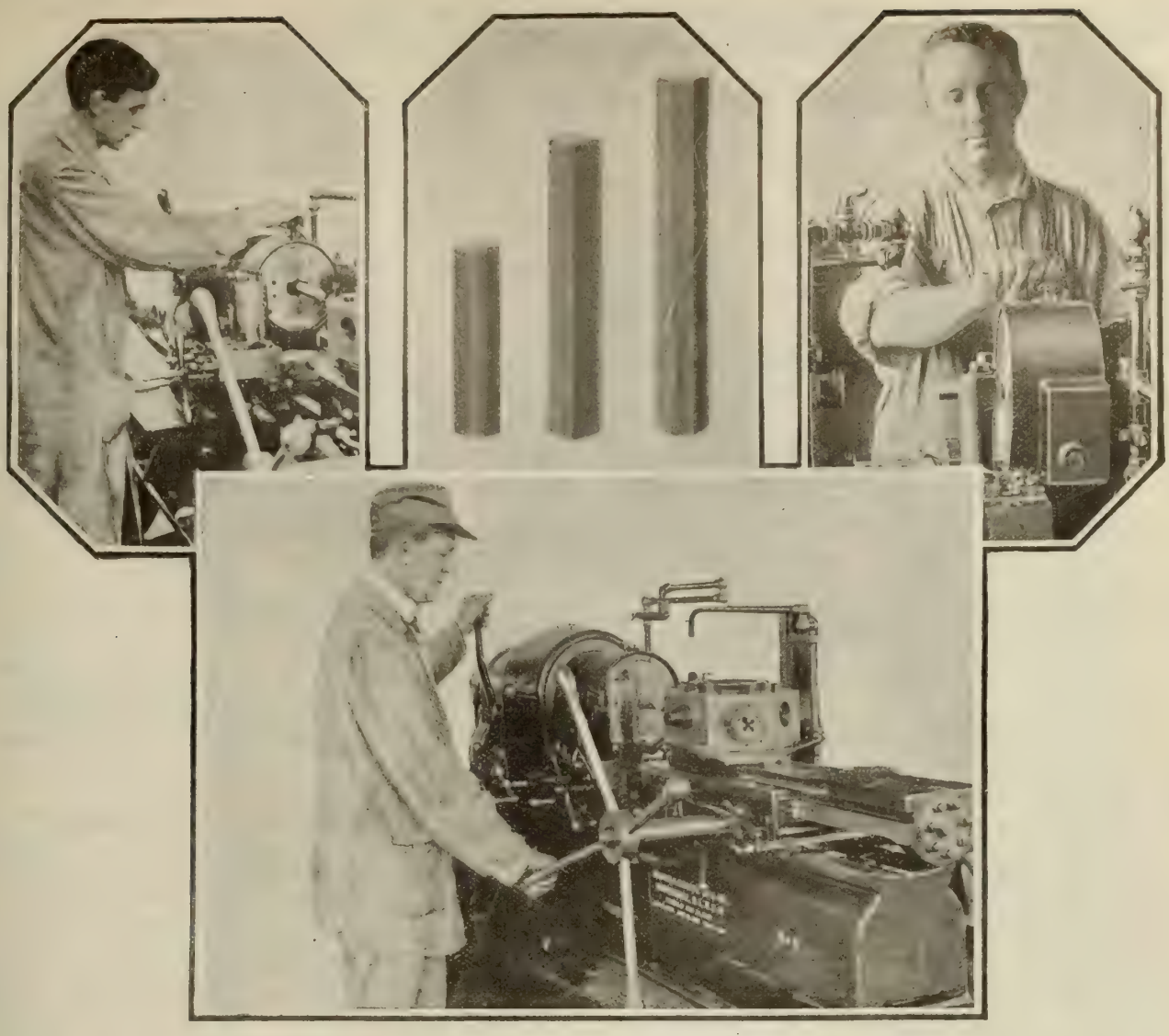
COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.



One Handle Controls the Feed

The distinctive features that give Brown & Sharpe Wire Feed Screw Machines such great flexibility are the Roller Feed and the Automatic Chuck.

The Roller Feed is located in a case near the front spindle bearing. This brings the feed rolls very close to the chuck so that each bar is used practically to the end.

The rollers feed any length without adjustment and will take stock of any shape or any size within the machine capacity. There is only one pair of rollers which are quickly and accurately adjusted.

The chuck used in connection with the roller feed is equally simple.

It is adjustable to all shapes of stock without changing the jaws and takes all sizes within the machine capacity automatically compensating for slight variations in the bar. These improvements will be appreciated as they obviate the necessity of a large stock of expensive collets. The adjustment for different sizes is easily and quickly made, the jaws being set with a wrench in the same manner as those of a universal chuck and when adjusted they can be clamped to hold the size.

These features are of special importance since they eliminate a supply of changeable parts for feeding different sizes and shapes of stock.

The chuck and roller feed are operated in conjunction by a single lever on the front of the headstock.

Catalog 22G describes the entire line in detail; your inquiry will receive prompt attention.

Brown & Sharpe Manufacturing Company

Providence, R. I., U. S. A.

If interested tear out this page and place with letters to be answered.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found'a & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Hamel & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Mechy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found'a & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg Co., Hartford, Conn.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F. Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co., Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

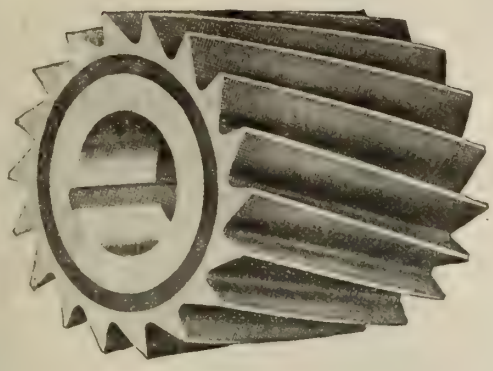
DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

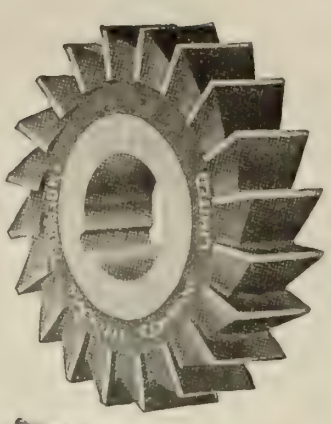
DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

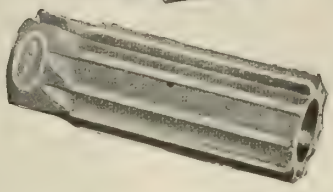
DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mach. Co., Toronto, Ont
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

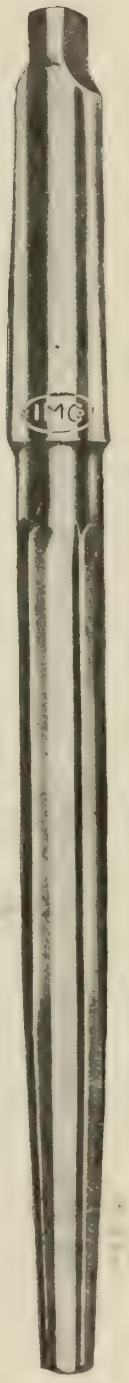
"IMCO" Tools





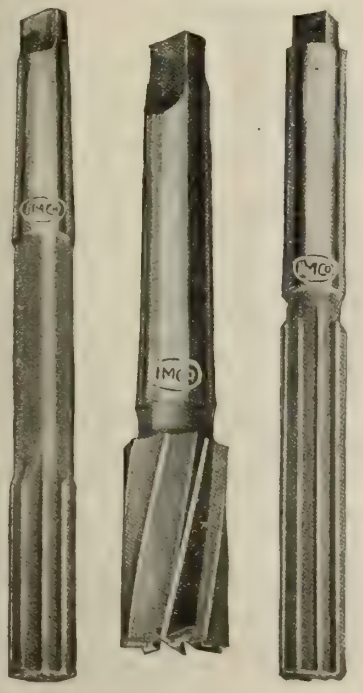






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Imco tools have rapidly established a splendid reputation for endurance, for reliability, for the faculty of cutting keenly and accurately after hard use—in short, for economy.

For the real economy that is measured in dollars and cents by the reduction in factory costs.

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Ingersoll, Ontario

American Plant: American Machine Products Co., Inc.
DETROIT, Michigan

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Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

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W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
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Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto,, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

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Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Irc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
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Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

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Cowan Truck Co., Holyoke, Mass.
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ELEVATOR ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
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Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Wausau Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Brantford Emery Wheel Co., Brantford, Canada
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

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Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

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Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

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FACTORY LOCATIONS
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FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamilton

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mchy. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

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Northern Electric Co., Ltd., Montreal Que

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Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
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Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

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Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

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Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

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St Lawrence Welding Co, Ltd., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

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Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

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British Smelting & Refining Co., Ltd., Montreal, Que.

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Armstrong Bros. Tool Co., Chicago.

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Mesta Machine Co., Pittsburgh, Pa.

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GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont
St. Lawrence Welding Co., Montreal, Que.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

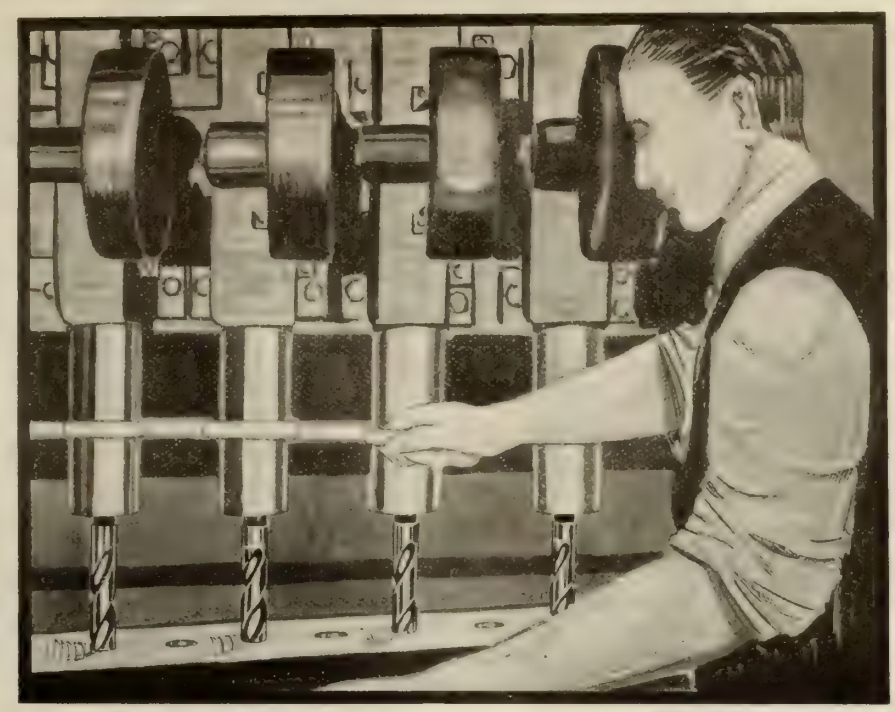
GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont
Wilton Tool & Mfg. C., Boston, Mass.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. C., Boston, Mass

GAUGES, THREAD
Wilton Tool & Mfg. C., Boston, Mass.

GAUGES, VACUUM AND PRESSURE
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Cleveland Twist Drill Co., Cleveland
Crescent Mchy. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt Ont.
Wilton Tool & Mfg. Co., Boston, Mass.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES ,REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

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Canada Machinery Corp., Galt, Ont
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co. Inc. Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Inc., Indianapolis.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes, Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
Standard Machy. & Supplies, Montreal.
Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

HANDLES, BALANCE, CRANK AND MACHINE
Williams & Co., J. H., Brooklyn, N.Y.

HANGERS, SHAFT
Can. Link-Belt Co., Ltd., Toronto, Ont.

HACK SAW FRAMES
Aikenhead Hardware Co., Toronto.
Atkins & Co., E. C. Inc., Indianapolis.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

HACK SAWS, POWER
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Inc., Indianapolis.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

HAMMERS, FORGING
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

HAMMERS (DROP), MOTOR AND BELT DRIVEN
Beaudry & Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, HELVE POWER
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

HAMMERS, CHIPPING, CAULKING, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HAMMERS, NAIL MACHINE
Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

HAND PLANERS
Oliver Mchry. Co., Grand Rapids, Mich.

HAND PLANING AND JOINTING MACHINERY
Oliver Engineering Co., Montreal, P.Q

HAND LEATHERS OR PADS
Graton & Knight Mfg. Co., Montreal.

HANGERS
Brown & Sharpe Mfg. Co., Providence, R.I

HANGERS, SHAFT
Algoma Steel Corp., Sault Ste. Marie.
Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

HARDNESS TESTING INSTRUMENTS
Shore Instrument & Mfg. Co., New York.

HEAD, AUXILIARY
Hoefer Mfg. Co., Freeport, Ill.

HEATING AND VENTILATING ENGINEERS
Can. Blower & Forge Co., Kitchener, Ont.
Sheldons, Ltd., Galt, Ontario.
Sturtevant Co., B. F., Galt, Ont.

HEAT TREATMENT OF STEEL
Gray Ball Bearing Co., Ltd., Toronto.

HEAT GAUGES, HARDENING AND ANNEALING
Shore Instrument & Mfg. Co., New York

HELMETS, SANDBLAST, AMMONIA
Strong, Kennard & Nutt Co., Cleveland

HIGH SPEED STEEL
See Steel.

HINGE MACHINERY
Baird Machine Co., Bridgeport, Conn.

HINGES
Butterfield & Co., Inc., Rock Island, Que.
London Bolt & Hinge Wks., London, Ont.

HOBS
Greenfield Tap & Die Co., Greenfield, Mass
Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada Galt, Ont.

HOISTS, AIR
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

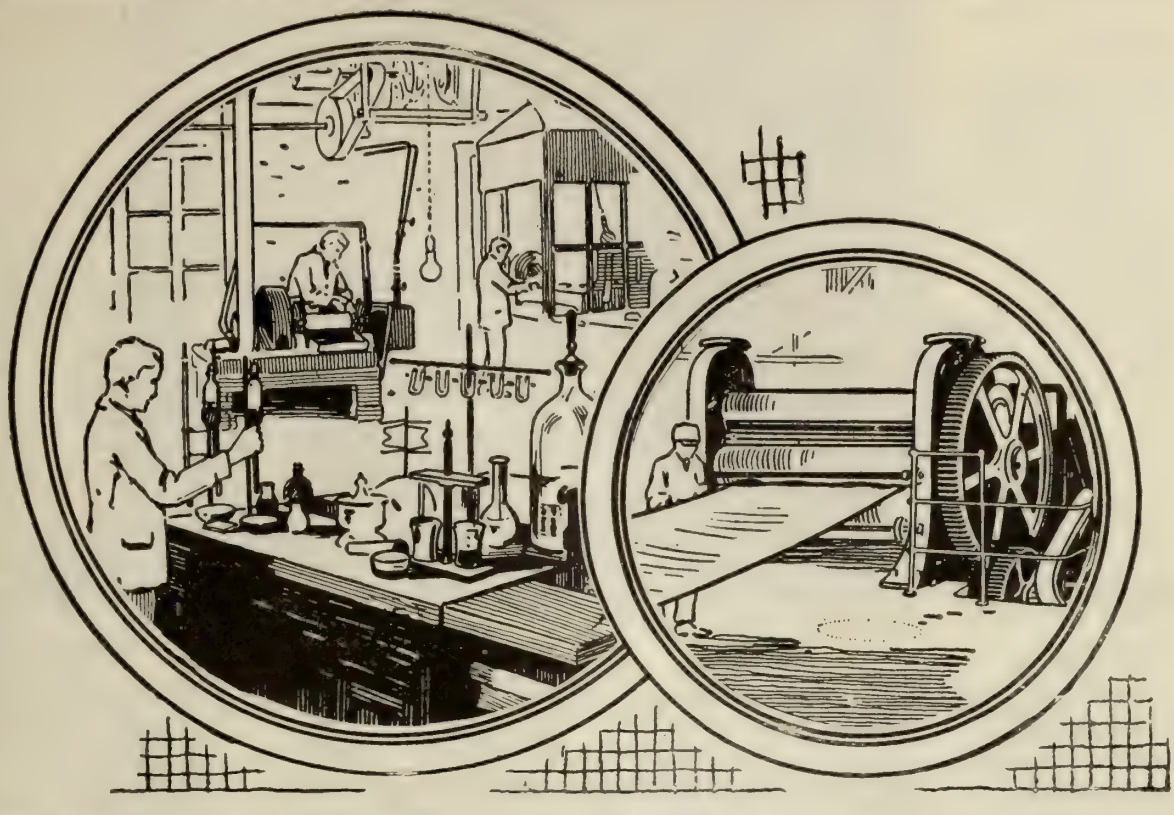
HOISTS, CHAIN AND PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELECTRICAL
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

HOISTS, ELEC., STATIONARY, MONO RAIL
A. Leatty & Sons, Ltd., Welland, Can.
Oliver Engineering Co., Montreal.
Volta Mfg. Co., Welland, Ont.

HOLDERS, STEEL DIE FOR MARKING
Matthews & Co., Jas. H., Pittsburgh, Pa.

HOLDERS, ELECTRIC
Electric Steels & Metals, Ltd., Welland



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Montreal,	Kitchener,	Regina,	Vancouver,
Ottawa,	North Bay,	Saskatoon,	Victoria.

If interested tear out this page and place with letters to be answered.

HOOKS, BELT LACING
Clipper Belt Lacer Co., Grand Rapids.

HOPPERS
MacKinnon Steel Co., Ltd., Sherbrooke.
Dominion Bridge Co., Montreal, Que.
William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

HOSE, FIRE PROTECTION
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal

HOSE, PNEUMATIC
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Independent Pneumatic Tool Co., Chicago.
Quaker City Rubber Co., Philadelphia, Pa.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS
Goodyear Tire & Rubber Co., of Canada, L..., Toronto.
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HOSE, SAND BLAST
Pangborn Corporation, Hagerstown, Md.
Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
Quaker City Rubber Co., Philadelphia, Pa.
Intern'l. Machine Tool Co., Indianapolis.

HOSE, STEAM, SUCTION AND WATER
Gutta Percha & Rubber, Ltd., Toronto.
Quaker City Rubber Co, Philadelphia, Pa
International Mach. Sply, Ltd., Montreal
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

HUMIDIFIERS
Sturtevant Co., B. F., Galt, Ont.

HYDRAULIC ACCUMULATORS
Dom. Steel Products Co., Ltd., Brantford.

HYDRAULIC MACHINERY
Garlock-Walker Machinery Co., Toronto.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.

HYDROMETERS, HYGROMETERS, HYGRODNIKS
Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

INDICATING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

INDICATING SCALES
Can. Kron Scale Co., Montreal.

INDUSTRIAL SITES
City of St. Johns, Quebec.

INGOTS, BRASS, BRONZE, GUN METAL, PHOSPHOR
Thomas Moore & Son, Montreal.

INGOTS, FORGING AND ROLLING
Electric Steel & Metals Co., Welland.

INSULATING COMPOUNDS
Robertson Co., Ltd., H. H., Sarnia, Ont.

INSTRUMENTS, ENGINEERING
Consolidated Optical Co., Toronto.

IRON ORE
Hanna & Co., M. A. Cleveland, O.

IRON, WROUGHT, ROLLED, PIG
Swedish Steel & Impt. Co., Ltd., Montreal

JACKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
...be Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

JACKS, PIT AND TRACK
Canadian Fairbanks-Morse Co., Montreal
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

JAWS, FACE PLATE
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

JOINTERS
Gray Ball Bearing Co., Ltd., Toronto.

JIGS, TOOLS, ETC.
Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

JOURNAL WEDGES
Canada Foundries & Forgings, Welland.

KEY SEATERS
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
E. C. Atkins & Co., Inc., Indianapolis, Ind.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)
LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)
LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Ledge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm. Owen Sound Ont
Lehman Mach. Co., St. Louis, Mo.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smaller-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto
Wood Turret Machine Co., Brazil, Ind
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trahern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox, Southington, Conn.

MACHINERY DEALERS
Archibald & Co., Chas. P., Montreal.
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co. G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)
MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS
Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.

MICROMETERS
Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
E. C. Atkins & Co., Inc., Indianapolis, Ind.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee Wis.

MILLING ATTACHMENTS
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.



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The men on the swing frame grinders say that the Aloxite wheels "hang" to the work, cutting clean and deep—not riding over it. They say that Aloxite wheels are easier to handle, require less pressure, less effort; yet they keep up production records.

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After from forty to fifty hours of abusive, punishing work the wheels have usually lost but three inches. They are then put on stand grinders till used up.

The working conditions, because of the remarkable toughness of Tisco steel and the sharp, jagged, irregular surfaces to be ground, are, perhaps, the most difficult in all grinding.

Yet we have given the Tisco people just the right wheel in the right place—just as we can give you.

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New York Chicago Boston Philadelphia Cleveland Milwaukee Detroit Grand Rapids Cincinnati Pittsburgh

MILLING MACHINES, AUTOMATIC
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING CUTTERS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MILLING TOOLS
Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M.

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind.

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa.
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
St Lawrence Welding Co, Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto.

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill.

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

PATENT SOLICITORS
Sudden, Hanbury A., Montreal.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Eidout & Maybee, Toronto.

PECK CARRIERS FOR POWER PLANTS
Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

PHOTOSTATS
Commercial Camera Co., Providence, R.I.

PIG IRON
Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

PINS, TAPER
Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph

PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

PIPE, JOINT COMPOUNDS
Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

PLANING AND SHAPING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Keriton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

PLANER-SHAPER, COMBINED OPEN SIDE
Lynd-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

POWER HAMMERS
Quickwork Co., St. Marys, Ohio.

PLANING MILL EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

PLATES, Q.M., SHEARED AND CHEQUERED
Peckovers, Ltd., Toronto, Ont.

PLATING, PLANTS & SUPPLIES
Can. Hanson Van Winkle Co., Ltd., Toronto, Ont.

PLIERS
Aikenhead Hardware Co., Toronto.
Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pmatic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

POWER CRANES, HAND
MacKinnon Steel Co., Sherbrooke, Que.

POLISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

POLISHING PLATES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. of Canada, Galt, Ont.

POLISHING PAPER
H. H. Barton & Son Co., Philadelphia.

POTS AND KETTLES, CAST STEEL
Elec. Steel & Metals, Welland, Ont.

POWER HOUSE CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert.
Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

PORTABLE MACHINERY
Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
Petrie, Ltd., H. W., Toronto.

PRESSED STEEL PARTS
Gray Ball Bearing Co., Ltd., Toronto.

PRESSERS, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

PRESSES, BROACHING, FORGING AND FLANGING
Atlas Press Co., Kalamazoo, Mich.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, CA... EYELET
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

Tranco Trucks

The Universal Elevating Truck

MADE-IN-CANADA



Make a Substantial Cut in the Cost of Handling Material

When you adopt the TRANCO method you have something different from the ordinary methods of trucking. You have a simpler method—a method that is more efficient—and one that means a big cut in the cost of handling material.

With TRANCO trucks in operation you pile the material on standardized, movable platforms instead of on the floors, or fixed platforms. Then you convey the loaded platforms by means of the TRANCO truck to its destination, where they remain until the material is disposed of. Time spent in handling is thus reduced to a minimum and much expensive labor is saved. In checking up results it has been found that in many cases one man with a TRANCO truck can do the same amount of work that formerly required five men under the old system of trucking. A big factor this in view of the high cost of labor to-day.

There are three outstanding features of TRANCO Trucks—

1. **Ease of locomotion and operation, acquired by the use of Chapman Double Ball Bearings.**
2. **Operation with steering head and handle at any angle.**
3. **Safety to operator and material.**

Breakage, soilage, scratching or other injury to material is greatly reduced.

The movable platforms are compact, easily stored, and inexpensive.

In their design and construction TRANCO Trucks are all that could be desired. They are built to endure rough usage as well as steer and roll with extreme ease.

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If interested tear out this page and place with letters to be answered.

PRESSES, FILTER
Perrin, Ltd., William R., Toronto.
Smalley-General Co., Inc., Bay City, Mich.

PRESSES, PNEUMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Toledo Machine & Tool Co., Toledo.

PRESSES, DROP AND FORGING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

PRESSES, HYDRAULIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 18 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, O.S.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland

RIVETS.
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford.
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Dom. Steel Products Co., Ltd., Brantford.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md
Lawrence Welding Co, Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland.

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

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E. C. Atkins & Co., Inc., Indianapolis.
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Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
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SAWS, HACK (See Hack Saws)

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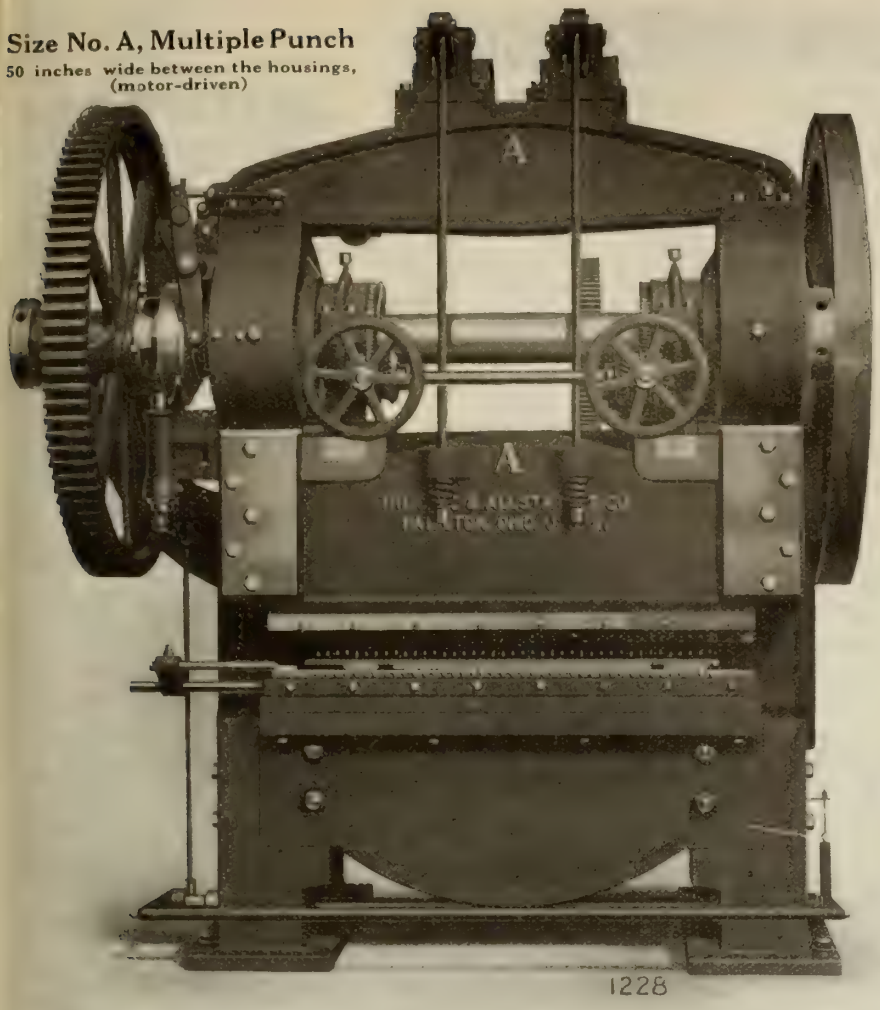
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Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

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Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

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See Dies.

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Pangborn Corporation, Hagerstown, Md.

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Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

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Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Whs., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
I. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
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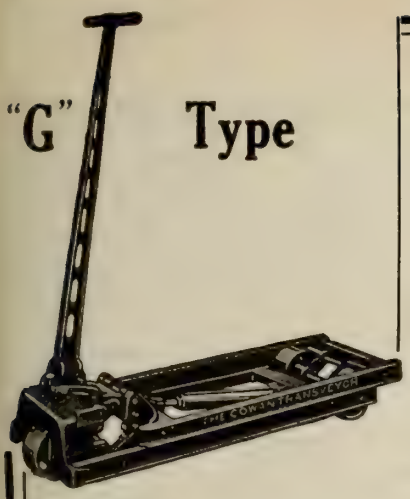
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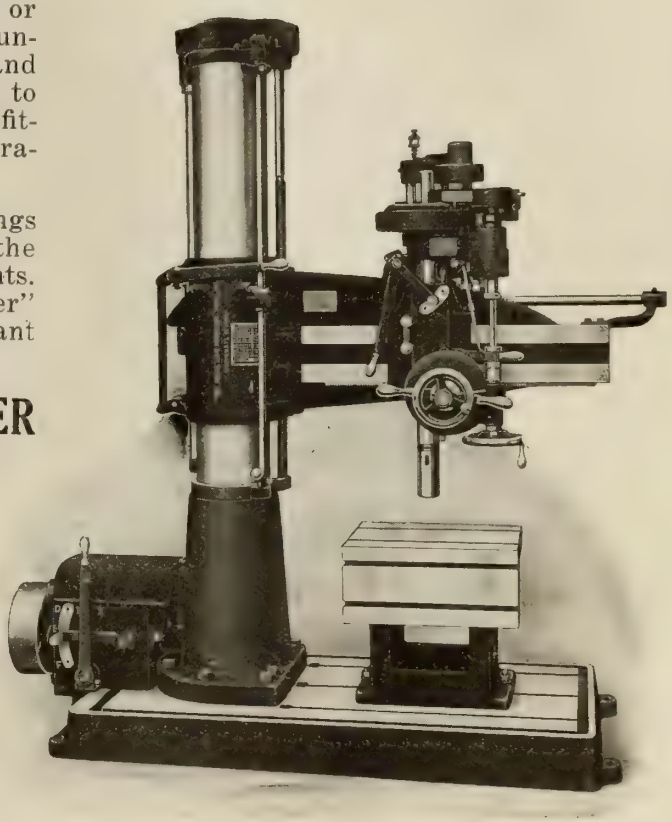
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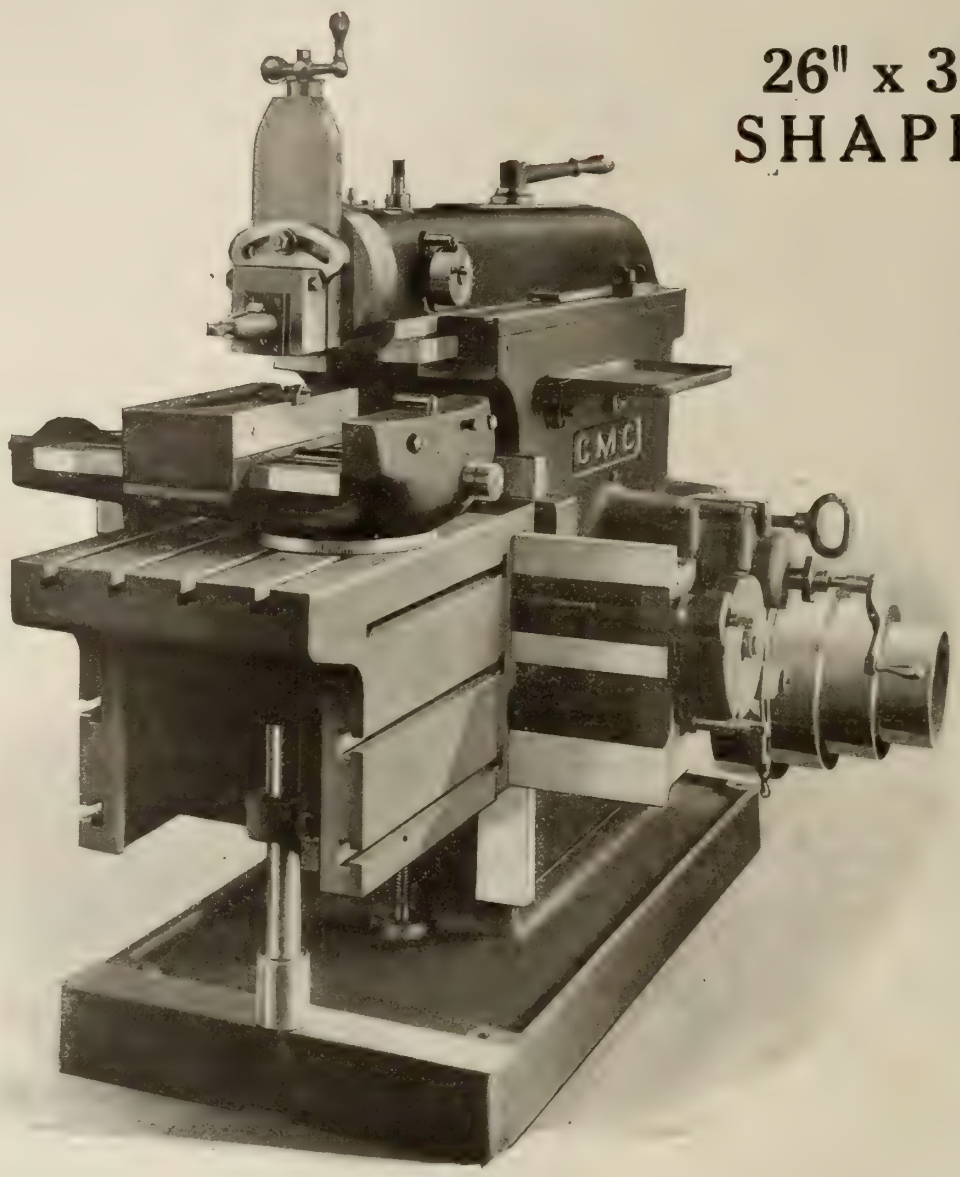
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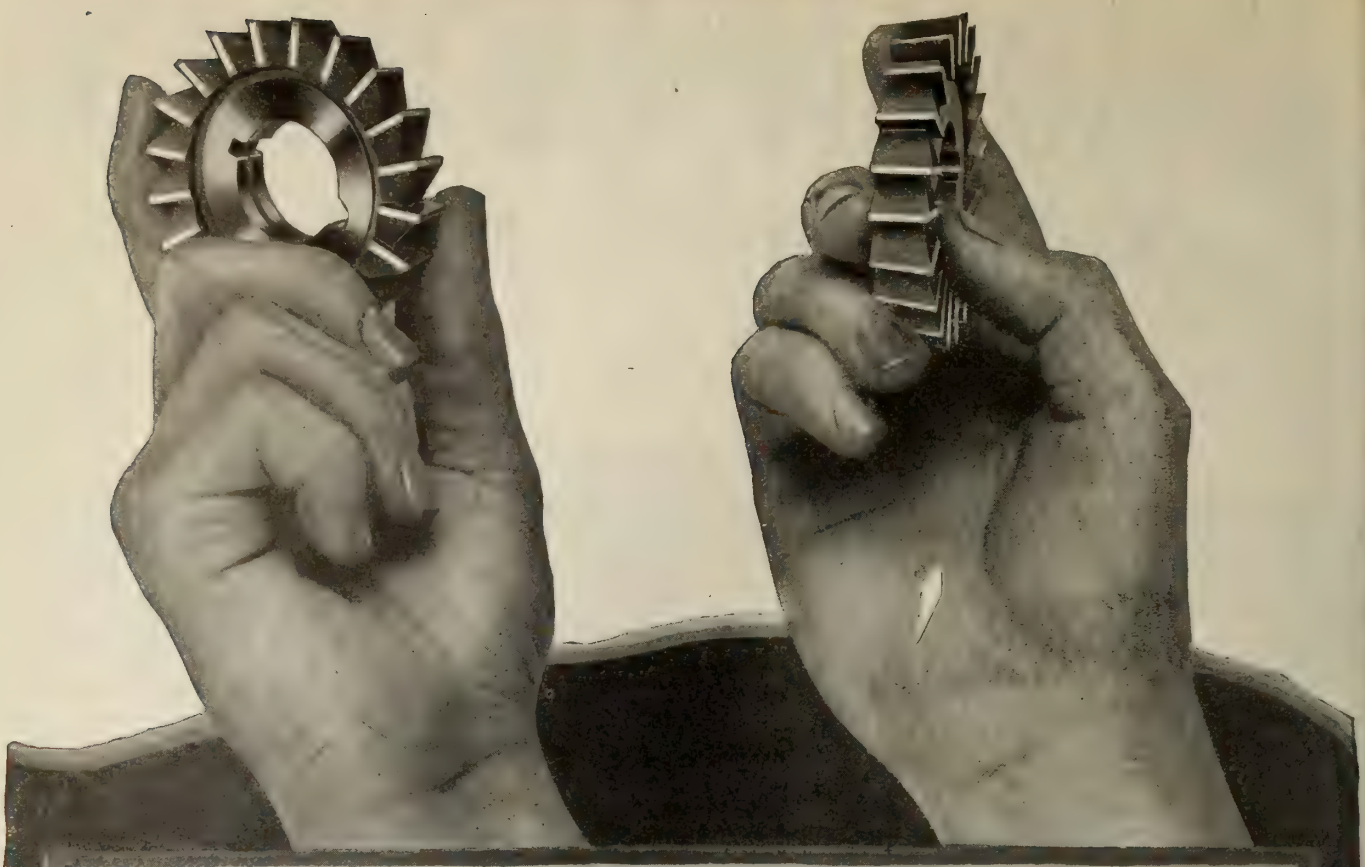
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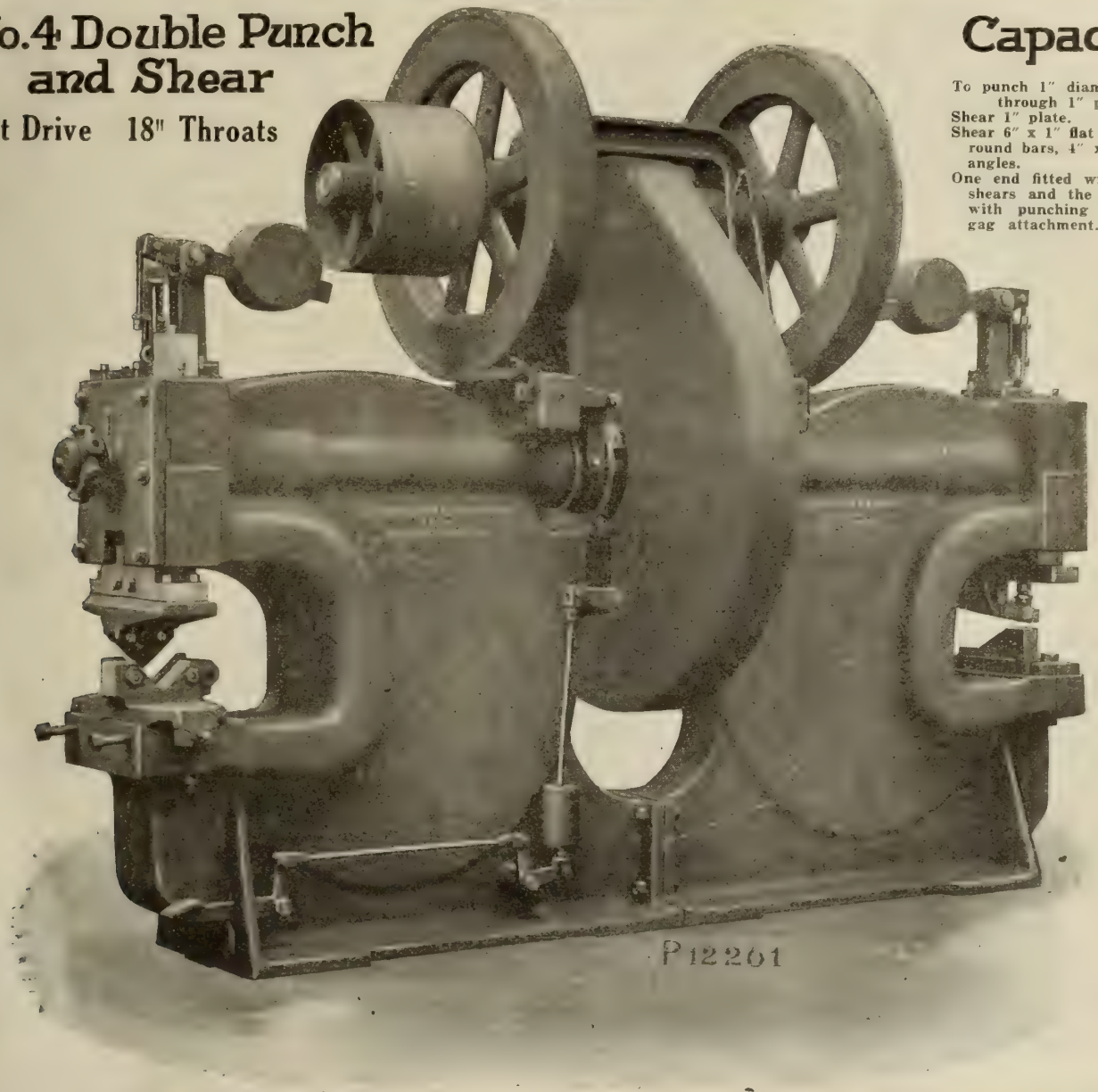
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The BERTRAM Page

MACHINE TOOLS

No. 4 Double Punch and Shear

Belt Drive 18" Throats



Capacity

To punch 1" diameter holes through 1" plate.
Shear 1" plate.
Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜" angles.
One end fitted with Angle-shears and the other end with punching tools and gag attachment.

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Canadian Machinery and Manufacturing News, February 12, 1920. Vol. 23, No. 7. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

GARVIN MACHINE TOOLS

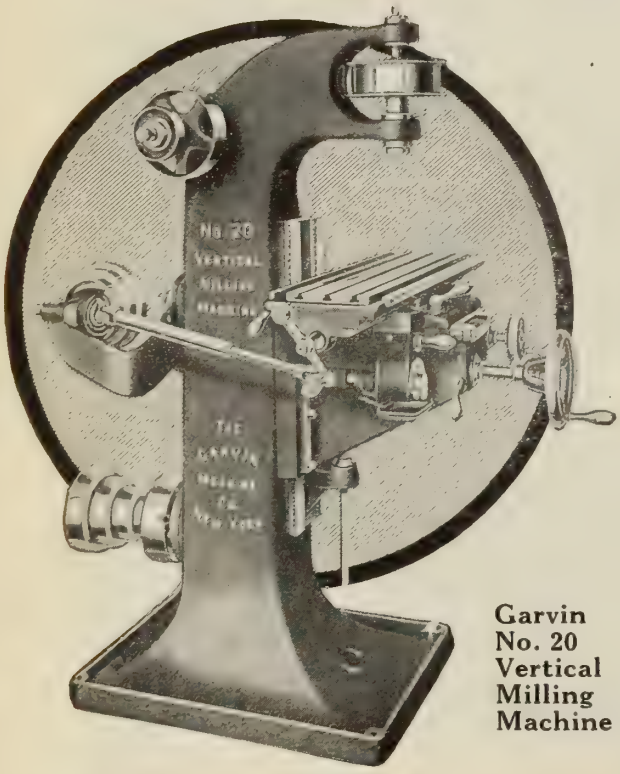
GARVIN MACHINE TOOLS

Milling Machines
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Duplex Horizontal Drills
Gang Drill Presses
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A vertical milling machine is the ideal type for face-milling, spotting off bosses, milling out recesses and T slots, finishing circular slots and edges and die sinking—but only if the machine is absolutely rigid.

The Garvin machine shown here can be run at high speeds without vibration. Its design combines the convenience of the vertical machine with the solidity of the horizontal types. You can speed production by the use of Garvin Vertical Milling Machines.



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Ask for Circular No. 227

The Garvin Machine Company

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Robertson Process Metal

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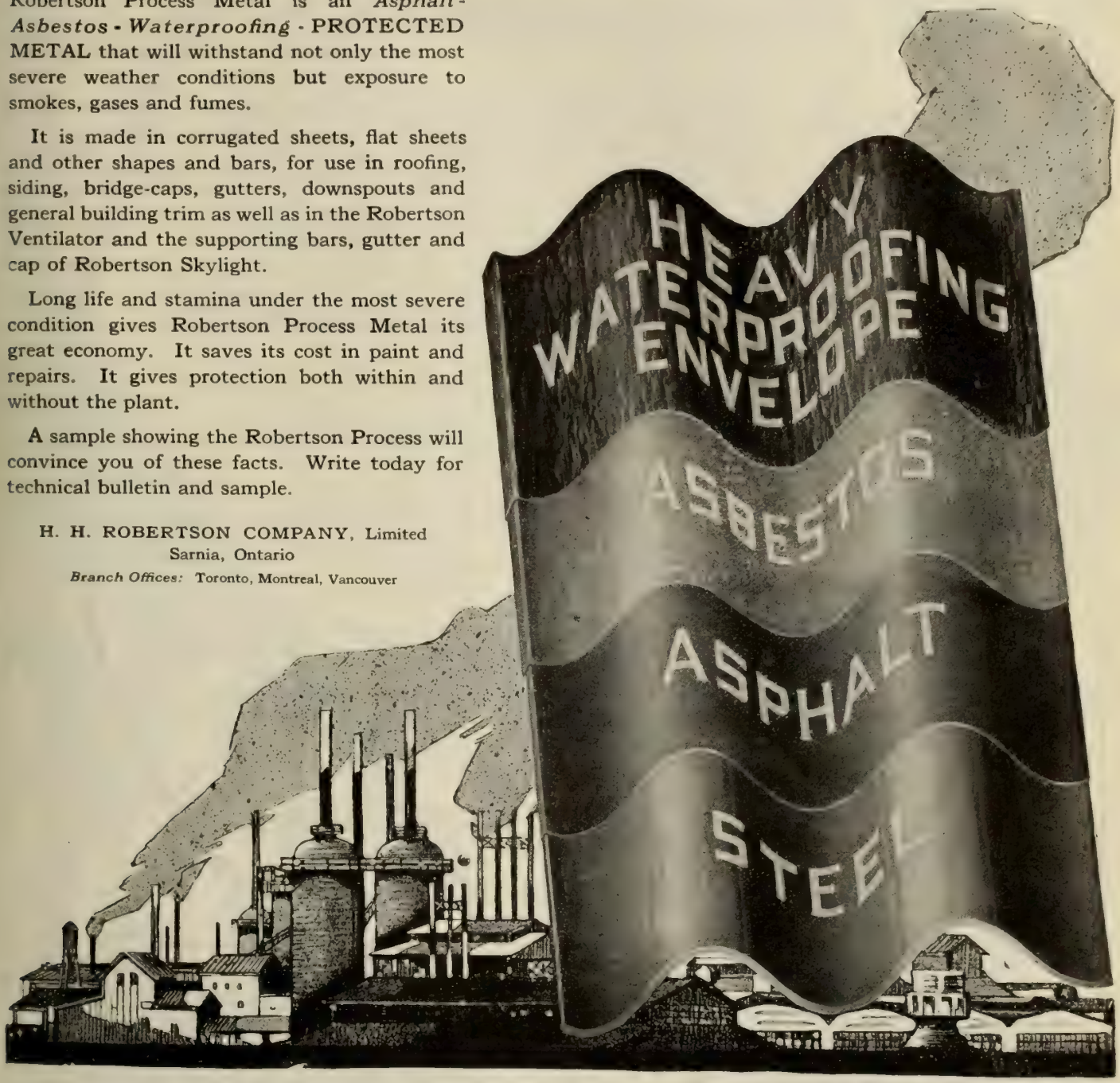
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It is made in corrugated sheets, flat sheets and other shapes and bars, for use in roofing, siding, bridge-caps, gutters, downspouts and general building trim as well as in the Robertson Ventilator and the supporting bars, gutter and cap of Robertson Skylight.

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4 x 3½"—4 x 3"—3½ x 3"
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BEAMS—
15", 12", 10", 8", 6", 5", 4", 3".

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3¼ x 5 x 3¼ x 5/16"
3 5/16 x 5 1/16 x 3 5/16 x ⅜".
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All sizes from ½" up to and including 4".

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REAMERS AND MILLING CUTTERS

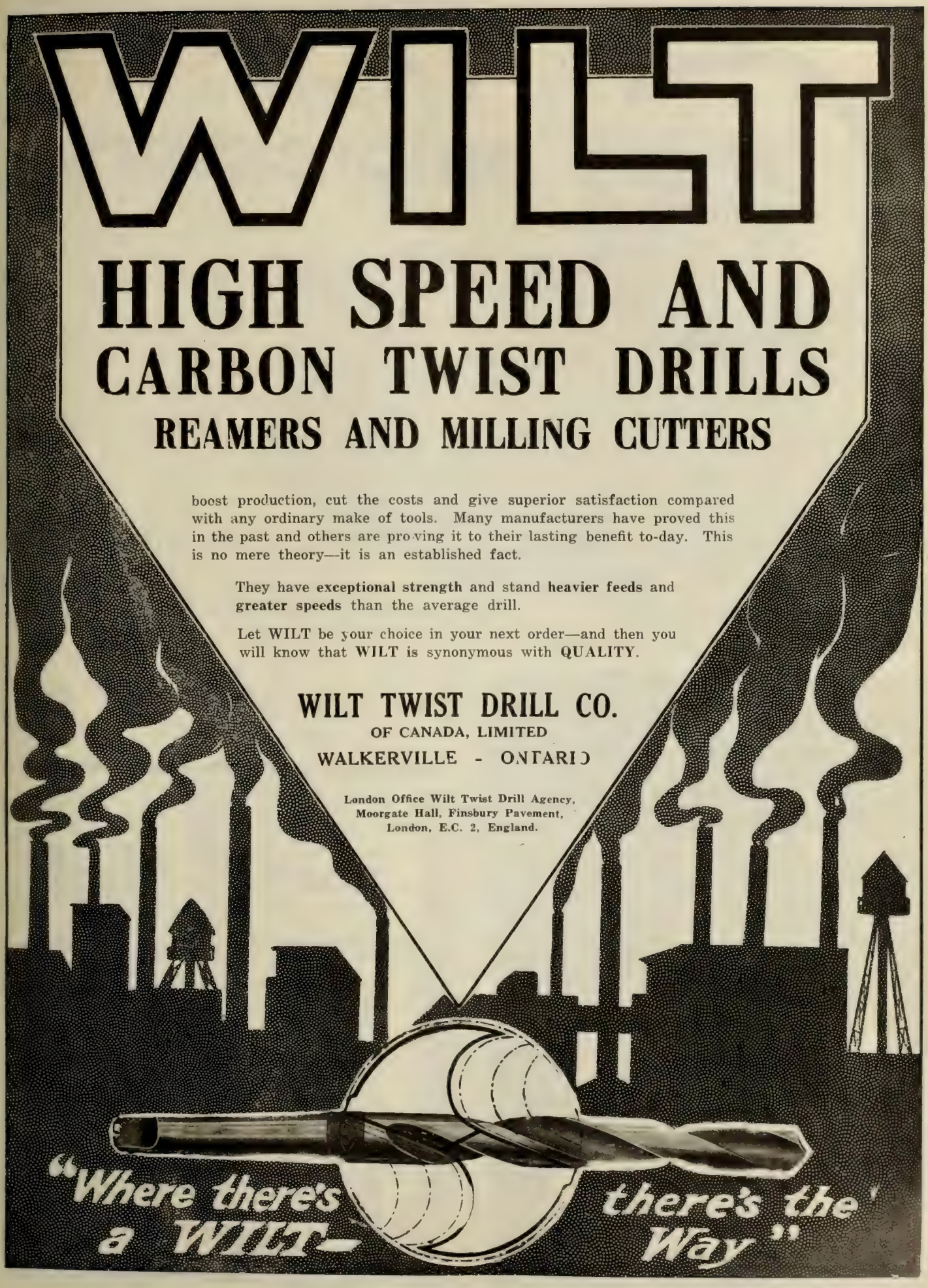
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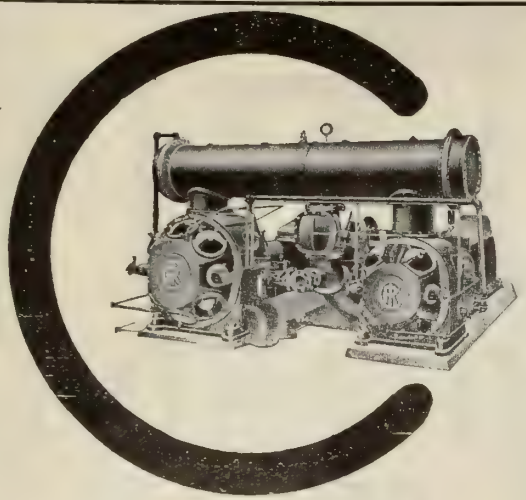
They have **exceptional strength** and stand **heavier feeds** and **greater speeds** than the average drill.

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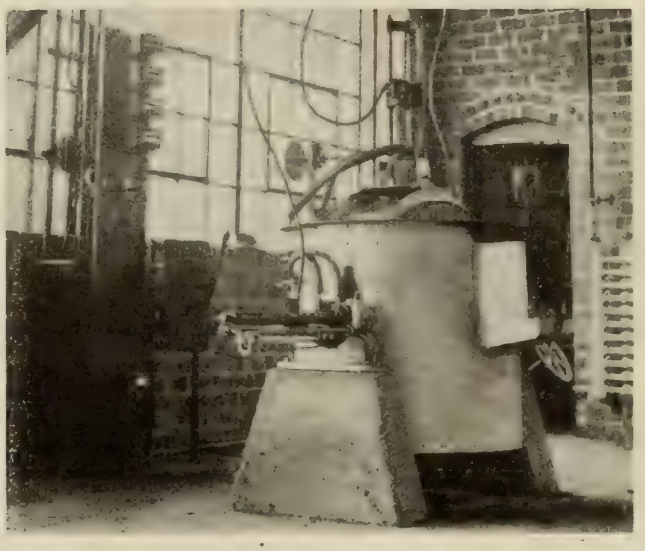
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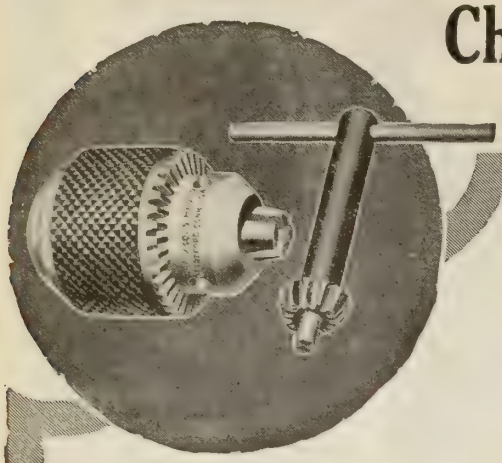
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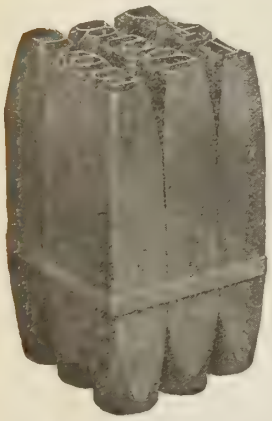
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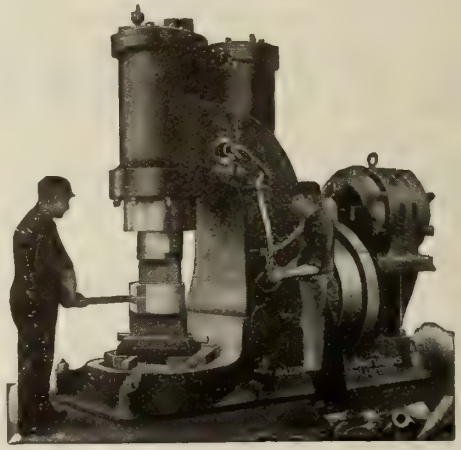
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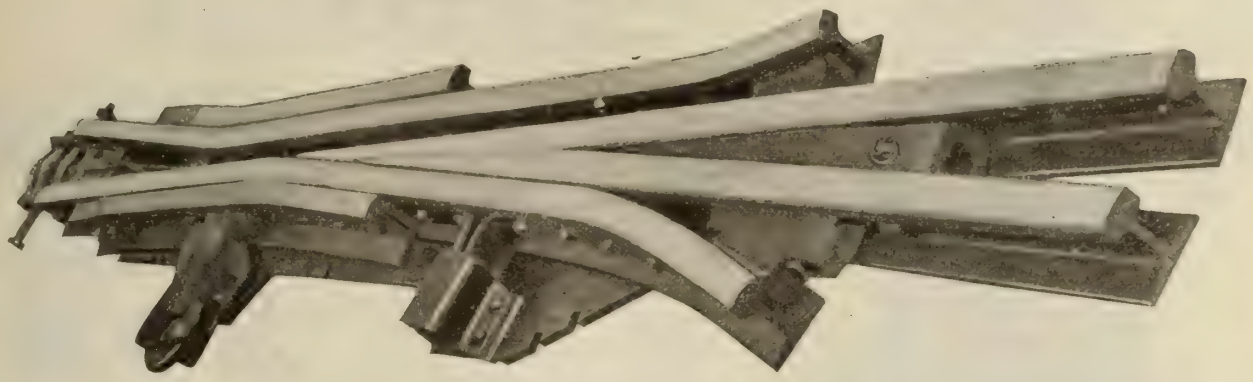
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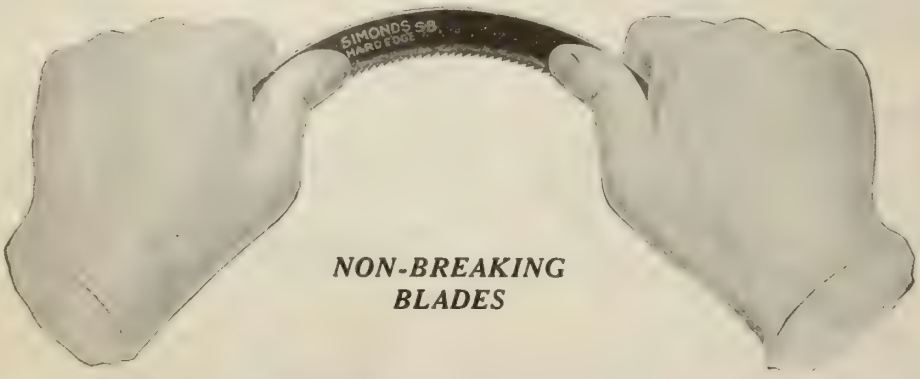


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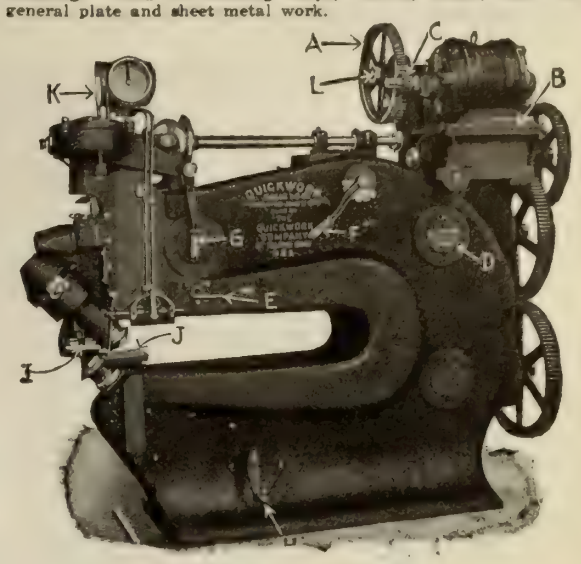
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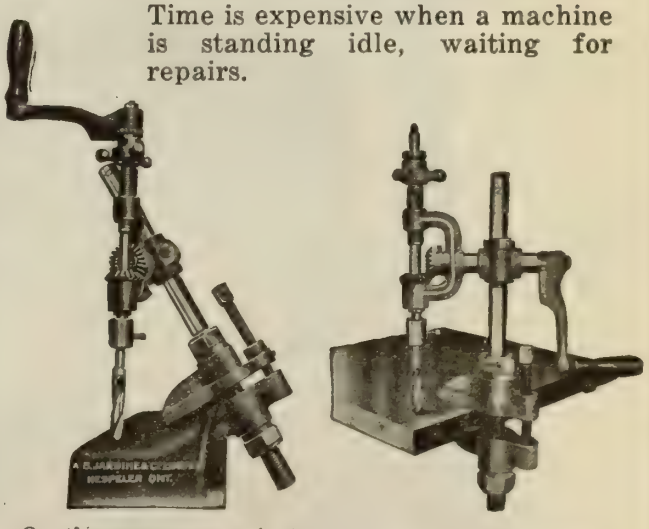
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High Speed Milling on Aluminum Oil Pans

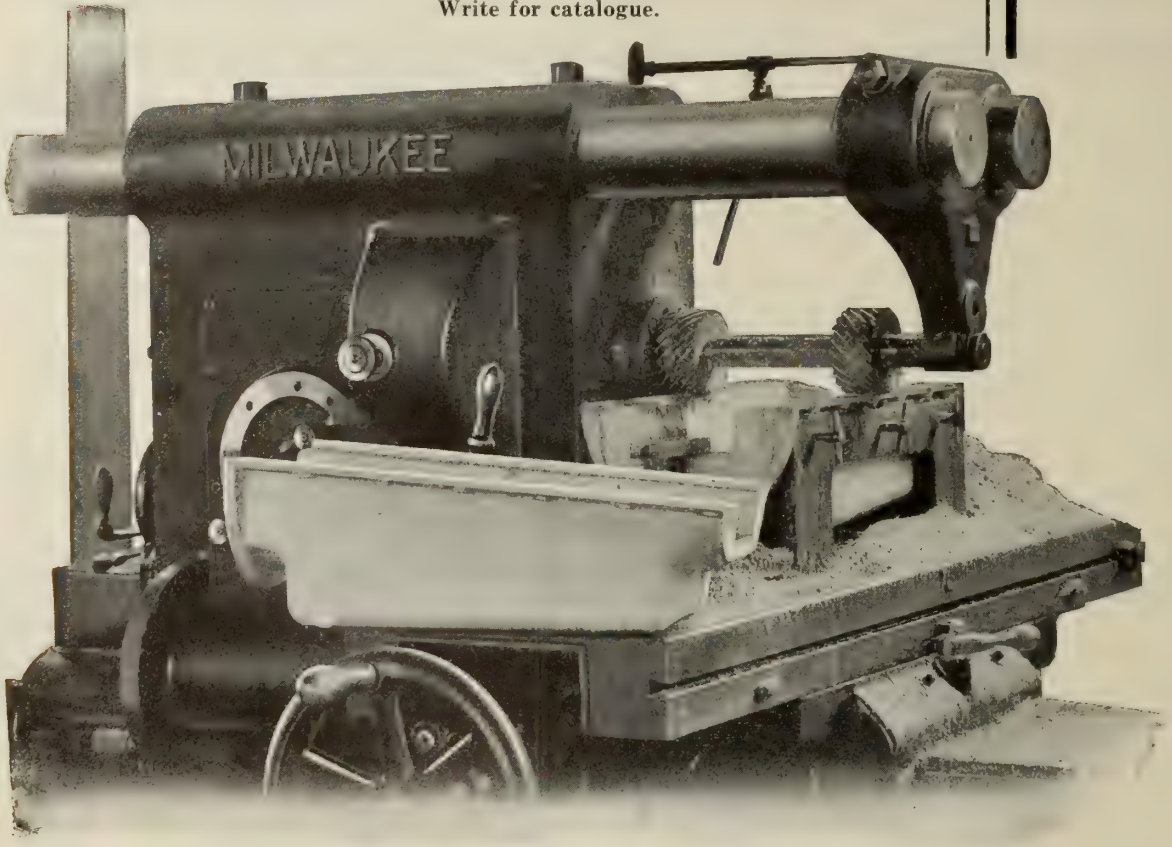
The milling of aluminum oil pans, as illustrated, is being done on a No. 3B Plain Milwaukee Milling Machine. The cutters, 4 in. dia., 2 in. face, running 320 R.P.M., remove 3/16 in. stock, the table feeding 16 in. per minute.

When one pan is finished, another is clamped in its place and the feed is reversed. A smooth surface is produced with one pass of the cutters in either direction.

On account of the rigid double overarm construction, arm braces are not necessary, thus facilitating for the rapid loading and unloading of the work. Note that one cutter is held far from the face of the spindle.

Milwaukee Milling Machines possess many features of merit, some of which are—One-piece box section column, reinforced with heavy vertical and horizontal internal walls; solid top, box section knee with extended slide; table, large and convenient; double overarm, exceptionally rigid; flanged spindle, highly efficient; automatic flooded lubrication system, thoroughly lubricates all bearings and gears in the column, feed box and pulley bracket; cutter lubricating system, operates only when spindle revolves; constant speed drive.

Write for catalogue.

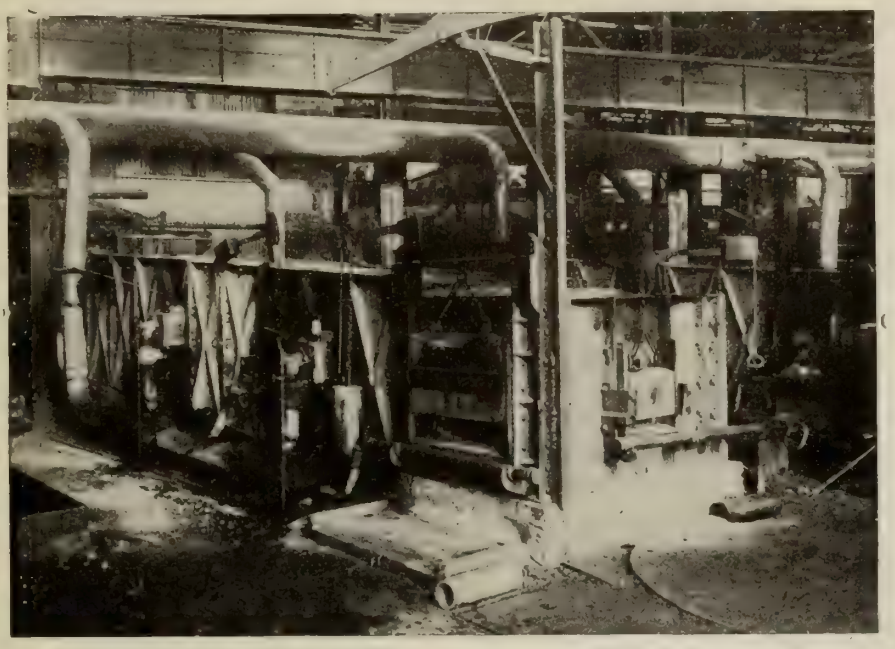


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demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



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Company, Limited
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A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

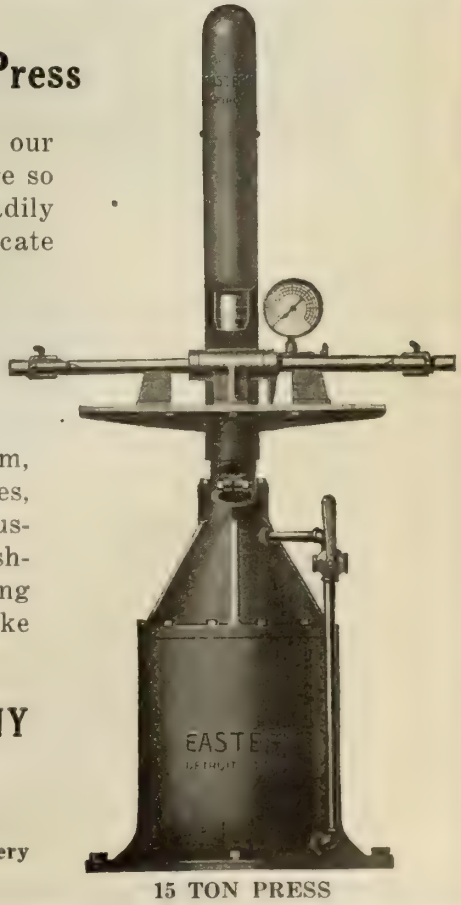
Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

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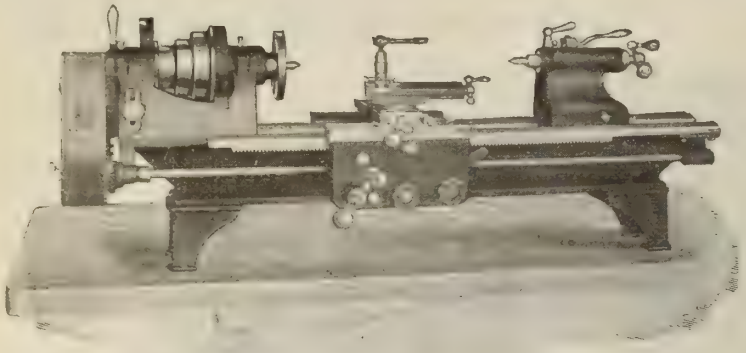
Canadian Representative: F. F. Barber Machinery Co., Limited, Foy Building, Toronto



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9 in. x 4 ft. Style "K" "STAR" Screw Cutting Bench Lathe



THIS LATHE IS A THOROUGHLY PRACTICAL MACHINE FOR SMALL WORK IN THE TOOL ROOM AND PRODUCTION WORK IN THE SHOP. Equipped with one or more of the many attachments, it handles a variety of operations and is a very fine lathe for the model maker and for experimental and scientific work.

It embodies all the most approved features of up-to-date lathe design and is made with the finest workmanship from the best materials obtainable.

Compound rest, spindle bored for draw-in-chuck, right and left standard threads 3 to 72 per inch, micrometer dials, change gears and full tool equipment, countershaft, etc. Bench type or with legs. Foot power if desired.

A lot of your smaller work can be handled by a 9 in. Star, releasing the inconvenient and expensive heavier machines for larger work.

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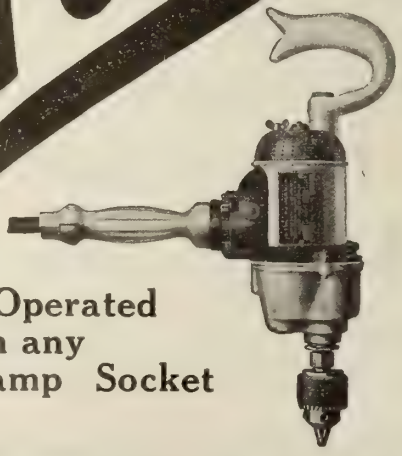
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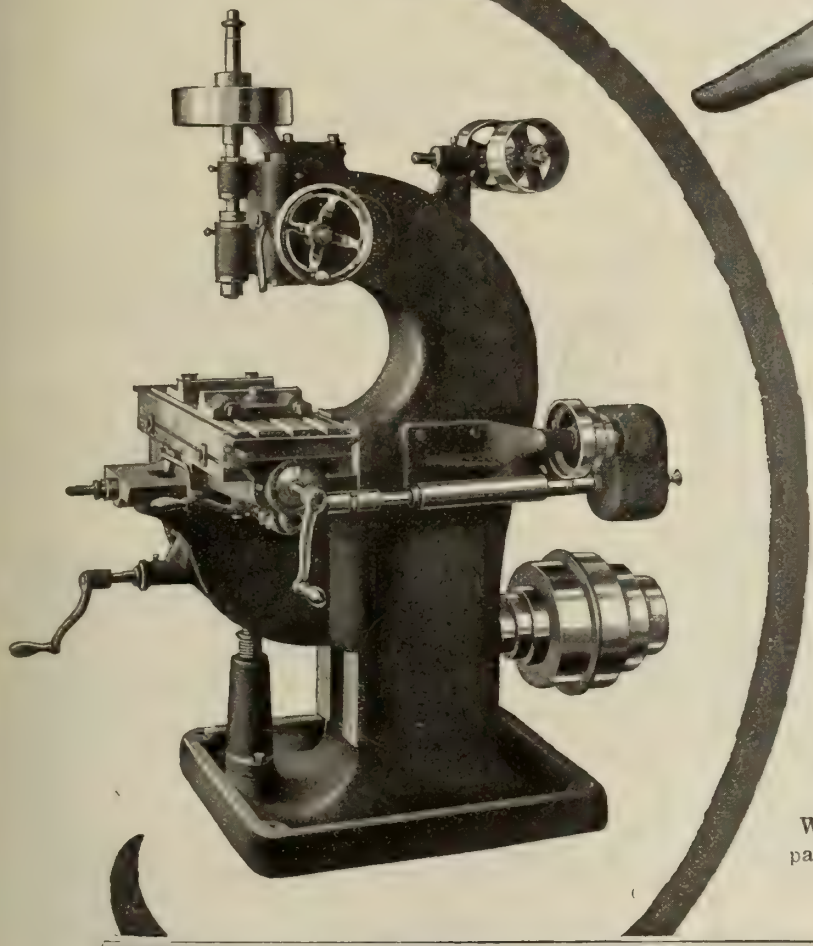
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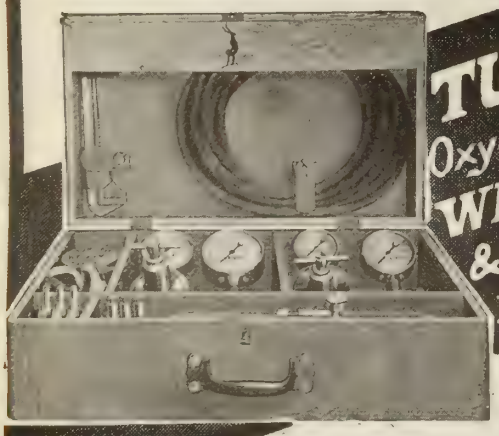
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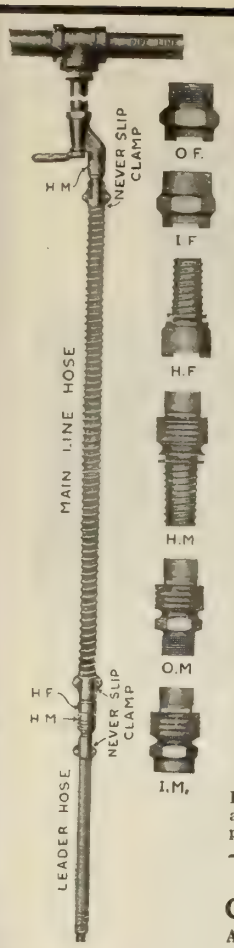


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Bowes Automatic Air Hose Couplings
Standard Equipment Everywhere

The Cleco Never Slip Hose Clamp
Made in same sizes as Bowes Couplings

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.
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STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
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The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ⅜-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

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Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ⅜-in.

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.



CLECO GROOVED HOSE NIPPLE



Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

WIRE CLAMP TOOL

To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.



Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

Write for Bulletin 34A, 41 and 43.

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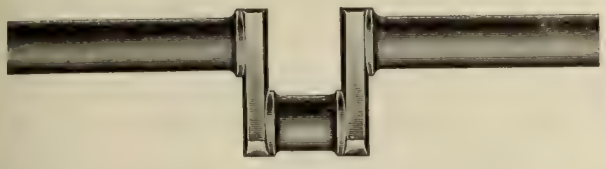
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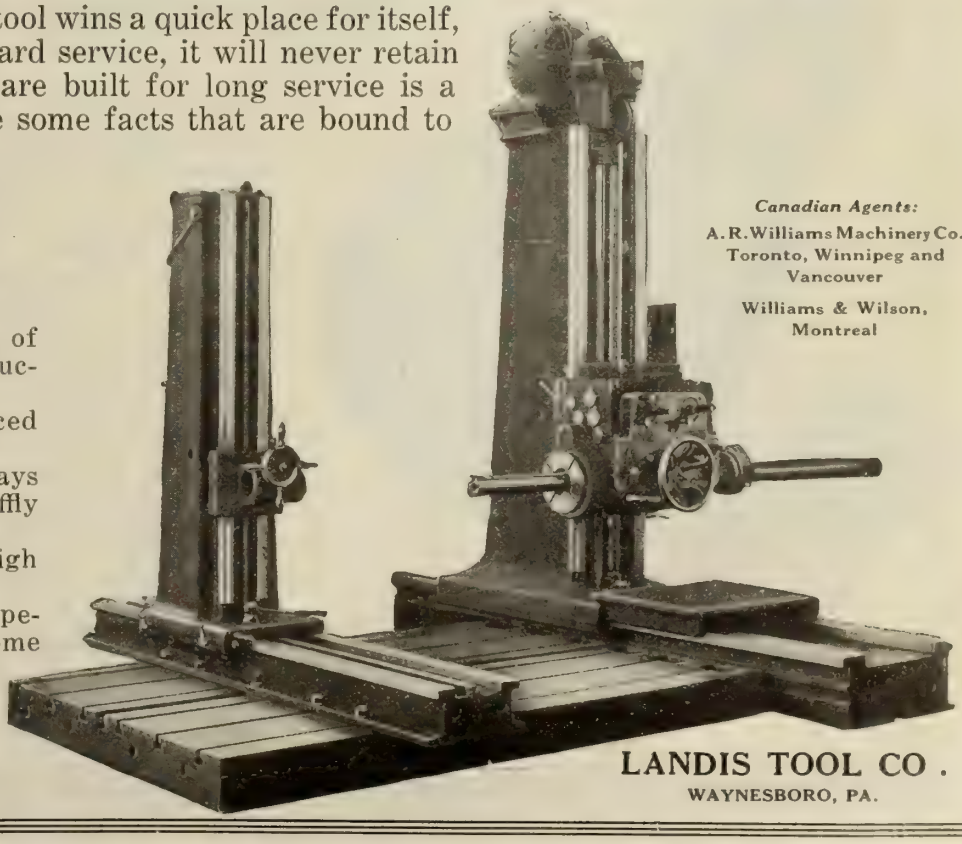
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Gears and shafts are of specially heat-treated chrome nickel steel.

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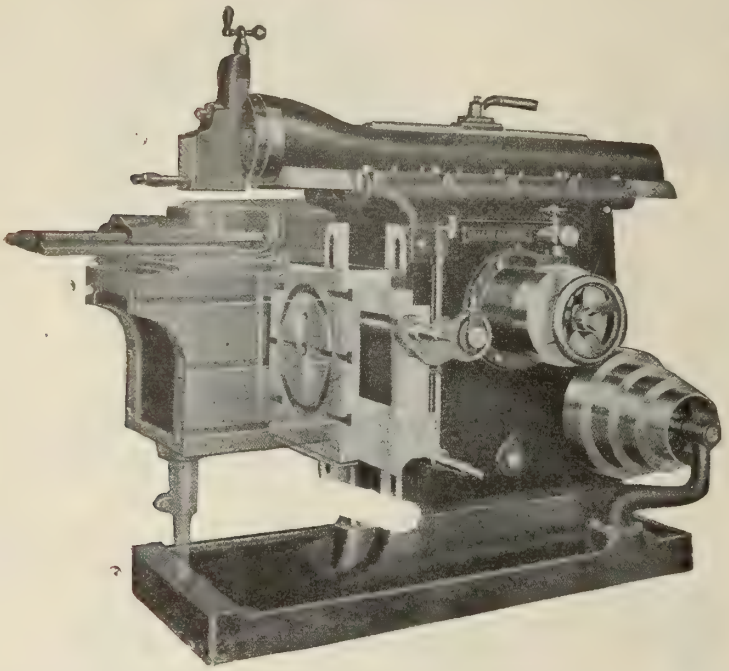
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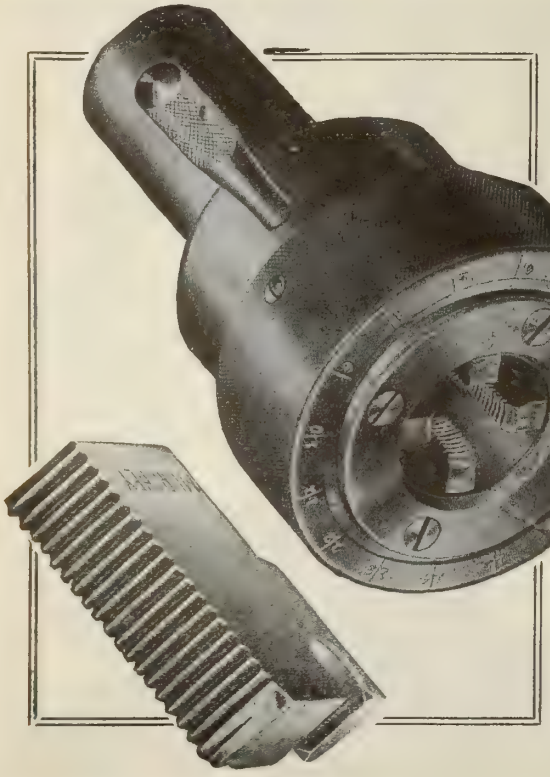
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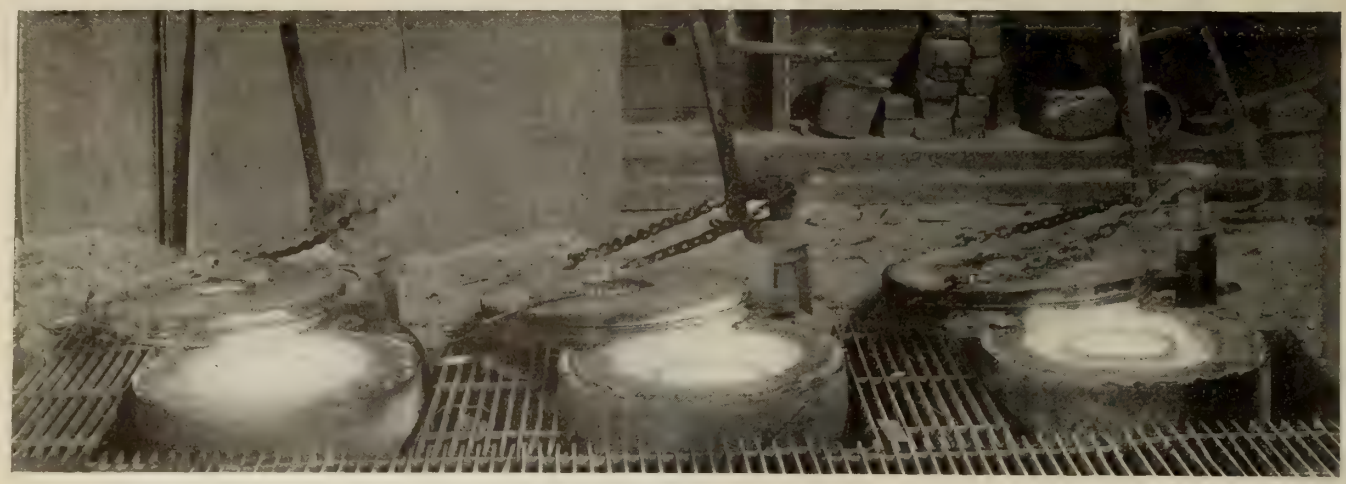
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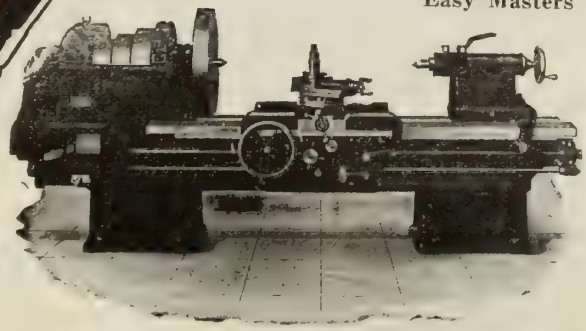
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Easy Masters of Big Jobs.



Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good—with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

The Sidney Tool Company
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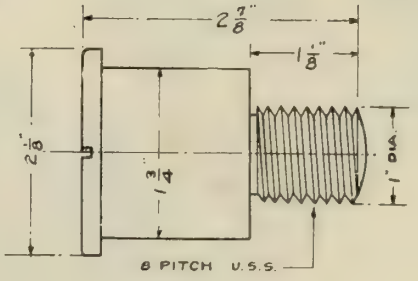
Sometimes a Smalley-General Thread Miller is more profitable on small work than a screw machine

Here's an Example:

Studs like this are common enough. You've probably got half a dozen of them in the machine you're manufacturing.

Possibly you've tried to save money by turning them out in a screw machine and then gone back to the old reliable lathe because the screw machine wasn't accurate enough and didn't give a good finish.

If you've had this experience you'll be interested to know that ordinary intelligent labor on the **Smalley-General Thread Miller** will turn out threaded parts with more accurate diameters, better finish and greatly less time than the skilled mechanic on the engine lathe. We're publishing the time study here for comparison. Don't you think it worth while to let us study your blueprints and give you guaranteed production estimates on your threaded work?



MATERIAL—.30 Carbon Steel.

SCREW MACHINE TIME—30 seconds, approx., not including chucking.

LATHE TIME—14 minutes, approx.

THREAD MILLER TIME—1½ minutes, floor to floor.

This particular job required accuracy, finish and parallel thread and hence was done on a thread miller in preference to screw machine.

Smalley-General Co., Inc.

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The Goodyear Industrial Hose offered you today is the result of a definite policy. It is the *solution* to your hose problems—not a makeshift.

In mines, mills, foundries, shipyards, railways, and a hundred other industries, all over Canada, it is setting new standards.

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The Goodyear Tire & Rubber Co. of Canada, Limited

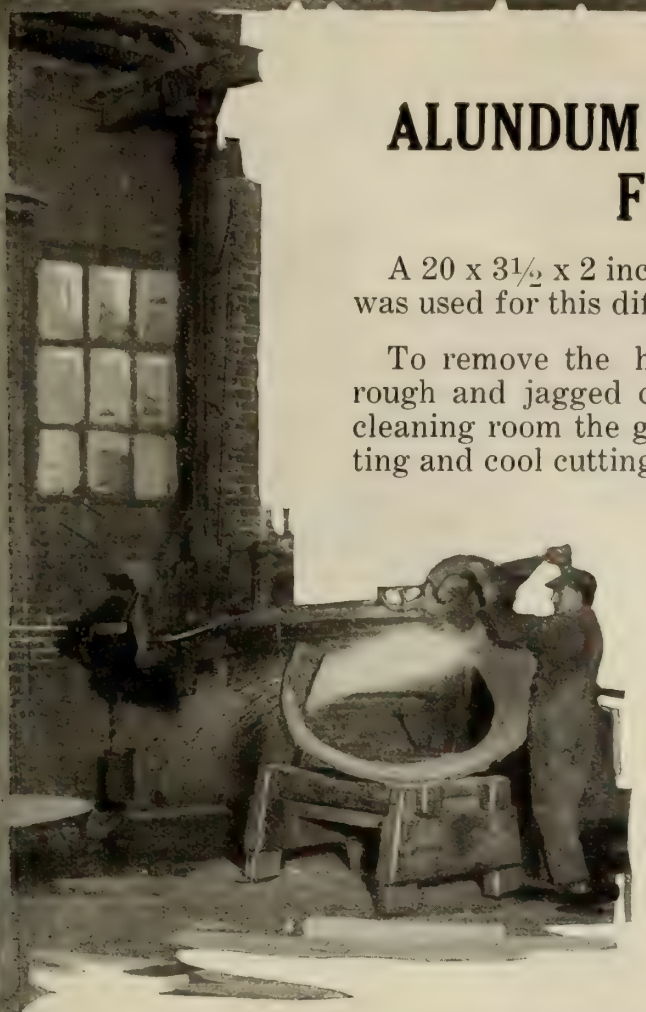
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ALUNDUM WHEELS IN THE FOUNDRY

A 20 x 3½ x 2 inch, 6616 grade Q Alundum wheel was used for this difficult snagging operation.

To remove the heavy fins and burrs from the rough and jagged castings when they come to the cleaning room the grinding wheel must be free cutting and cool cutting.



The important facts to remember are:

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2. The grain and grade depend upon such conditions as ***operating speed, contact of work with wheel, rigidity of machine*** and perhaps others.

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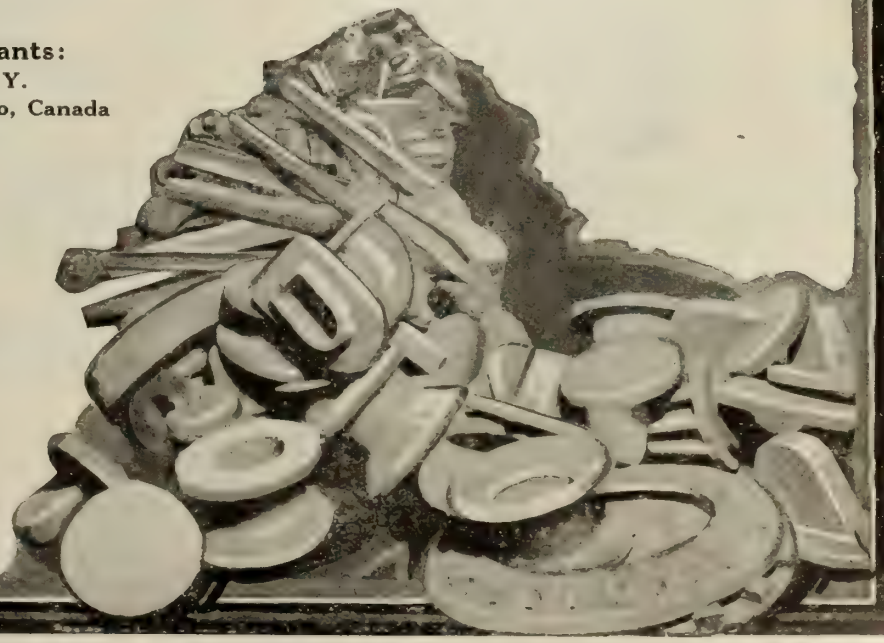
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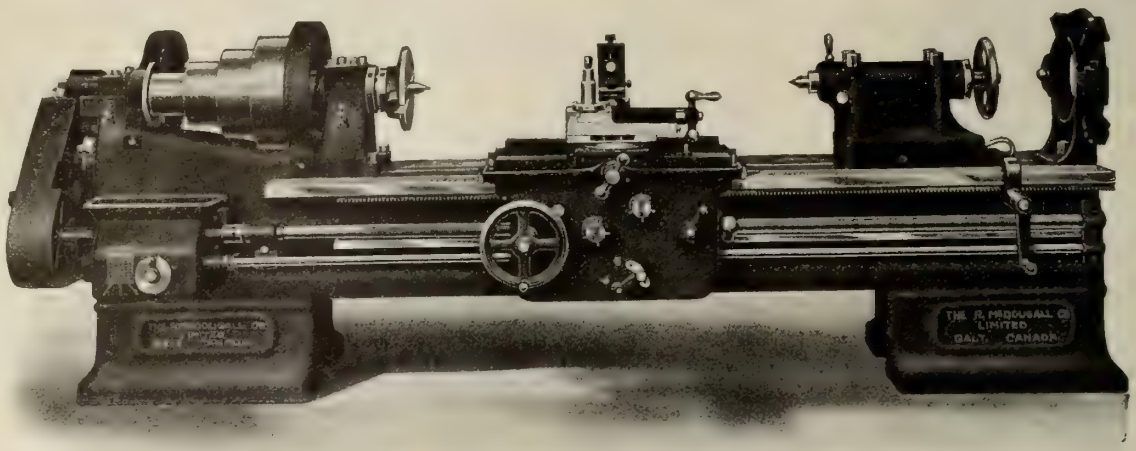
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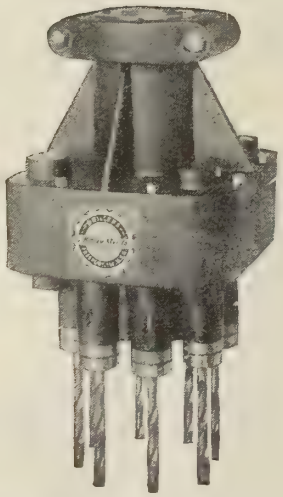
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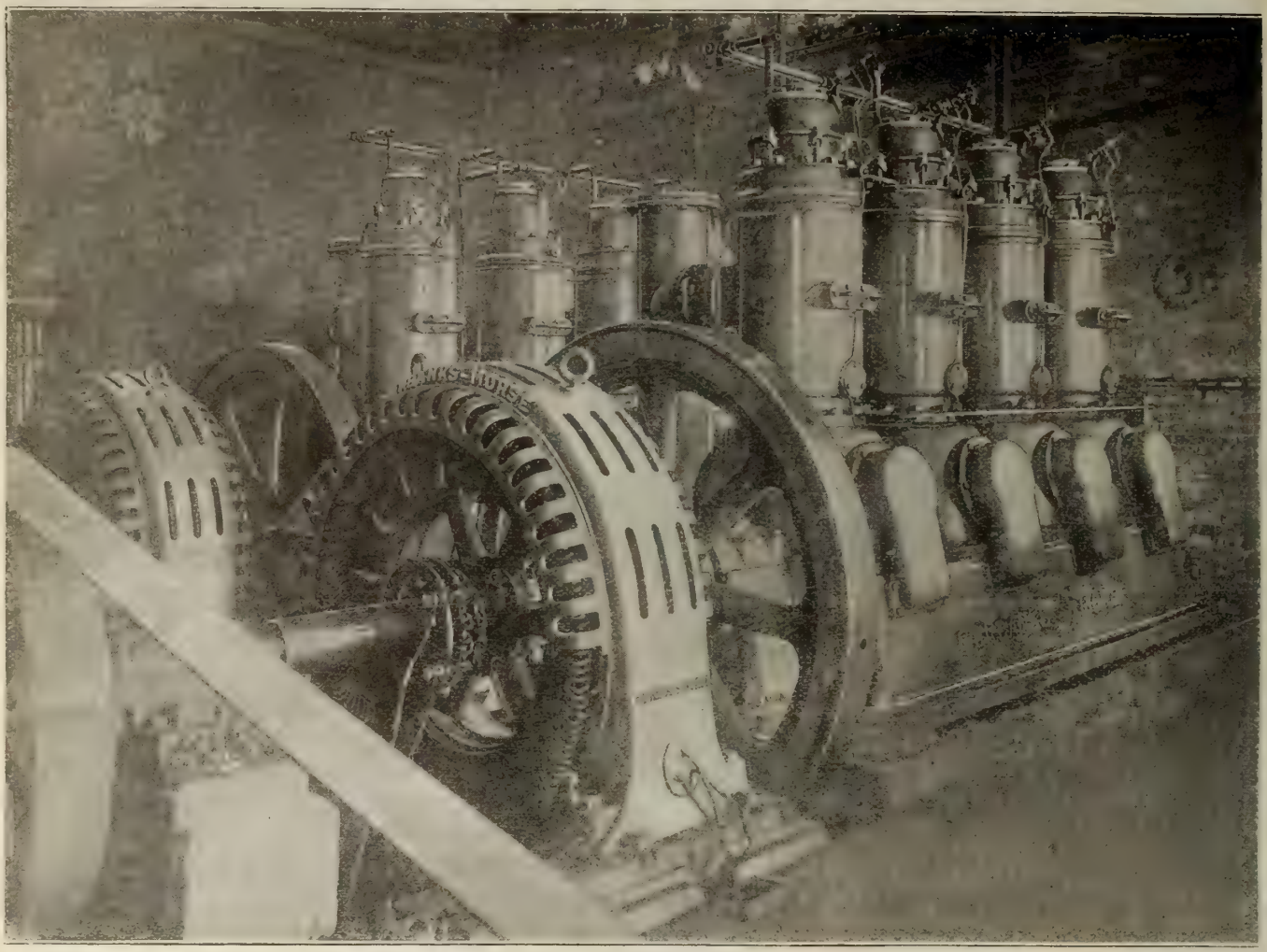
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MANUFACTURING NEWS

Vol. XXIII., No. 7 February 12, 1920



Details of the C.P.R. Mikado Type Locomotive

By J. H. RODGERS

PROGRESS is a force no man can stay. Richard Trevithick, the first engineer to make practical use of steam as a power for locomotion, may have visualized in his mind's eye the future development of the steam locomotive, but the achievements of present-day engineering in this direction are doubtless far beyond the fondest dreams of the pioneers in this branch of science.

The Mikado type locomotives recently completed at the Angus shops of the Canadian Pacific Railway registers another mile post in the progress this company has taken in keeping Canada in the forefront of mechanical evolution. The final delivery of the initial order of 10 of these locomotives has just been made and the present program calls for the construction of four new types: a Mikado type locomotive, having a tractive effort of 56,000 lbs., two classes of Pacific type locomotives with 43,700 lbs. and 42,600 lbs. tractive effort respectively, and one of the Sante Fe type with a tractive effort of 66,000 lbs.

The design of these locomotives has been carried out by the mechanical engineering staff of the C.P.R., the construction taking place at the Angus shops, under the direct supervision of W. H. Winterrowd, chief mechanical engineer, and W. A. Newman, engineer of locomotive construction, to whom we are indebted for the data and photos accompanying this description.

While there has been no radical change in the general design of these locomotives, they being quite similar to those constructed by the C.P.R. in 1912, special attention has been given to detail design, and every effort has been made to produce a common-sense locomotive, which will give reliable and efficient service and economical in operation.

Boiler Construction

A departure has been made in the design of the boiler, which is built on the extension wagon-bottom type, a feature that gives a more pleasing appearance in the upper lines of the engine. This class of boiler, while not actually an experiment, is the first of its kind to be adopted on the Canadian Pacific locomotives. The decision to try out this type of boiler was the result of considerable investigation and careful study, on the part of the designing engineers of the company, regarding boiler proportions and constructions, every care being taken to insure ample steam generating capacity, combined with easy steaming qualities. Some of the reasons for the adoption of this particular type of boiler may be briefly stated as follows: By locating the steam dome further forward, or on the second course, the seam construction on the course adjoining the fire-box has been much simplified; the standpipe is separated from the crown sheet by a greater distance, and, therefore, is further removed from the extreme ebullitions that occur close to the fire-box section; the dry-pipe is much shorter, so that the length of the steam passage, from the throttle valve to the cylinders, is correspondingly reduced. Still another advantageous feature is the increased steam storage space thus provided, which, it is estimated, will add materially to the superheating efficiency.

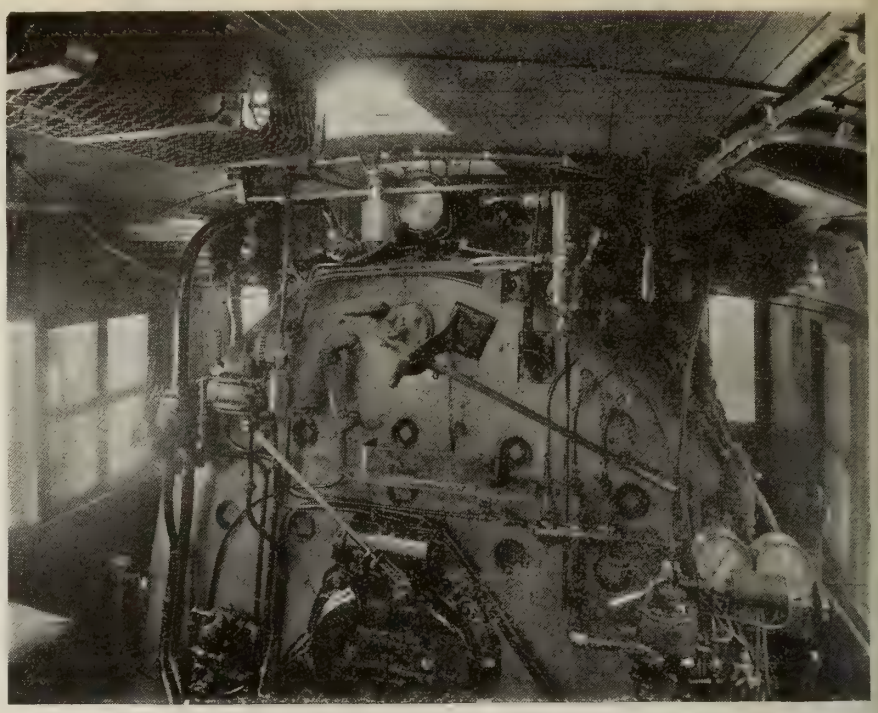
The boiler has an overall length of 38 feet 10 inches, with a diameter of 80 inches at the forward end, and 90 inches on the course adjacent to the fire-box. The capacity is based on Cole's ratio and is approximately 102.5 per cent. of cylinder requirements. The 2¼-inch tubes, of which there are 211, have a length of 18 feet 6 inches, a ratio length to diameter considered as most efficient. Another pioneer construction feature of the boiler is the use of a 28-inch barrel combustion chamber, the first of this type installed on C.P.R. engines. The mudring is of special interest, inasmuch as the cast steel ends are welded to wrought iron sides, the end portions of the steel sections being provided with drop corners to permit of through rivet-

ing for the corner fastenings of the inside fire-box sheets.

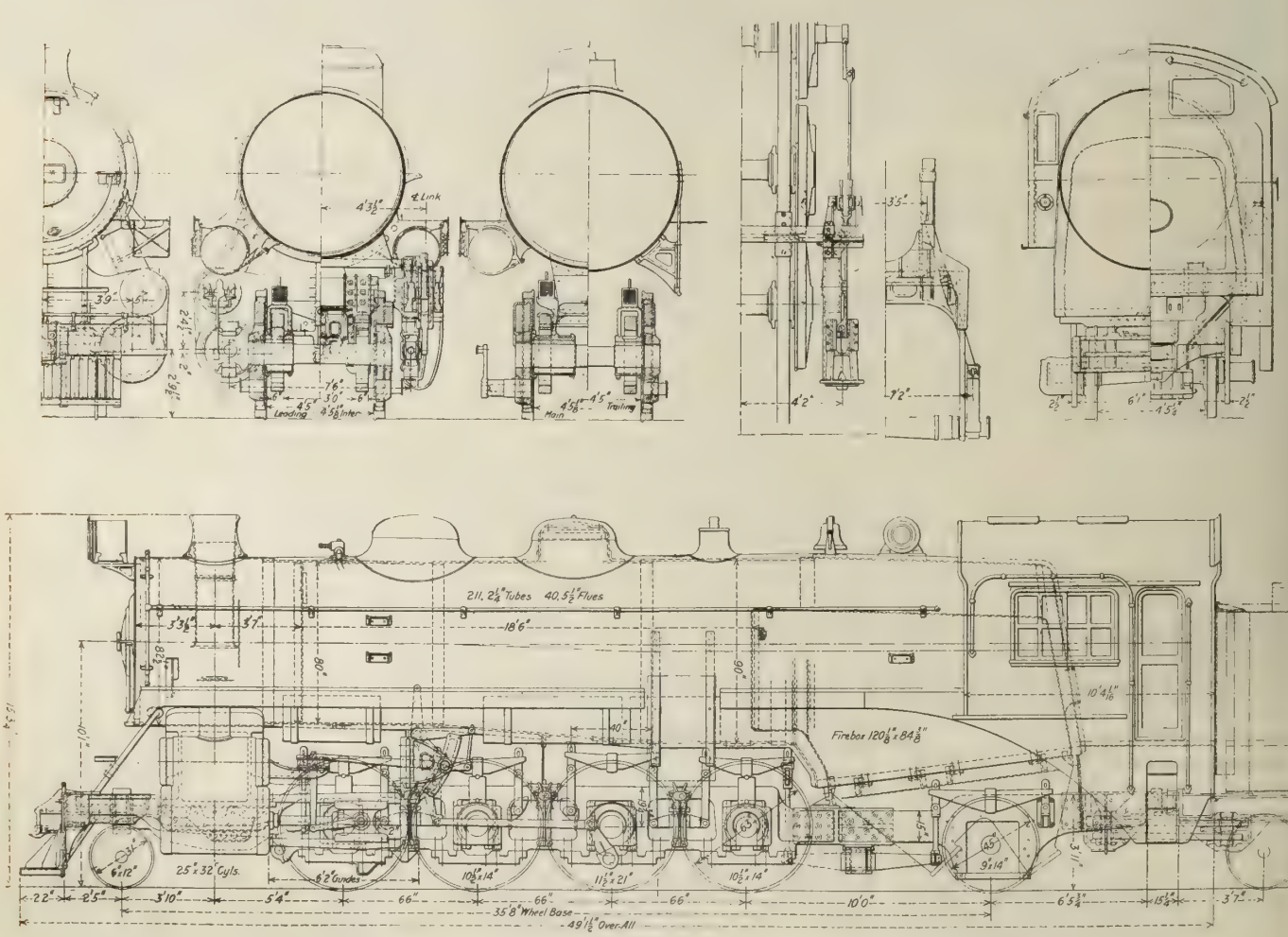
Main Frames

Experience has shown that no small amount of locomotive trouble has developed through frame breakage, and records indicate that the majority of such breakages take place immediately behind the cylinders. In an effort to eliminate, or at least minimize, this evident source of trouble, the designing engineers have provided adequate means to reduce the twisting strains apparently resulting from insufficient fastening at this point of the frame. The extension gives an additional depth of 15 inches directly back of the cylinders, and this portion of the main frame is firmly bolted to a corresponding lug on the back end of the cylinder casting, giving a total vertical bolting surface of 20½ inches.

The frames are of the single front rail type, with a uniform thickness of 6 inches, which is a little heavier than is usually found in general locomotive practice. Additional rigidity is further provided by a special wedge casting located beneath the saddle portion of the cylinder castings and between the main frame connections. The lugs of the castings are tapered, so that a firm wedge joint is secured by driving the lower casting into position and then bolting together with the vertical bolts to the saddle, and the side or horizontal bolts to the frame and cylinders. These alterations in design were deemed essential, in view of the fact that the engines will be used in sections of Canada where extremely low temperatures are frequent occurrence. The portion of the frame that carries the trailing truck is



BACK HEAD OF BOILER SHOWING CONVENIENCE OF ENGINE CONTROL — C. P. R. MIKADO LOCOMOTIVE.



Elevation and Cross Sections of Mikado 2-8-2 Locomotive and Arrangement of Ragonnet Reverse Gear

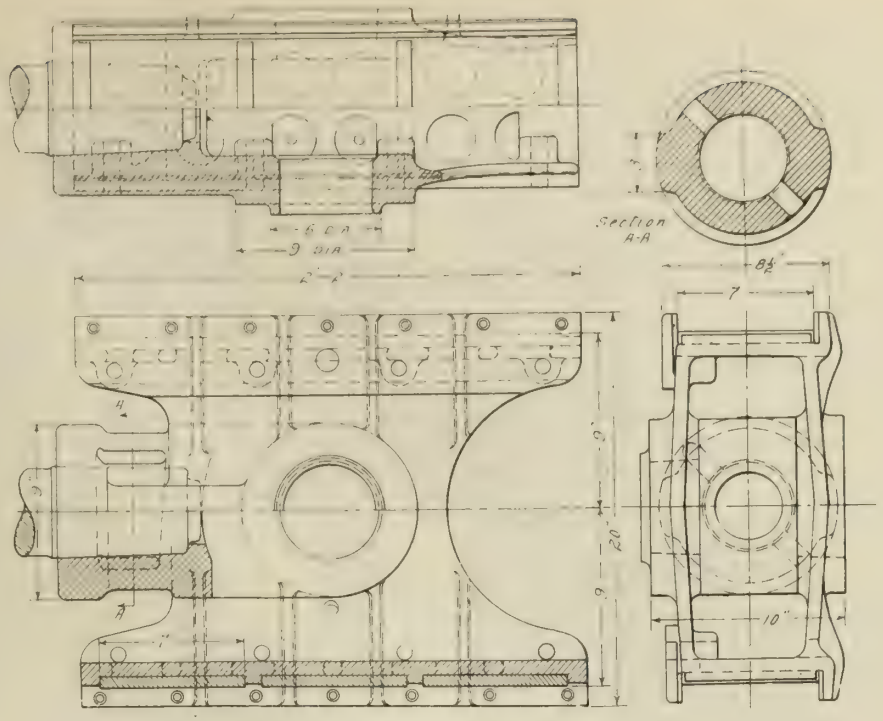
2½ inches thick, and joined to the main frame by a special offset connection.

Vaughan Trailing Truck

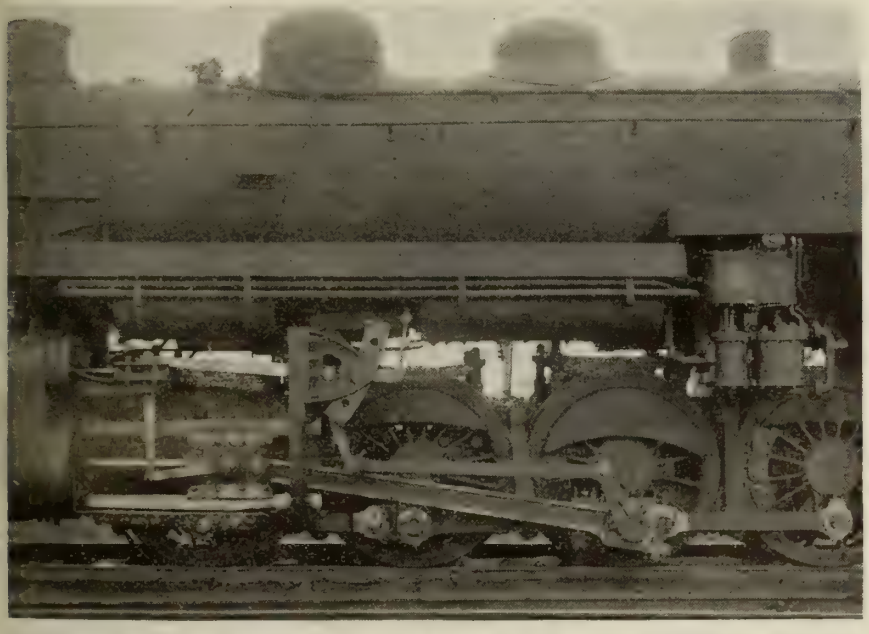
These Mikado locomotives are equipped with the Vaughan trailing truck, a type that has given entire satisfaction on C.P.R. engines for the 13 years they have been in continuous service. The frames for the trailing truck are located outside of the trailing wheels and are spaced 6 feet 3½ inches between centres. No radius bar is used with these trucks, the guiding motion being controlled from inclined vertical faces on the journal boxes, which bear on corresponding inclined faces on the pedestals attached to the extension frames.

Ash Pan Construction

One of the details of construction that has been given more than ordinary attention is the design of the ash pan. It is generally recognized by railroad engineers that the ultimate efficiency of an engine on the road is dependent, very largely, on this apparently minor portion of a locomotive makeup. This is particularly true in respect to those engines that may be called upon to operate in cold climates, under which conditions it is imperative to provide ample capacity and effective facilities for the discharge of the contents. The construction of the Vaughan truck, with its wide frame, allows of pan construction relatively free from flat horizontal surfaces, and with quick slopes at either side of the trailer axle for clearing purposes. In fabricating the pan the joints are made with sheet asbestos, and, wherever possible, the corner angles are placed on the exterior, so as to obtain an unobstructed surface on the inside. The safety factor has been intentionally incorporated in the construction of the pan, so that accidental dropping of hot ash or clinker is prevented by the automatic closing of the ash pan doors, the pivot supports of the doors being located back of the door centre of gravity, so that the doors are self-closing immediately the operating lever is removed.



DETAILS OF CROSSHEAD.



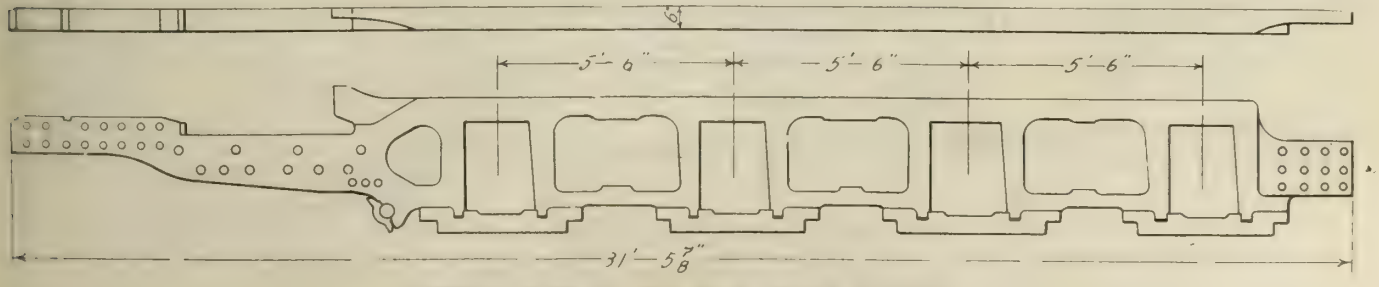
GENERAL VIEW OF THE ROD AND VALVE MOTION — MIKADO FREIGHT LOCOMOTIVE.

Moving Grates

In the past it has been found that the use of dead grates has given rise to much trouble in operation, so that this type of grate has been entirely replaced by the movable type, and the design finally adopted in these engines is of the butt finger type, 10 inches wide, and made in four sections. The centre carrier is of very light cast steel construction, and is reinforced along the lower or tension member by a structural tee iron. Every consideration has been given to design of side carriers to avoid excessive warping. These carriers are in two sections, which facilitate repairs to fire-box corners, as only one section of the grates need be removed.

Rods and Link Motion

The construction of the piston heads



GENERAL VIEW OF THE MAIN FRAME FORGING.

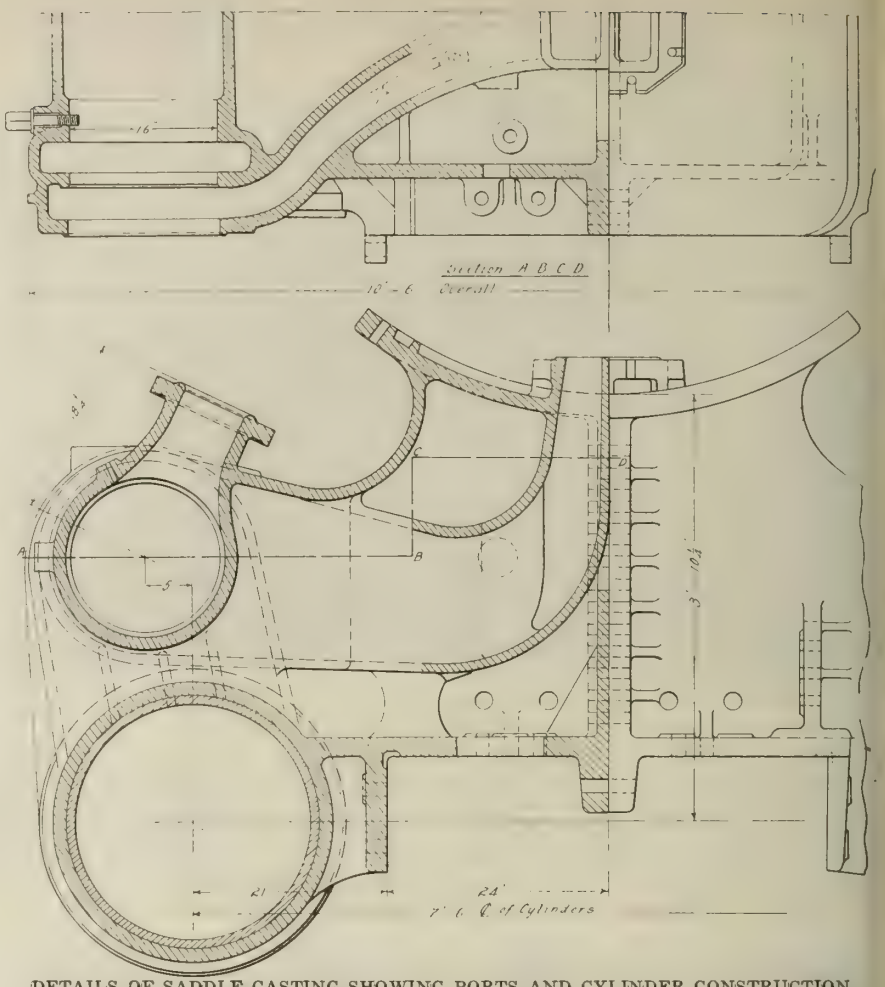
differs somewhat from previous practice, as exhaustive analysis, both mathematical and by actual tests, have been made at the Angus shops to determine the specific stresses to which piston heads are subjected. The result has been a great saving in weight, as the pistons in these engines are considerably lighter than those two inches smaller in diameter, which have, until now, been accepted as standard on other C.P.R. locomotives. The cast iron crosshead, which is made in one piece, is a modification of previous standard patterns. The design provides for six removable cast iron wearing pads—three top and bottom—each of which is 7 inches long by 6¾ inches wide. These sections are kept in position by side plates bolted to the crosshead body.

An interesting detail in connection with the valve operating link motion is the change effected in linking up with the crosshead. The union link is apparently fitted to the wrist pin, but actually works on a bearing formed by a step on the inside washer, which, in turn, fits on a tapered shoulder of the crosshead body. This has the advantage of relieving the wrist pin of any thrust from the valve mechanism through the union link.

By paying particular attention to every detail of reciprocating motion a remarkable saving has been effected in weight of moving parts. These are all made of carbon steel, but are only 96 lbs. heavier than on those used on lighter Mikado locomotives. The increase in weight of reciprocating parts is approximately 5.87 per cent., while the increased piston load is 31 per cent. —a creditable achievement.

Arrangement of Control

One of the problems of locomotive construction is the arrangement of the control and operating mechanism, 95 per cent. of which is located within easy reach of the engineer or fireman in the cab of the engine. Effort has been made to obtain the most convenient and efficient layout on the back head of the boiler, so that all valves, throttle lever, lubricators, air brake control equipment, etc., would be properly located and at the same time allow both the engineer and firemen to have an unobstructed view of the water glass and the steam gauge.



DETAILS OF SADDLE CASTING SHOWING PORTS AND CYLINDER CONSTRUCTION.

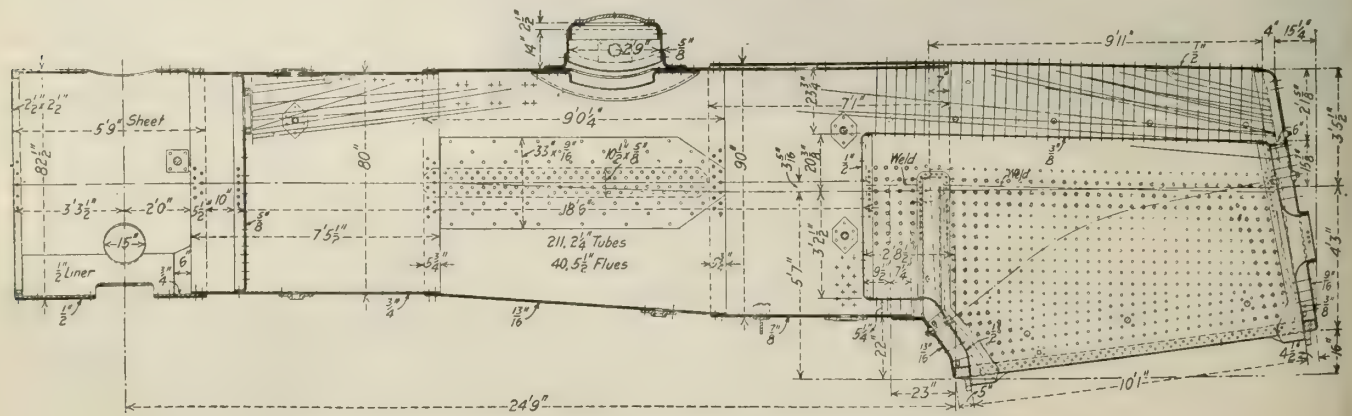
The vestibule cab is of the standard C.P.R. type, but owing to the width of fire-box it prevented the placing of the brakeman's seat in front of the fireman, as is generally the case. The cab is amply provided with wood-lined lockers for the crew's clothes, etc. Signal equipment is carried in a special wire rack located on the ceiling of the cab.

Standard C. P. R. Tender

The tender is of the water-bottom type. The tank, which has a water-carrying capacity of 8,000 Imperial gallons, is supported on a Commonwealth one-piece cast steel underframe. The coal space provides for a capacity of 12 tons, and the 45 degree slope of the back sheet insures a constant feed of coal to the front of the coal space, this feature dispensing with the use of a coal pusher. This is standard practice in C.P.R. tender construction. The swash plate bracing is arranged to minimize rivet strain.

Air Brake and Special Equipment

The air brake is the Westinghouse schedule "ET" with cross-compound



Extension Wagon Bottom Boiler for Canadian Pacific Mikado Type Locomotive

compressors. Ample cooling surface is provided in the air brake piping, 2-inch pipes being used between the compressor and the first reservoir. A parasite reservoir is also part of the air system, and the pressure is controlled by a Westinghouse parasite governor.

The locomotives have a total weight of 320,500 lbs., with 235,000 lbs. on the driving wheels, which gives a factor of adhesion of 4.18. The cylinders are 25 in. by 32 in.; driving wheels 63 inches in diameter, which, with a normal boiler pressure of 200 lbs. per sq. in., gives a maximum calculated tractive effort of 56,000 lbs.

The locomotives are hand-fired and have proved exceptionally good steamers, and quite live up to the expectations of economy in coal and water.

The Art of Properly Splicing Wire Rope

The art of properly splicing wire rope is something that is not understood by very many mechanics in spite of the fact that it should be one of the things about which they should know. The result is that in many cases a faulty splice is made, and an accident of some nature or other at a later date. We received a short time ago, from the Canada Wire and Iron Goods Co. of Hamilton, a very interesting catalogue on their line of wire rope and fittings, and in this book was a short article on the proper splicing of wire ropes, which is well worth reproducing.

Before going into the article proper, however, we might add that to any one interested in wire ropes, their uses and applications, a copy of this price list catalogue for 1919 is well worth a place on the desk.

The subjects of wire rope construction, materials used, the proper method of ordering and other valuable information are all given. Certain tables of useful information are also added at the back portion of this interesting book.

To get on to the subject of the splicing of wire rope, however. Following is the method in which they present this material.

Directions for Splicing Wire Rope

Wire rope is susceptible to the most perfect splice; a smoother and better splice can be put in a wire rope than in any other kind of rope, for the simple reason that it is made with a view to this purpose. It has just the desired number of strands, namely, six, and a hemp core, which provides a place for fastening the ends. It is a plain, simple process and but the work of an hour for any one to learn.

To Get the Length of the Rope to be Spliced Endless

In most cases the ropes can be applied endless, and in such cases the ropes can be forwarded spliced ready to go on. We can furnish ropes ready spliced by giving us the exact distance from centre to centre of shaft, and the exact diameters of the wheels on which the rope is to run. This measure can be got best by stretching a wire from shaft to shaft, marking the distance from centre to centre of shaft and carefully measuring the wire.

In cases where the endless rope cannot be put on, the rope has to be put around the sheaves, hove taut by pulley blocks, and the splice made on the spot. See Fig. 1 in diagram of splices.

The Necessary Tools

A hammer and sharp cold chisel for cutting of ends off strands; a steel point or marlin spike for opening strands; two slings of tarred rope with sticks (see Fig. 5) for untwisting rope; a pocket knife for cutting the hemp core; a wooden mallet and block.

First.—Put the rope around the sheaves, and heave it tight with block and fall (see Fig. 1). The blocks should be hitched far enough apart so as to give room between to make a 20-foot splice. A small clamp may be used to prevent the lashing from slipping on the rope where the blocks are hitched (see Fig. 1). Next, see that the ropes overlap about 20 feet; about ten feet each way from the centre, as shown by the arrow lines in Fig. 1. Next mark the centre on both ropes with a piece of chalk or by tying on a small string. Now proceed to put in the splice, with the blocks remaining taut when it is necessary, but the better way is to remove the blocks, throw off the rope from the sheaves, let it hang loose on the shafts, and then proceed with the splices on the ground or floor, or scaffold, as the case may be.

Second.—Unlay the strand of both ends of the rope for a distance of 15 feet each, or to the centre strand of both ends of the rope for a distance of 15 feet each, or to the centre mark. Next cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other (see Fig. 3).

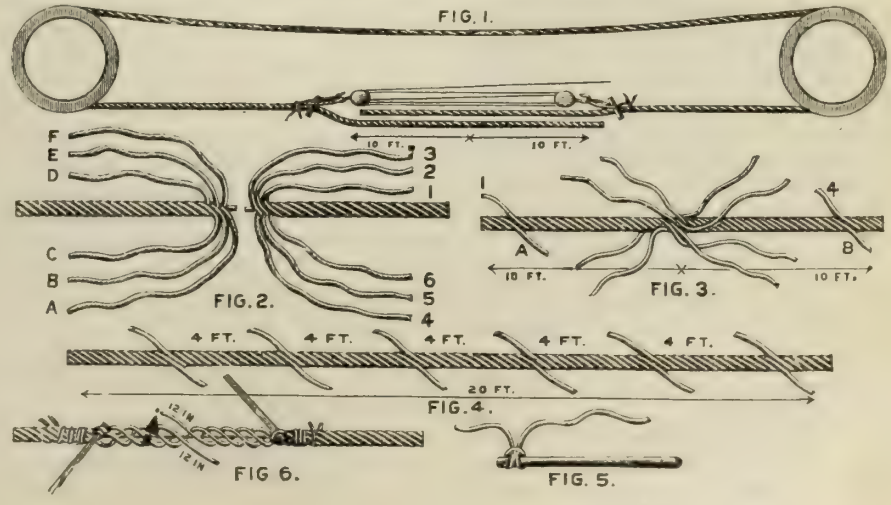
Third.—Unlay any strand A, and follow up with one strand of the other end, laying it tightly in open groove made by unwinding A; make twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but twenty-four inches of one are laid in Next, cut off A, leaving an end about twenty-four inches long.

Fourth.—Unlay strand 4 of the opposite end and follow with strand D, laying it in open groove as before, and treating this precisely as in the first case (see Fig. 2). Next, pursue the same course with B and 2, stopping six feet short of the first set. Next, with 5 and E, stopping as before, then with C and 3; and lastly with 6 and F. The strands are now all laid in with ends six feet apart, as shown in Fig. 4.

Fifth and Last.—The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps (see Fig. 5), and fasten them to the rope, as shown in Fig. 6; twist them in opposite directions, thus opening the lay of rope.

Next, with a knife cut out the hemp core for the necessary distance. Now straighten the ends and drive the marlinspike under the strands (see Fig. 6), and work end into the space previously occupied by the hemp core; then twist the clamps back, closing up the rope. The ends should be laid in, side by side—that is, they should not be crossed over each other. At the point where tuck is made, hammer with copper mallets to fix the strands firmly in place. Next, shift the clamps and repeat the operation at the other five places, and the splice is made.

A portable bath cabinet invented by a North Carolinian includes tub, tank for both hot and cold water, oil heater, medicine chest, towel rack, closet and extension seat.



Interesting Operations in Machining of Elbows

By F. SCRIBER

THE ELBOW, shown in position as held by the various fixtures used in connection with the machining of the finished surfaces, is first sand-blasted and all lumps are ground off, following which the flange is drilled. The large diameter is then turned, the hole is chamfered, the flange is faced on the side next to the turned diameter and as a sequence to this the flange is profile milled to the outline shown so it will conform to the outline of the part it is to be bolted against.

Three fixtures are used to handle this part efficiently and the first operation consists of drilling the six holes in a manner as provided for by the fixture illustrated in Fig. 1.

The interesting feature of this fixture arises from the fact that the base A is merely used as a block to support the elbow, it being of cast iron, finished top and bottom only, while the portion B is in reality a template made of cast iron with six guide bushings C for locating the drilled holes, which is done relative to the boss X by having two pins D straddle loosely any one of the six bosses. Apart from this the plate B is located from the large centre hole of the elbow by means of three pins E that are caused to expand by the screw F, with hand-knob G working on their bevelled ends, these pins being held in position by screws and springs H.

With the template in position on the work the same is slipped over two pins J in the base of the fixture, thereby tying the entire arrangement together for locating in the drilling machine, this operation being performed in the usual manner, care being taken when drilling hole K directly over the curve not to force the work into a tilted position on the fixture, this being easily accomplished by keeping the hand not in use operating levels on the left side of the template.

In turning this elbow Fig. 2 advantage is taken for locating purposes of the holes previously drilled, which locate each elbow centrally under the boring head of the machine and at the same time counteract any tendency to turn under the cut, pins A enter two holes and are used for this purpose. The base B of this fixture contains two slides C which are held in place by plates D. These slides are adjustable by means of screws E and they are used for clamping the work on the periphery in a manner obvious from the illustration, it being also apparent that this fixture is clamped to the table of the machine using tongues F for locating from the slots of the same.

The cutting operations at this time consist of turning the diameter X and facing the flange with box tools, facing the end and chamfering the beveled hole, all of which are performed on a horizontal boring mill by using standard types of tools.

A difficult operation to perform is that of profile milling the outer form around the bosses and periphery, but by setting the elbow up as arranged for in the fixture, Fig. 3, this is well taken care of, and after describing the manner of holding, the operation of profile milling will be described, at which time reference will also be made to the cutter, Fig. 4.

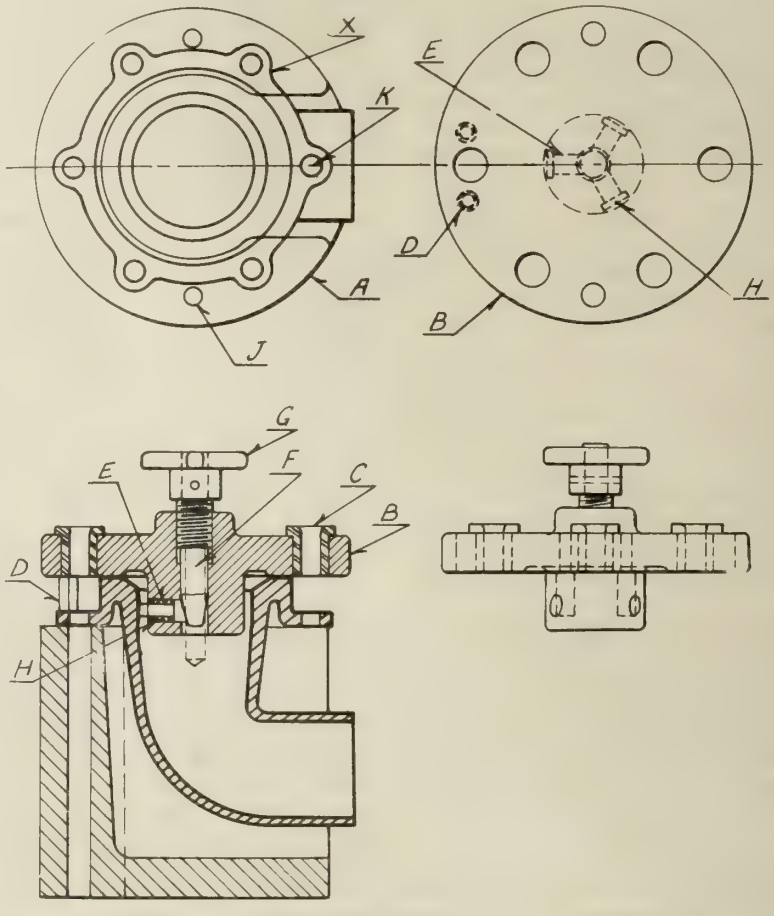


FIG. 1. ILLUSTRATING THE DRILLING FIXTURE.

Referring to Fig. 3, with plate A entirely removed from the fixture, the elbow is placed over the curved post B, and it is allowed to rest on the three spring pins C which have the end turned down at Z to enter three holes in the work, thus locating the same radially upon the base D. Next the formed plate A is slipped over the curved post B, a key E being used to locate the same with reference to the post. The three bolts F are now put in place through the plate and work at the three holes not used to go over the spring pins, thus securely holding the formed plate to the work. We next clamp the formed plate on the curved post by tightening screw G against collar H. Spring-pins C, which heretofore were loose, are now locked by screws J, thus the whole arrangement balances well, one unit against another, making a very substantial holding fixture. The pin K keeps the curved post in an upright position while the base of the fixture is clamped to the table of the machine in the usual manner.

This operation is somewhat different than the usual run of profile milling inasmuch as but one spindle of the machine is used without the customary guide pin, the cutter shank being so made as to guide on the formed plate of the fixture.

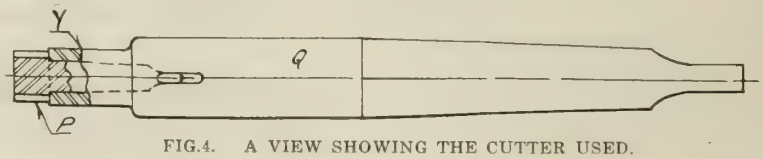


FIG.4. A VIEW SHOWING THE CUTTER USED.

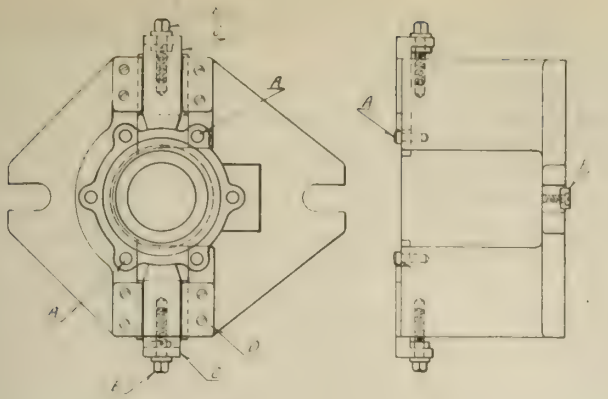


FIG. 2. DETAILS OF TURNING FIXTURE.

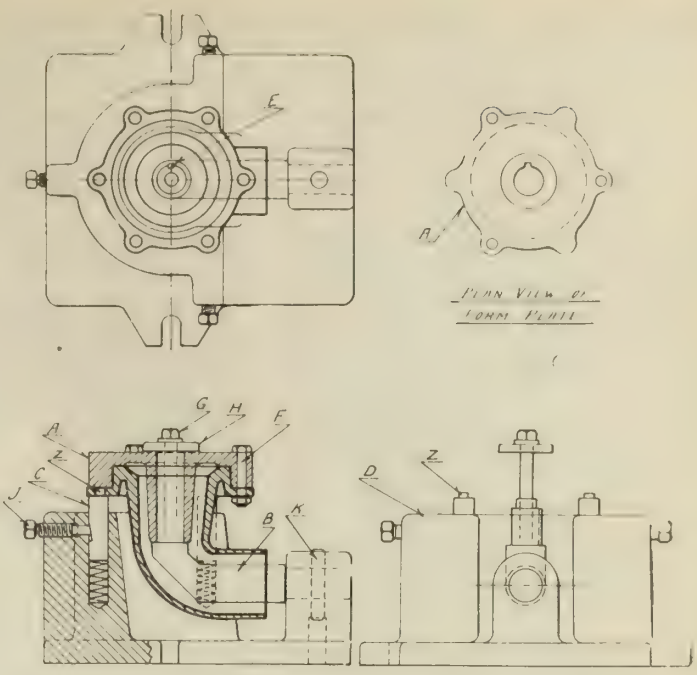


FIG. 3. DETAILS OF PROFILE MILLING FIXTURE.

Referring to Fig. 4, the cutter proper P is of the type which is sharpened by grinding on the face of the teeth; this is tongued into the shank Q. The portion of the shank Y is held in contact with the formed plate while the cutter is revolving and milling the outline of the work, the desired contact with the formed plate being maintained at all times by the operator feeding the two handles of machine simultaneously, causing the table to travel in a transverse and longitudinal direction just sufficient to provite a good cutting action.

This entire tooling arrangement is one in which variety and novel construction are combined in set-ups on standard machines to produce a high-class interchangeable product in a very proficient manner, leaving very little to chance.

PROTECTING THE LATHE CENTRE

By Harrison Jenkins

No doubt readers in general will agree with the writer when he mentions that in operating a lathe it is an annoying thing to find that as you are placing the work in the chuck, your arm or elbow comes in contact with the sharp point of the tailstock centre.

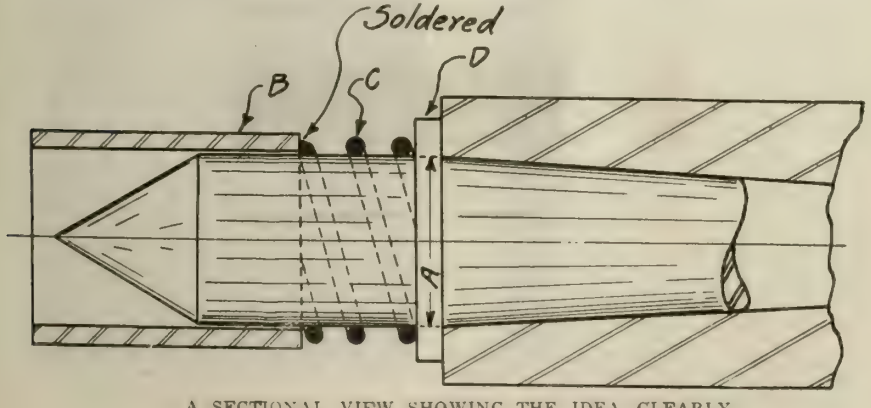
Lathe operators in particular no doubt have experienced like trouble, yet any danger (for such it is) can be easily avoided and overcome if one takes the time to discover some little idea to eliminate the bugbear, and the following idea, though very simple, certainly overcame the trouble already discussed.

The writer merely made a centre with a straight portion, A, on which he slipped a piece of pipe, B. He then soldered a small spring, C, to one end of this pipe as shown. The washer, D, was merely placed in its position, so that the wear would come on the washer and not on the tailstock sleeve.

The idea itself is, of course, obvious, for when not in use the pipe protects the sharp point of the centre, yet when required for use, the tube easily slips back on the pressure of the work being applied.

DRILLS AND STRAIGHT HIGH-SPEED TOOLS

High-speed tools, such as drills and other straight tools, should be welded by the electric butt process and in no other way. Before welding, the two ends to be joined should be planed off instead of being ground. When ground, the ends have a tendency not to join properly and the result is that an oxide forms in the weld, which invariably results in breakage when the weld is made. When welded the tool should be placed in an annealing pot filled with hot sand. When the pot is full it should be placed in an oven and brought to a temperature of 1,500 deg. Fahr. and allowed to remain in the oven at this temperature for three hours, after which the heat should be turned off and the pot allowed to remain in the oven until the tools are absolutely cold. The tools are then ready to have the burr, caused by the compression in the butt welding machine, ground off or turned off. Under no circumstances should this burr be removed prior to the heat treating process. A Western tool manufacturer, who has turned out in 1919 more than a million dollars' worth of these tools, follows this process, and the failures of his tools are so rare and infrequent as to be almost negligible. In this same plant, 700 very heavy tools were recently welded by the electric butt process and, instead of turning up the end to be united, they were ground. In the inspection room these tools were subjected to a drop test. The inspector drops the tool from the height of his waist line on to two blocks placed on the floor in such a manner that the respective ends of the tool are caught, thereby subjecting the welded portion of the tool to a sudden shock. In the case of these 700 tools, every one of them broke in the weld. This may seem like a very simple point, but it is one which the welder should not disregard.—"Welding Engineer."



A SECTIONAL VIEW SHOWING THE IDEA CLEARLY.

A British metallurgist believes he has re-discovered the secret of the ancient Spanish armorers in producing a tarnish proof steel that even resists acids.

Do You Believe in Keeping Tab on Your Products

If You Feel Your Production Costs Excessive, Read This Article. It Illustrates Clearly How One Particular Firm Stopped Their Production Leaks, in a Definite and Simple Manner

By J. H. MOORE, Associate Editor Canadian Machinery

PERHAPS readers will have heard the story of the Irishman living in New York, who sent passage money to a fellow-countryman to come over and see the sights in the great and wonderful American city. The story has it that in due course of time the new son of Old Erin arrived at Gotham, and stepped off the gangway, where he was greeted by his old-time friend.

After the usual comments had been passed the newcomer remarked, "Say, Pat, there's one thing I clean forgot to ask you about. Is there such a thing as a system of Government practised here?"

"Sure," said Pat.

"Well, then," said the visitor, "I'll tell you right off the reel, I'm agin it—no system for me, at all, at all."

It may be a large-sized jump from such a story to the machine tool industry, but just as this Irishman had no use for system in the Government of a country, there are men in the machine tool game to-day who have no use for system of any kind in the shop or office.

Luckily, this breed is dying out, so we can safely assume that the majority of readers of CANADIAN MACHINERY are in favor of any rational system being adopted in a plant that will tend toward lower costs and greater production.

Any system to be a success must be based on a common sense fact, so if we are chasing the bugbear high cost, we must first find out the cause for the bugbear making his appearance. When we speak of leaks in a shop, we do not necessarily infer that some of the water pipes are burst, but that through some fault in the management, a little efficiency drops out here and there, which takes away from the production, and increases the cost of the product. Stop these drops completely and you have perfect management, but as such a condition is impossible, the next best thing to do is stop as many of the leaks as possible.

A plumber, before fixing any leaks, would first find out where the leaks are. He might adopt the policy of starting at the flooded portion, and try to trace from the various streams leading to the large flood the location of the different leaks. This policy is also adaptable in the machine business, but must be tackled in a rather different manner. You might look on the flooded portion, namely, the unsatisfactory result, showing the high cost of the product, and attempt to trace back to the various sources of trouble, but unlike the plumber's case (where water leaves its mark), inefficiency does not always leave so plain a trail.

One cannot gaze at a firm which has just failed, or landed into a quagmire of inefficiency, and tell in a short time all the reasons for the sorry state of affairs. The plumber can trace his leaks quickly, but, in many cases, it re-

F-S Mc Co., Ltd

MACHINE _____ DATE [redacted] DEPT [redacted]

SHEET NO. _____ SHEETS COMPLETE

PART _____ ORDER [redacted] NO OF MACHINES [redacted]

ORDER NO	PATT OR FORG NO	DRAWING NO	NAME OF PIECE	MATERIAL	DIAM.	LENGTH	NO OF PIECES REQUIRED	NO OF PIECES IN STORE RGH	NO OF PIECES IN STORE FIN	WEIGHT IN ROUGH OF ONE	PLANING	LATHE	SLOTTING	MILLING	GEAR CUTTING	DRILLING	GRINDING	ASSEMBLING	MEMO

THIS ILLUSTRATES THE TYPE OF RECORD SHEET USED — NOTE THE VARIOUS COLUMNS AND THEIR USES.

quires considerable ingenuity to follow out the whys and wherefores of plant leaks.

An Example

Take for example a case the writer has in mind:

A certain firm were turning out varied lines of machine tools, and while making a reasonable profit, they felt they were not getting the money out of the concern that they should, so decided to investigate the trouble.

Operation by operation, they went through their production system, and apart from a very few changes, found that not only was their product being produced economically, but that the maximum point of production had been reached.

In spite of these points brought to light, the opinion still existed that somewhere there was a decided leak. Someone suggested that they watch the weight of their castings closely. This idea was poo-poohed as too trivial, but the originator of the suggestion stuck to his guns and pointed out that the very fact that all castings were made outside, offered a splendid opportunity for a leak in costs.

The records were looked up, and traced in each case back to the point where the various patterns had first been made. Imagine the surprise of those concerned to find out that in some cases over 185 pounds additional weight had been added to some castings. The average-sized piece on the various machines showed around 15 to 20 pounds difference. In the year's output this made an imposing figure, being away up in the thousands. Readers might be inclined to say, Why didn't they watch this item closer? But the pitfall was a mighty easy one to fall into.

Here, in brief, was the system first adopted: When a new pattern was made for any machine, the fact was duly noted on a card with the proper date, price of pattern, what used for, and so on. As a last item on the card, the weight of the first casting produced from the pattern was also recorded.

From these various figures the net weight of the complete machine was figured.

Take for example the case of a milling machine. A machine of such nature has a certain number of grey iron castings, steel castings, brass castings, etc., etc. From each pattern card the weight of the piece was noted, marked on a totalling list and added together.

All steel parts, cold rolled, machine steel, and so on, were kept track of on other cards, and the weight marked on the cards. These in turn were totalled. In this way the office could tell how much grey iron, brass, steel, etc., etc., was in a milling machine of a certain type. When we say they could tell the weights, we speak from a theoretical standpoint. Perhaps it would be best to say, "they thought they could tell."

No allowance was made for variation, and, strange to say, the profits were figured on a basis as follows: We supply so much material at so much a pound, which means so much cost. Our labor cost is a certain amount, therefore adding the cost of material to the labor cost, plus overhead expense, makes a certain total.

We receive for our machine so much, and taking away the total previously figured, leaves us with a total of so much. So stated before, they were making a profit even in spite of the leak, but the difference discovered in the weights added a considerable amount to their turnover.

What was the matter with the first system? Personally, we believe it was not based on practical grounds, but altogether on theoretical ideas. No allowance was made for the fact that a pattern, when new, makes a cleaner casting, each wall being of the thickness that the designer intended, or, at least, somewhere near it. As time goes on the pattern gets rapped around, and the core box, as usual, receives anything but kind treatment.

It would seem that coremakers in general have but one ambition in life, viz., to file, file, file, at a core, until it is much smaller than intended. Of course, the pattern has been well rapped, with the result that the casting produced, carries walls, perhaps ¼ in. thicker all around than intended, and up goes the weight. To those readers who may imagine these statements as exaggerated, we would suggest they get in touch with some designer of machinery and ask his opinion. Ten chances to one, he will answer in this way: "Well—I'll leave the answer to your own judgment, but when I want a wall ⅞ in. thick I usually state ¾ in., or even ⅝ in. on my patternmaker's drawings." This answer will, no doubt, convince, and you will leave him with a peculiar look in your eye.

To conclude this article, which is not intended as a guide to leaks, or how to find them, but merely a means of quoting the one case described, let us see how this firm kept track of their product after the alarming discovery.

Naturally, they were not going to be caught again in the same trap. The first step was a trip to the foundry, where a battle royal was enacted. Threats of the withdrawal of their work, with counter threats of "We should worry" took place, before common sense prompted serious consideration to the problem.

After Old Man Common Sense got a strangle hold on the proceedings, things went much better.

Where the foundry was at fault, they admitted their guilt, while no better results could be turned out with certain existing patterns, these were either fixed up or scrapped, and if scrapped, replaced by new ones. Each pattern got a thorough inspection, which gave the new-system-to-be a fair start.

Specification sheets similar to the illustration shown were printed on thin, but tought) paper. These sheets were, of course, transparent and somewhat after the style of tracing linen. The original sheets never left the drawing office, being filed as if they were actual working drawings. Each type of machine had a set of sheets, each set subdivided into the different materials used.

The first item to be marked on the sheet was the type of machine, also the particular parts to which the sheet referred.

Then came the number of the sheet, and the number of sheets complete to the set. The other items illustrated at the top portion of the sheet were added later, as we will explain.

Now came the task of filling out the lower spaces. The order number, pattern, price, or forging number; name of piece, material, diameter and length, (if the piece was not a casting), and the number required. Last came the weight of one piece in the rough.

A blueprint was now made of the sheets, and the proper order number, number of machines going through on the order, the date, and the proper department, were all marked at the top portion. Readers can readily understand that all black parts shown on the illustration came out white on the blueprint.

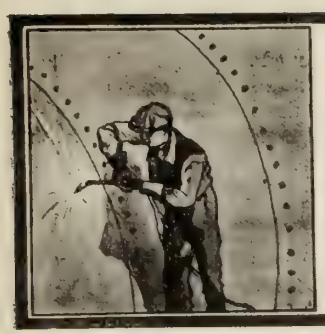
In the lower portion of sheet, the progress of each piece was carefully watched. First, the quantity in the storeroom was noted, both rough and finished material. Next, the various operations were ticked off in the order through which the pieces passed. The last space marked memo, was for any special note of interest that the clerk wished to make.

While the explaining of this system may sound intricate, it is the very reverse, and mighty easy to keep up-to-date, once it is started. As every order number is completed, a new set of blueprints are used, and the old ones either filed for future reference, or thrown away, as desired.

The progress of the work can be told at a glance. It can be immediately noticed what particular operation is holding up the work, and this condition remedied. While we have used the sheet as an example for keeping tab on a milling machine's progress, it is equally adaptable to other classes of work, and can be safely recommended to those not already familiar with its use.

Chicago inventors have patented an L-shaped private garage to hold two automobiles, either of which can use a single door that extends across the angle.

For removing water from submerged ships a motor driven pump has been invented that can be operated at depths beyond the capacity of steam pumps.



WELDING AND CUTTING



NEW HAZARDS IN ELECTRIC-ARC WELDING*

By ALFRED W. JANSEN

THE adoption of electric-arc welding in the shipbuilding industry as a substitute for riveting has presented new dangers to workmen, which, under some conditions, are unusually hazardous. Care has been taken for the eye, for in recent years the dangers from this intense light have been studied by specialists and adequate protection has been given. But the harmful effects of these light rays upon the tissues of the human body has had little attention. How to protect the workman from this hazard is more easily solved when the cause of the intensity of the light ray is known under all conditions.

The complete spectrum usually presented in the process of electric-arc welding is composed of the visible, the ultra-violet, and the infra-red rays. The ultra-violet and the infra-red, the invisible rays, are those harmful to the exposed tissues of the body. The intensity of the invisible rays is determined by the temperature of the arc and by the surroundings, which may either reflect or absorb the light. While it has been known that painful body-burns have followed exposure to these extreme light rays, it has not been determined whether they are caused by the ultra-violet or the rays in that point of the spectrum where the X-ray is found. The infra-red rays are not the cause, for while they have an irritating effect and are rather uncomfortable and fatiguing, they are not especially dangerous.

There are no great hazards in arc welding done in the open, in shops, or in places where special screens may be erected to protect the welder and those near by. They have not been serious in confined places such as boilers, where the surroundings have absorbed some of the intensity of the light and not reflected it. But on board ship, in compartments where the working space is hardly large enough for two men to be employed at the same time, and where the entire surroundings have been covered with red lead, the dangers of the light rays seem to be greatly increased.

Not long ago, electric-arc welding was used aboard a large steel ship under construction, in a compartment as described above. The welder had worked with the same apparatus for some time under ordinary conditions and had not experienced any burns on the exposed parts of his body. Within a few hours the man complained of burns on his neck and chest. A close examination of the skin showed it to be dried up and cracked, like an old piece of china, on which the glazing has become crazed. Added to this the skin was slightly inflamed and was deeper in color on the right side of the neck. Here there was a spot about the size of an egg which seemed to have been subjected to more exposure than other parts of the body. There was a little tinge of blue on the inflamed spot which looked like a burn caused by the X-ray. It was decided that this was due to the improper adjustment of the face-mask, which caused constant exposure to the direct rays. The burns on the back of the neck were apparently caused by the intensified rays reflected from the red lead.

After four days the burned condition healed sufficiently to permit further experiments to determine the cause of this unusual condition. The welder was supplied with a linen bandage lined with lead foil, which he wore as a collar to protect the entire neck. As ultra-violet rays will not pass through lead, and as no further burns appeared, it was decided that the ultra-violet rays were the cause of the trouble. As the welder had worked with the same apparatus under other surroundings, it was concluded that the reflected rays from the surfaces painted with red lead were increasing the power of the harmful rays to such a degree as to cause painful burns. Such severe burns might even lead to cancer.

The next experiment was made by welding in a compartment that had not been red-leaded, and where the surfaces were of the natural metal color. The hazard in this case was very much reduced. As no special apparatus was available for measuring the intensity of the rays in the red-leaded compartment, it is not known whether the ultra-violet rays had reached that point in the spectrum scale where the X-ray is found. It seems, however, that the red lead had either the effect of absorbing the infra-red rays, and thereby intensifying the ultra-violet, or the red lead converted the infra-red to ultra-violet rays.

As in shipbuilding these working conditions in a compartment are common, and the burns are so intense, a necessary precaution is to have all of the welding done before the surrounding surfaces are red-leaded. This is the surest way of giving the workman maximum protection.

* From Metal Trades.

PRESSURE OF ACETYLENE IN WELDING INSTALLATIONS

The question of increasing the pressure of the acetylene gas oxy-acetylene installations has formed the subject of long discussions in the German technical papers during the war. It is a question that was given considerable attention by the Union de la Soudure Autogene some months before the outbreak of war.

Acetylene installations have been proposed and even constructed—in Germany especially—in which the acetylene gas, after leaving the purifier, has been compressed by means of a small automatic compressor into the service piping at a pressure of 3 to 4 pounds per square inch. A storage tank serves as a reservoir and regulator.

On the other hand acetylene generators have been developed in the United States which generate and supply the gas up to a pressure of one atmosphere. A French company have for a long period constructed generators producing gas of a pressure of about 2½ pounds per square inhc.

It is natural to ask, in view of the tendencies to use increased pressures, at what pressures the acetylene should reach the blowpipe. A little reflection and a few experiments lead to a very clear solution of this problem.

The blowpipes which utilize dissolved acetylene, amongst the earliest to be used, always give excellent results. Very rarely is there a return of flame or detonations, whilst the consumption practically agrees with what is considered the ideal, namely equal volumes of oxygen and acetylene. Further, the two gases enter the blowpipe at almost the same pressure, which, in comparison to other blowpipes, is high for the acetylene and low for the oxygen.

Blowpipes utilizing acetylene produced direct from generators were designed after those for use with dissolved acetylene. The oxygen being used to obtain the necessary velocity, of flow, the construction was much more difficult, and for many years this type of blowpipe gave results distinctly inferior to those obtained with dissolved acetylene. To the success of dissolved acetylene may be traced the idea of utilizing the acetylene at a pressure much higher than that given by the ordinary type of generator. It was considered that this was the most important factor for the good working of blowpipes.

But the construction of low pressure

blowpipes has made great progress during the past ten or twelve years. Blowpipes have been placed on the market which aspirate the acetylene with much lower pressures of oxygen and at the same time obtain a more perfect mixing of the two gases. The return of the flame has almost been overcome, whilst the proportion of oxygen to acetylene consumed in the blowpipe has been reduced from 1-5 or 1-6 to 1-3 or 1-2, and even lower. In a way one can say that with a well designed low-pressure blowpipe the results obtained are practically equivalent to the dissolved acetylene blowpipe.

The question of the pressure of acetylene is always cropping up, but less than in previous times. In many cases it is only necessary to very slightly increase the pressure by simply loading the gas holder for example, for obtaining more satisfactory results with a particular make of blowpipe. The French Association have shown that a pressure of 8 to 10 inches of water is practically sufficient with good blowpipes using pure acetylene.

The use of dissolved acetylene has advantages of simplicity and convenience which are incontestable, but it is useless to attempt to follow its path with generator practice which give entirely different and sometimes dangerous conditions.

It is preferable, where increased pressure is required, to use, say a medium pressure generator on the lines of the French Company in which the pressure does not exceed four pounds per square inch.

To repeat, it is possible to obtain just as good results with good modern low-pressure blowpipes supplied from a well-designed low-pressure generator with acetylene at a pressure of 8 to 10 inches of water. The service piping being designed so that at a maximum consumption the loss of pressure does not exceed ⅛ inch, and where the hydraulic back pressure does not absorb more than 2 inches of pressure.

It is necessary to note that these remarks refer to the present, but it is clear that blowpipes have not reached their ultimate perfection. One can forecast, however, from the above remarks, that, on the grounds of efficiency and economy the replacement of low pressure generators by installations working at a high pressure, the day is far distant.—"Acetylene & Welding Journal."

INDUSTRIAL SAFETY CODES AND THE AMERICAN ENGINEERING STANDARDS COMMITTEE

The Bureau of Standards in Washington held a notable conference on industrial safety codes, at which there were representatives of practically all organizations of a national scope interested in any of these wide phases of industrial safety.

There was a thorough discussion of the whole situation, the consensus of opinion being that there should be a large number of industrial safety codes —perhaps 50 or even 100—developed during the next few years.

The subject is a very far-reaching one. Not only are vast financial and industrial interests involved, but it is said that the welfare of more than six million workers is directly involved in the work of a single organization, the National Safety Council.

The conference unanimously voted that the preparation of all such safety codes should be under the auspices and rules of procedure of the American Engineering Standards Committee. In accordance with the recommendation of the conference, the American Engineering Standards Committee requested the International Association of Industrial Accidents Board and Commissions, the Bureau of Standards, and the National Safety Council to organize a joint committee on safety codes, this committee to include representatives of these bodies, and such others as they may consider advisable, with the understanding:

(a) That this joint committee shall report upon safety codes required, priority of consideration of the codes, and sponsor bodies for their preparation.

(b) That the joint committee be requested to make a progress report by February 1, 1920.

In compliance with this request of the Standards Committee, the three bodies have organized certain committees to carry on the work. These included some of the best known business and safety men in the country.

It is planned to add two more members to the committee, one each from the Ohio and the California commissions.

The committee held its first meeting in Washington on January 9, at which time tentative recommendations were formulated for some thirty safety codes. This committee, which represents in its own personnel a large range of interests, is actively at work. It is consulting a large number of other interests involved. Rapid progress is being made, and it is expected that the committee will be able to render an important preliminary report in the near future.

A new French material for waterproofing leather, cloth, paper, and other materials, is described in a recent issue of the "Chemical Trades Journal." It consists of a mixture of eight parts of amyl acetate and four of castor oil, with one part of sulphur chloride stirred into it. Though this forms a jelly, giving off hydrochloric acid, it liquefies after being kept tightly covered a few days, and, the acid being then neutralized with barium carbonate, gives a colorless solution on filtering. To make a varnish, nitrocellulose is dissolved in the liquid after the addition of alcohol or benzine.

In the Paris observatory clocks are kept 90 feet under ground, where the temperature has varied less than one degree in several years.

WHAT MAKES GOOD INSPECTION*

By Lew R. Palmer

Quite properly tact has been given first place in consideration of the subject of Good Inspection. An inspector may have education, practical experience and ability, but unless he has tact he lacks the main essential of a good inspector.

Those of us who have done pioneer safety work learned at the outset that promoting safety was largely a matter of salesmanship, and a good salesman cannot be successful unless he is tactful. Safety must be sold from the top to the bottom—to the management and to the workmen.

I recall a discussion between a Pennsylvania factory inspector and a steel mill safety inspector, where the factory inspector could not understand how a certain division of a large steel plant had made such improvement in safeguarding and in accident prevention. According to the State inspector, he had never ordered a single safeguard installed but that, the man in charge of the division claimed, it would "surely shut down the mill if installed." The plant safety inspector on the other hand said it was very simple to secure the installation of guards.

The plant inspector knew his man. He knew that he was an enthusiastic baseball fan, and in most cases the interview started with a discussion of the latest achievements of the local prospective pennant winner. Eventually, some of the accidents occurring in other departments would be discussed. The good records that had been made through team work in some rival mill or department would be commented upon, and the sporting blood of the superintendent in question would soon begin to circulate. Before the safety inspector had left the mill one or more of the safeguards he had gone down to the mill to have installed had been recommended by the superintendent himself. In most instances it is far easier to get people to do things because they want to than because they have to. In the case of the plant inspector the safeguard was installed in a remarkably short time, and woe be unto the foreman or workman responsible should the guard not be maintained in place.

It can be truthfully said of Faith, Hope and Tact, the greatest of these is Tact.

The welder should learn to weld quickly, using the largest tip consistent with the job. It is much the same as using a hammer. If a machinist has small work to do he chooses a light hammer for any hammering required, but if the job is heavy, and he knows his business, he will use a heavy hammer. Less distortion will be produced in welding with as large a tip as the job will stand than would result if a small tip were employed. Less gas and less time also will be required, and the job will be sounder throughout.

*From an address before the Fourth Industrial Safety Congress of New York State.



WHAT OUR READERS THINK AND DO



THIS MAN BELIEVES THAT STRATEGY IS NOT CONFINED TO WAR ALONE

Editor, CANADIAN MACHINERY: The topic recently opened for discussion relating to the opportunities for the ambitious worker, is one which I suppose has given every live mechanic something to reflect upon. To me it seems as though most of the shops are full of "Industrial Jeremiahs" sitting as it were under their respective juniper trees and bewailing their fate with respect to their calling in the field of industry.

Assuming that we are to deal with the situation as we find it in Canada, let me proceed to give my views of the Canadian executive in general. The field is crowded with ambitious men, more so to-day than ever before. There is a continual striving for position as leaders of men in religion, politics, both municipal and general, and even in the smallest machine shop. Our friend H. H. J. in his recent article appears to be looking at the question simply from the standpoint of mechanical proficiency. If Mr. H. H. J. imagines for one brief moment that, by being the best mechanic he is qualified for the biggest position, some day he will wake up with a bunch of new ideas in his head. Usually the best worker is found "working." On the other hand, to state things plainly, so to speak, the boss's job is a good deal a matter of politics. Besides his worries in connection with his everyday duties he has constantly before him the spectre coming up from beneath of the individual who can fill his position better than himself, and above him the haunting supervision of superiors who have mentally resolved that so far up the ladder he shall go and no farther. In other words it is up to himself to hold himself up and also keep climbing. If, as the old adage has it, "there are tricks in every trade," then the business of being a boss is a whole bag of tricks, and no two of them alike. In fact the business is an art and the main art is to conceal art. Probably a little anecdote will throw some light on the subject and help our friend to see things from a standpoint other than mechanical efficiency. Seeing that the incident I am about to relate happened so long ago, and the gentleman in question always has such a multitude of schemes on hand, he will naturally be too engrossed to recognize this narrative even should he happen to read it, so here it is: "A man there was who climbed to the eminence of tool-room foreman through the power of his tongue. Albeit, somehow or other he got into such a state of affairs that his job looked to be worth about two cents judging the time he would last, considering his rate of pay. However, this one was a wise bird, and, on being called into the office one morning to receive a reprimand he resorted to the following trick, thereby showing great presence of mind. Seeing no other way out of his awkward position he very realistically broke down and wept like a child, and proceeded to inform the management that it was nervous exhaustion caused by too much application to business and he would be forced to take a rest and see a physician. Of course his doctor naturally sympathized with him and ordered up his much-desired 'rest cure,' and all our friend had to do was to go back and collect sympathy from the management. Being a married man he thought the most effective way was to bring his little daughter down to the works daily for a few minutes, and he himself tried to look anxious by wearing a very sad expression. Needless to say the management fell for this stuff fine. However, it is only a matter of time until his schemes get stale and he will be tumbled." This of course may be rather an extreme case of diplomacy, but it certainly is scheming that puts a great many executives into positions. Probably our friend, by using the foregoing hints in conjunction with his mechanical ability, will begin to climb, and if he does I would very like to hear his revised views in the columns of CANADIAN MACHINERY at some future date.

WILLIAM ERNEST.

HERE'S THE CASE AS IT APPEARS FROM THE ANGLE OF THE FOREMAN

I REMEMBER reading a statement in CANADIAN MACHINERY some time ago, of a certain foreman or superintendent, who had worked very hard during the war, on being asked what he intended to do after the war he answered that he would take a job as an ordinary machinist and work with the boys to recuperate. This is the failing of a good many foremen, as they get all the kicks and few of the halfpence. They have to take responsibility of the work turned out by every man.

Many a time the workman is confronted with a problem which taxes or perhaps overtaxes his mechanical ability, and he goes to the foreman for instruction. The foreman is expected to hand out a snap decision which is perfectly sound in every respect. If it develops later that Bill or Tom has been able to improve on the foreman's original suggestion, it does not by any means follow that Bill or Tom ought to have the foreman's position.

The ideal foreman ought to be the best mechanic in the shop and know how to handle men and boys. That means being a good character reader; also he should be a good business man. It must be borne in mind that the foreman is not running an educational institution but a business concern, of which he must make a commercial success, and his success is measured in dollars and cents profit to the firm. If his department was running at a loss he would soon be called upon to give the reason why. Knowing this to be the case, can a foreman be blamed for not moving an expert lathe hand to the bench at which, as yet, he has had no experience, and put a green hand on the lathe just for the pleasure of instructing them both? The occasions when foremen deliberately keep a good man back for fear he should prove more capable than himself are very rare. If the man has got the initiative no foreman on earth can prevent him from rising in his profession. When I take a mental review of all the foremen I know, I can count more than 95 per cent. that have risen from the ranks, and in many cases were assisted and recommended by the foremen they worked under.

Most working men consider things from a purely selfish viewpoint and do not consider the problems of the foreman at all. He is the legitimate goat for all the troubles that occur. He has to face the music in the office, and gets it in the back from the men. He gets it both coming and going. If the men can put one over on the foreman they think they have done something to boast of. (I have no doubt many foremen could write some good stories on putting one over on the boss.)

Now what is the remedy for this state of affairs? It seems to me that we

should try to see things from the other man's viewpoint, that the firm should appoint a mechanical instructor, and the apprentice should be looked upon as a liability or a responsibility and not as an asset to be handed over to the foreman to make a profit on. On the other hand the apprentice should stay with the firm long enough to reimburse them for the expense he has put them to.

Most firms are willing to consider the suggestions of their employees and pay them for any idea they adopt, but usually the payment does not begin to represent the money saved to the firm because the firm certainly won't adopt the suggestion unless it is a money saver.

I guess this letter is long enough so I will conclude by suggesting that we all learn that immortal poem of Bobby Burns, "Wad some power the giftie gie us to see oorsel's as ithers see us. It wad frae mony a blunder free us, and foolish notion."

A. FOREMAN.

GRAPHIC DIVISION, A TIME SAVING DEVICE

JOHN S. WATTS

The method used to divide a line into a given number of equal parts, by graphic arithmetic, is undoubtedly well known to draftsmen, but the knowledge of it is not applied as much as it might be to save time in laying out work on the board.

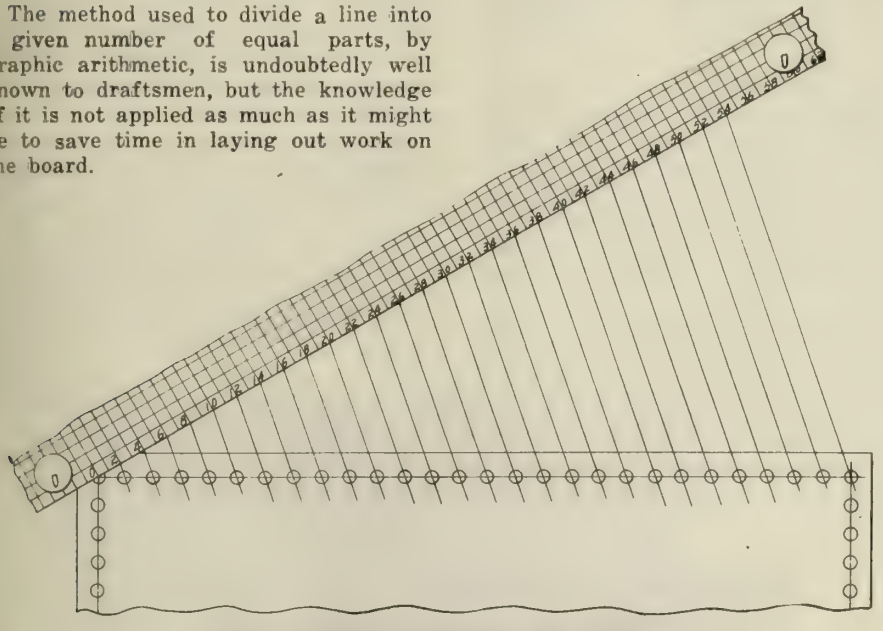


CHART SHOWING THE IDEA DESCRIBED

In the numerous cases in drafting room work, where it is necessary to divide a line into a comparatively large number of parts, such as in showing the rivets in a boiler plate, or in structural work, etc., the wrinkle shown in the sketch accompanying this article is a great time saver, and is conducive to more accurate and neater work than the time-honored way of stepping off with dividers.

The idea is simply to have a narrow strip of squared paper of sufficient length always at hand. Its usefulness is greatly enhanced by numbering the spaces, somewhat on the lines of the one shown in the sketch.

We will suppose that the plate shown is to be divided into 27 spaces, and as 27 spaces of the squared strip is rather too much smaller than the line to be divided, we will, for convenience, take 54 spaces on the strip and use only every second division.

The procedure, now, is to pin the strip on the board, as shown, i.e., with the edge of the strip (at the division line marked "o") exactly intersecting the end of the line to be divided. The other end of the strip can be pinned down on the board at any convenient place.

Now join point 54 (because we want 27 spaces, but are taking 2 spaces on the strip, and $27 \times 2 = 54$), to the outer end of the line to be divided, and with parallel ruler, or two triangles, draw lines parallel to the first line, and the 27 spaces will be accurately and quicky found.

In actual work the lines would not be drawn, only marks need be made on the line to be divided. And where the line was not too long, a sheet of squared tracing paper could be used, and the points pricked through directly onto the line without having to use triangles.

REMOVABLE DEFLECTOR BLADES FOR B.&S. GAS HEATER

By F. Horner



The Brown & Sharpe gas heater, with steel blades to deflect the flame into a flat shape suitable for heating pieces quickly for tempering, is often inconvenient for other purposes, such as local heating with the point of the flame, and some kinds of blowpipe soldering operations. The sketch offers a suggestion for modifying the construction so as to leave the burner available as an ordinary one for such functions. Un-rivet the blades from the burner tube itself, and re-rivet them onto a short piece of tubing sufficiently large to slide down over the burner tube. The short piece may be split through, as shown, to afford a spring clamp, so that the fitting will not slip round.

"WHAT SHALL I MAKE?

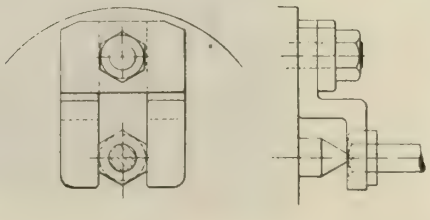
By Donald A. Hampson

A good many mechanics, fired with a desire to go into business on a small basis, have asked themselves that question. One answer may be found in the crying need of the automobile repair business. "An expansion reamer in sizes from ⅝ inch up." There is not a garage in the land that wouldn't buy from one to a dozen of these tools that are more useful to them than a lathe or a press, yet dealers cannot supply them, and catalogues do not show any except in sizes much too large for automobile work.

An elephant without tusks seems almost impossible, yet in Ceylon the male elephants have no tusks at all; they have miserable little grubbers projecting two or three inches from the upper jaw and inclining downwards.

ADJUSTABLE BOLT DOG

By F. Horner.



In place of the ordinary solid bolt dog, the sketch offers an alternative in the way of a divided construction, the halves being set and clamped to suit the size of bolt head to be driven. A stout clamping-plate is laid over the tail ends of the halves, and pulled down on them; serrations may be cut on the meeting surfaces to assist in preventing skidding.



DEVELOPMENTS IN SHOP EQUIPMENT

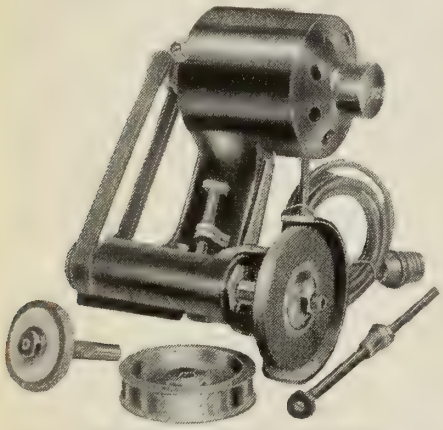


COMBINATION GRINDER

The National Machine Tool Co., Racine, Wis., have placed on the market what is known as their combination tool, cutter and gauge grinding machine.

This machine has been designed for any kind of grinding performed in the tool room or machine shop. It has a motor placed over the spindle, which makes it possible to grind cutters, arbors, reamers, mandrils, etc., between centres, on either a large or small lathe.

When using the grinder on lathe, planer, shaper, or milling machine, the motor is always out of the way, allowing the grinding wheel to be used right down to the limit.



GENERAL VIEW OF GRINDER

The grinding arbor has a hollow spindle like a lathe or screw machine, with a collet to hold 5-16 bar for internal grinder. This feature makes the internal grinder adjustable, and can be let out to suit the nature of your work.

This style machine can also be used for lapping small dies, bushings, and any kind of work usually performed in a lapping machine. It can be used in the shaper for many purposes, including the making of snap gauges, while by placing on a large wheel you can accomplish surface grinding.

As the name implies this machine is a combination grinder, and has been designed with the object of relieving the tying up of other machines. By its use, work which formerly was accomplished on lathes and other machines can be readily done on this grinder.

The main bearings operate on balls, and the wheel moves over the work, instead of moving the work over the base of the machine. The complete weight is only 50 lbs., which makes it easily portable.

LAFAYETTE GRINDER

The Lafayette Tool & Equipment Co., 21 S. 12th St., Philadelphia, Pa., has recently placed on the market a universal grinder for precision tool-room work. This machine is illustrated in Fig. 1 and Fig. 2. While one of its most obvious applications is on a tool-room lathe for both internal and external thread gauge grinding, this machine is also intended as a grinding machine when used on the bench, and as a grinding attachment to be applied to lathes, milling machines, shapers, planers, etc., to handle a variety of work. The grinding wheel spindle bearing housing has a longitudinal movement in a saddle, which in turn has a vertical movement on the column. A swivel is provided with a protractor of a large radius for inclining the grinding wheel spindle, when thread grinding, to suit the helix angle. Micrometer dials are provided for both longitudinal and vertical adjustments, making it very convenient to obtain accurate settings whenever required for precision work.

Realizing the importance of service rendered by the spindle construction in any precision grinder running at 25,000 revolutions per minute, which is required to produce work that is accurate to within 0.0001 inch, the manufacturers have developed a style of spindle which they claim to be entirely free from vibration, even under the most severe working conditions, and one which will produce an unusually smooth finish. The spindle is made of a special analysis steel, hardened and ground, and the bearings are of Non-Gran bronze, lubricated from a reservoir of oil, and protected against oil leakage, dirt and grit by felt washers. The bearings are tapered and readily adjustable for wear. The driving shaft is independent of the grinding wheel spindle, preventing transmission of pull from the driving belt and allowing the wheel perfect freedom of operation. Adjustment is provided for belt tension, and the grinding wheel has downward action, so there is no danger to the eyes of the operator. A General Electric universal motor is furnished, which can operate from any 110-volt circuit, whether direct or alternating current.

Means are provided for trueing the grinding wheel that make this machine very suitable for thread gauge grinding, as well as for general purposes. The wheel trueing device is designed to accommodate three diamonds, and graduations at the base of the trueing device permit of setting it at any angle. Adjustable stops, as well as means for locking, are provided, and the trueing device bracket is adjustable vertically in reference to the column to secure proper alignment. It will be noted that, when thread grinding, the wheel is trued in the horizontal plane of the centre line of the work and lathe spindle. It

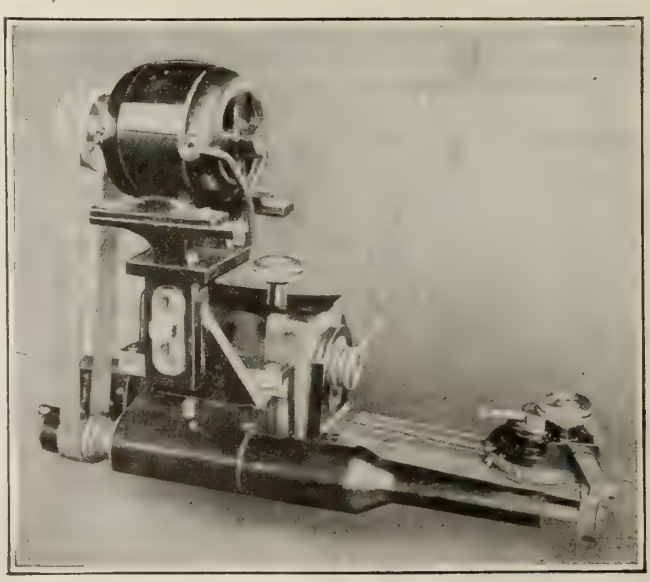


FIG. 1. LAFAYETTE UNIVERSAL GRINDER EQUIPPED FOR HANDLING INTERNAL WORK.

sometimes happens, particularly when grinding internal threads, that there is no room for the trueing attachment when actually grinding. An adjustable stop is furnished which enables the trueing device bracket to be rapidly attached to the column at the proper height. The bracket is quickly clamped to the column by a stud with an interrupted thread.

For grinding deep holes and long internal threads, the manufacturers have developed an extension spindle and an extension spindle bearing housing. The application of these features to the Lafayette universal grinder is illustrated in Fig. 1. Non-Gran bronze bearings are also used in the extension spindle bearing housing. When used together with a surface plate, this machine is very suitable for surface grinding. Fig. 2 shows the adaptation of the Lafayette universal grinder to the grinding of circular forming tools. With the use of other simple adapters, securing the work to the rack, this machine can be used for a variety of bench grinding. With the use of an extra rack holding device, it is not necessary to remove the work in order to true the wheel, and the diamonds are always in the correct position for trueing.

In addition to the specific uses referred to in the foregoing, this machine, when applied to a lathe, may be used for cylindrical, taper and internal grinding. Used with the relieving attachment on the lathe, taps, cutters, etc., are relieved by grinding after hardening. This grinder may be used for grinding cutters in position on the milling machine, and when clamped to the overarm of the milling machine, it may be used for surface grinding, or clamped vertically to the overarm bracket of the milling machine; it may be used for finishing dies of various kinds. The use of pencil grinding wheels is recommended for the grinding of dies. This machine may also be attached to shapers and planers, for surface grinding and a variety of other purposes. It will be readily seen that the machine is quite universal in character, and that its many applications make it possible to adapt it to a great many uses, either in tool-room or special work or in precision manufacturing processes.

KREMER CUMMINS BELT SHIFTER

A mechanical belt shifter for machine cone pulleys, extremely simple in design and efficient in operation, is being placed on the market by the Kremer Cummins Machine Co., 1833-1835 E. 55th St., Cleveland, Ohio.

It consists chiefly of a steel channel, having teeth machined along one edge, forming a rack. This rack is supported and held stationary by two drop forge pieces, one attached to each end of the channel, as the means of connection to the hanging bracket which forms part of its support.

No part of the shifter is applied directly to the machine too or countershaft. The upper belt-shifting carriage is mounted on the channel and operated by means of a sprocket or gear in mesh with the teeth of the rack. This carriage will move in either direction as desired by means of the operating handle provided for the purpose. A suitable loop surrounds the belt and slides on two rods extremely from one side of the carriage. This provides a positive means of shifting the upper portion of the belt. A step is provided on the channel by bending out any desired tooth of the rack. This prevents the belt from being thrown entirely off the cone pulley, should the shifting carriage be moved farther than the necessary amount. A length of pipe extending downward from the upper shifting carriage carries at its extreme end the lower shifting loop and operating handle. This part is placed close to the machine pulley and provides a suitable means for shifting the lower portion of the belt.

When the machine tool is equipped with safety guards, the handle of the last mentioned part may be made long enough to extend through a slot or opening made in the guard. This arrangement provides absolute protection to the operator.

In operating this device, the operator first shifts the belt to the next smallest step of the machine cone pulley by means of the operating handles. The two operating handles always assume the same position with each step of the machine cone pulley.

This belt shifter is inexpensive, easily installed, and gives a very practical method of changing the speeds of cone-driven machine tools.

Asbestos paper that has been used for protecting preheated castings and welded parts is a most excellent pack for annealing steel dies. It crumbles readily and forms a superior fireproof heat insulator, which cleans off easily and which may be used indefinitely.

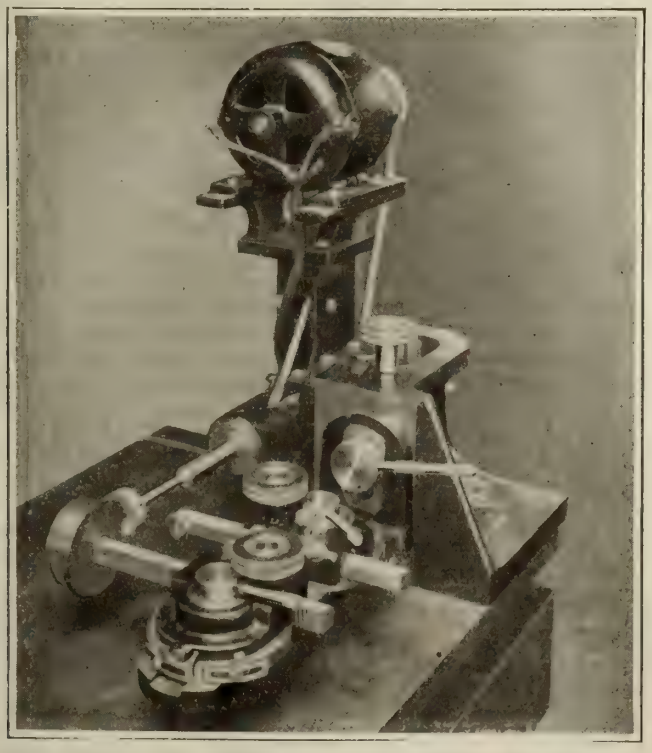
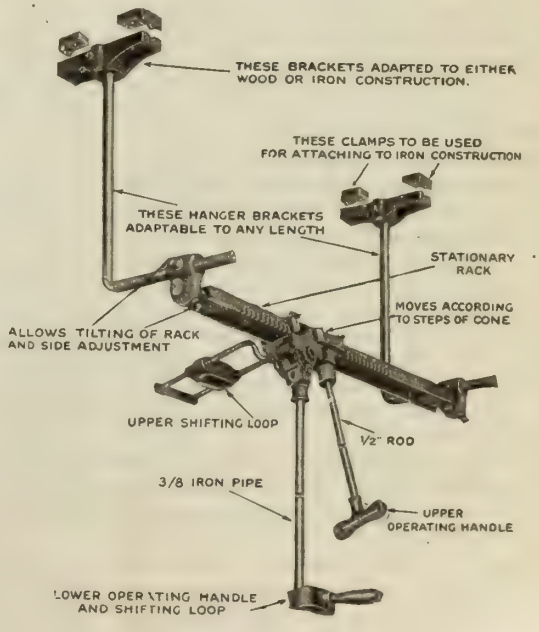


FIG. 2. LAFAYETTE UNIVERSAL GRINDER IN USE GRINDING A CIRCULAR FORMED TOOL.



KREMER CUMMINS BELT SHIFTER

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Well—It All Depends

IT all depends on who does the thing or who says the thing.

Some weeks ago an item appeared that Hon. Ernest Drury, Premier of Ontario, had gone to a doctor and been vaccinated.

Well, what of it? Had it happened three months ago we would have heard nothing about it. Chances are that Mr. Drury would not have been vaccinated at all. If smallpox had come into his corner of Simcoe, he would have simply steered the old grey mare into Barrie or some other place decorated with some doctors, got his little scratch and departed. Would it get on the front page of the papers? Not much. No editor would have given a line to announce such an event.

But now that Mr. Drury has come into prominence, the thing changes. Folks who argue that vaccination is right, proper and good, stow that bit away and spring it as a real argument to bolster up their case.

Mr. Drury being vaccinated and Premier Drury being vaccinated are two largely separated occurrences.

Again. An ordinary individual comes along and tells us that we are spending too much money; that we have ceased to know what thrift means. He gets a scant hearing, and the chances are that just to show how wrong and warped his views are we blow in a few extra dollars that day.

But Lloyd George makes a statement on the need of national thrift. He points out where our present policy of spend much and save nothing is going to lead us to a stone wall.

Well, what happens? Folks take a strangle hold on the neck of their money bags. They begin to look each foolish thing in the eye, and grow enough courage to say "Scat!"

But it all depends on who says things or does things. Very often their size and importance depends entirely on the size and importance of the men tied up to them.

A Boat With a History

THE Powhattan, the big American transport that was towed into Halifax a few days ago after being tossed around off the coast for almost a fortnight, has had a rather interesting history.

She was formerly the Hamburg-American liner Hamburg, and prior to that the private yacht of one William Hohenzollern, the former German Emperor.

It was on the Powhattan that former Emperor William visited England in 1906. At this time he was reputed to have paid the Hamburg-American line $4,256 a day for the use of the liner, which was then known as the Hamburg.

Later the vessel was used to carry Theodore Roosevelt and his party to Europe in March, 1909, when he made his trip to Africa hunting big game. In 1914 the liner was chartered by the American Red Cross to take doctors and nurses to the European war zone, and made a number of trips in this capacity, under the Red Cross.

When the United States entered the war in 1917 the Red Cross was renamed Powhattan and placed in the transport service. The vessel carried thousands of soldiers to Europe and return without incident, beginning her last trip on September 23, 1919.

The U. S. Steel Corporation

PEOPLE are talking and thinking in terms of millions now. It was not many years ago that a millionaire was photographed and bowed to. Folks wondered how he took that much money away from the rest of the people.

In Canada we speak glibly of the millions we have raised in our war loans. We are thinking in sums away beyond and over our heads.

The United States Steel Corporation announces an increase in wages on February 1—rather a decent thing to do just after breaking the strike directed against it. Well this increase will amount to $24,000,000 a year, a sum equal to a five per cent. levy on the entire common stock.

Chances are that holders of common stock will not be called upon to put up this levy. The over-anxious public, now willing to pay premium and super-premium prices for steel, will see that that extra $24,000,000 is provided.

Now to get back to the question of millions again—this new increase makes the annual pay roll of the U.S. Steel Corporation more than $475,000,000 per year.

For an organization that has been assassinated and dissolved and dispersed and broken up several times each way by the Sherman anti-combiners, said Steel Corporation seems to be in fairly good health yet.

The ladies of Wiseville had met to discuss a way of meeting the H. C. L. Substitutes and the intricacies of the magic art of food preparation were thrashed out. One woman told of a dish she had prepared, which she declared her husband had eaten and pronounced good, which he would not have eaten had he known that its principal ingredient was something he had always refused.

One of the ladies drew a fine point as to deception.

"Well," said the other, "I suppose you hold that a man never deceives his wife."

"Oh, no, indeed!" she said. "I shouldn't go so far as that. How would it be possible for the average man to get a wife if he didn't deceive her?"

That was bad enough, but another of the ladies felt encouraged to say that she had met that day a young woman who had been employed by her. During the talk with her which she had, she noticed that the girl's face did not shine with the usual happy expression. She inquired: "Is your husband kind to you?"

"Oh, yes, he is; he is very kind. He is more like a friend than a husband."

Metric System is Now Under Hot Discussion

THESE are troublesome times in the United States, that is as far as the system of measurements are concerned. As readers perhaps already know, there is an organization known as the "World Trade Club," which has burst forth into song in favor of the metric system. This organization has flooded the country with letters and dope of all description in an attempt to prove the metric system as the one and only system, but so far its efforts have been nil, and has awakened responsible manufacturers in general to the danger of a compulsory metric system being adopted.

Following is the report of the committee on trade and commerce of Pittsburgh, Pa. This matter was addressed to the board of directors no later than January 23, 1920:

"Your committee on trade and commerce has given careful attention to the question of the adoption of the metric system of weights and measures as suggested in the report of your committee on suggestions and recommendations, which was referred to this committee for consideration.

"At the present time there is being conducted by an organization styling itself the 'World Trade Club,' with headquarters in San Francisco, an active campaign favoring immediate legislation to make compulsory the exclusive use of the metric system, and thousands of letters have been pouring into Washington from all parts of the country, with the result that a bill has been prepared for presentation to Congress. It is not at all clear who and what the World Trade Club may be, or from what source its evidently abundant finances are procured. It is certain, however, that the country is being flooded with a mass of literature quoting innumerable authorities on the subject. In a casual glance through one of the pamphlets we find the statement: that

> 'In the British Isles, however, currency not being decimal but divided into guineas, pounds, crowns, half-crowns, florins, half florins, shillings, half shillings, pence and farthings, etc."

"In this statement the effort to create sentiment against the sub-divisions has led to inaccuracy, inasmuch as the guinea has long been obsolete, and the half florin and half shilling never existed. It is possible that on examination, more inaccuracies would be found in the great mass of literature so lavishly distributed.

The metric system was legalized in 1866 by virtue of an Act of Congress. Thus, for over fifty years it has stood on a legal parity with the English system, and fully available to all who wished to use it. It is not therefore fair to say that if it cannot win on its own merits by voluntary adoption under the protection of this law it is not entitled to win under a law of force. The present attempt is to prohibit the use of the existing system and make the metric standard the one exclusive official system.

"At this time, when, as a result of the world war, production and commerce are in a chaotic condition, and when the whole world is hungry for the products of the two greatest nations whose commerce would bear the whole burden of this inopportune tampering with the fundamentals, it would be folly to make 'confusion worse confounded' by attempting any such radical change.

"It is and always has been the practice of Pittsburgh manufacturers to quote upon inquiries as well as to execute orders based on the metric system. This is readily done by converting into our own equivalents.

"Three-fourths of the world's manufactured goods, and more than a large majority of the machine tools used in Latin America are produced on the system of measurements which we use today.

"As soon as it became known that the Chamber was to consider this subject your committee began to receive in rapid succession communications from prominent manufacturers and representative organizations, all but two of which vigorously condemned the effort to further disrupt our industrial and commercial conditions by inopportune tampering with such a vital basis of production. Among these correspondents might be mentioned The American Hardware Manufacturers' Association, The American Institute of Weights and Measures, "The Iron Age," the American Flexible Bolt Company, The American Spiral Spring & Manufacturing Company, Fawcus Machine Company, Harris Dump & Supply Company, Homestead Valve Manufacturing Company, Keystone Driller Company, Lockhart Iron & Steel Company, Locomotive Stoker Company, J. & J. B. Milholland Company, The McConway & Torley Company, Penn Bridge Company, Pittsburgh Machine Tool Company, Pittsburgh Piping & Equipment Company, H. K. Porter Company, The Simonds Manufacturing Company, Standard Underground Cable Company, James B. Sipe & Company, Union Switch & Signal Company, United Engineering & Foundry Company, Westinghouse Electric & Manufacturing Company, Westinghouse Air Brake Company, The Wilson Snyder Manufacturing Company, The Carnegie Steel Company, and the Rosedale Foundry & Machine Co.

"Only two firms appeared to favor the meter-liter-gram system, and one of these qualifies its opinion by stating: 'Unless the changing over would have an effect that we do not know of.' That effect, as indicated above, would be to practically eliminate from the world's markets the products of the two great commercial nations affected by increasing inefficiency and decreasing production through the changing of standards, gauges, dies, tools, drawings, specifications, patterns, machinery, etc., and the enormous expense incident thereto, at a time when costs are higher, production lower, and demand greater than ever before.

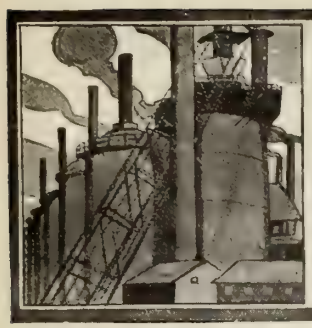
"BE IT THEREFORE RESOLVED, That the Chamber of Commerce of Pittsburgh unqualifiedly condemns all efforts to effect any change in the existing system of weights and measures as impractical and inimical to the trade and general commercial interests of our country, and

"BE IT FURTHER RESOLVED, That copies of this resolution be sent to the Chamber of Commerce of the United States, to our Representatives and Senators in Congress and to the chairman and members of the Committee on Coinage, Weights and Measures, to the American Chamber of Commerce in London, and to the Hon. David Lloyd George. Also to the Chamber of Commerce in San Francisco."

HARD OR SOFT TIRES

There is a good deal of doubt amongst road transport engineers, whether the solid rubber tires used on the majority of commercial vehicles should be hard or soft. Some engineers advocate hard tires—the harder the better—and others are in favor of soft tires; and there are still others who hold that the choice depends upon the condition of the roads and the design of the vehicle, especially in relation to its springs. It may seem curious that this point has not already been cleared up, but the reason is simply that with the usual mechanical drive from a petrol or steam engine there is no means of determining the exact amount of energy supplied to the wheel. Until this is known, the relative efficiencies of different hardnesses of tire cannot be more than guessed at. With electric vehicles the case is different, as the amount of current used can be measured to the minutest fraction and the efficiency of the motors and other parts of the equipment is fixed. Therefore the Electric Vehicle Committee of Great Britain recently decided to organize a series of thorough tests to bring the matter to a conclusive issue. These tests will be of great value to the motor industry in all parts of the world.

The interior of some passenger cars on the Egyptian state railways is cooled by tanks of ice, from which the air is circulated by electric fans.



MARKET DEVELOPMENTS



A Feeling of Uncertainty Pervades the Market

The Advisability of Further Advance in Prices Causes Discussion in Producing Ranks—Exchange Situation Very Unsatisfactory—Supplies Due for an Increase—Machine Tool Activity Largely Through Automotive Industry—Scrap Metal Market Uncertain

NO person would care to predict the market situation of to-morrow. The producing ranks in the iron and steel market have practically started a contest. These forces are about equally divided, one side desiring a further advance in prices, while the other side are attempting to curb this runaway tendency, claiming that in the long run it would be to the pecuniary advantage of all producers if prices are not advanced at the present time.

One concern adheres to its principle that steel prices should not be advanced above the March 21 price, while another concern claims that prices should be $7 a ton higher than those in effect a few months ago.

Machine tool enquiries are still improving. During the past week the placing of orders has kept up at a good rate. Much of this business, however, can be ascribed to the scramble of prospective buyers to take advantage of a few days' grace accorded them by certain machine tool manufacturers who have advanced prices. Since the first of the year practically every line of machine tools has gone up. On some lines two advances have taken place within the past 30 to 60 days. Much of the present activity in machine tool circles is due to the incessant demands of the automotive industries. Various concerns engaged in this line are at present in the market for equipment.

There is some talk that taps, carbon drills, cutters, and other supplies are about due for an increase. While this is not official, it comes from very reliable sources, so that it would not be surprising to see this occur in the near future.

The scrap situation could be summed up in one word: "Peculiar." No one seems to want to state exactly what is going to happen. The exchange rate has the market on red and yellows all tied up. Large shipments of copper are going from England to the States to take advantage of the exchange situation. No. 1 machinery scrap is quoted at $25, but it is well known that the metal would bring more than that. The feeling existing is: "Bring us the material and we will pay the price for it. There is practically none coming in—and those having it are holding for about $40 per ton F.O.B. consumers' mill at Ontario points.

LACK OF RAW MATERIALS THREATENS PLANTS WITH TEMPORARY SHUT-DOWNS

Special to CANADIAN MACHINERY.

MONTREAL, Que., February 11.—Despite the belief that the question of exchange has had the effect of reducing the purchase of materials coming in from the States, the business in general continues to be almost normal. There is, possibly, a decline in the less essential imports, but trading with American houses continues on a comparative heavy scale. Canadian manufacturers report that demands on their lines have shown an increase of late, and this is probably due to the prevailing rate of exchange. Nervousness has been shown in some quarters over the change that has come about in the sharp falling off of British and European trade. The action of the British Government in curtailing imports of many luxuries has reacted on Canadian firms, and this situation will likely continue as long as the financial difficulties are the controlling factor.

Coupled with the depressing nature of the exchange is the evident underproduction of many commodities caused by the disturbed conditions in many industrial circles. Reports from the States indicate that through a lack of sufficient raw materials, due to inadequate car supply, many mills and manufacturing plants are threatened with curtailment or temporary shutdowns. Further than this, shippers may be confronted with a new schedule of higher freight rates as railways everywhere intimate that increases are inevitable. When steel commodities are required to be brought in from the States, coal dealers are confining their purchases to material sufficient to cover immediate needs only. This practice will be followed as long as they are compelled to pay the exorbitant premium of current exchange. Dealers here report a very strong market but refrain from quoting a fixed price on any commodity unless it be for a direct sale. The trend, however, is upward.

Metals Stronger

There continues to be a good demand for all classes of ingot metals and finished sheets, but considerable difficulty is still experienced in obtaining materials, especially in galvanized products. Imports from the States are affected owing to the high exchange rate, and deliveries are very uncertain. Tin has advanced one cent to 71 cents per pound. Spelter shows a similar advance and is quoted at 12½ cents per pound. Antimony at 14 cents represents an advance of 2 cents per pound. Other metals are very firm.

Demand Promises Good Business

Machine tool activity has been a little upset owing to prevailing conditions but the demand is still prevalent and will probably be accelerated once the exchange rate becomes more reasonable. Of course schemes are in operation to minimize the present burden, but the influence is one that tends to hold up business. Calls on Canadian tool manu-

facturers, and dealers who have used equipment to sell emphasize the need for machinery, but the high cost at present is an important factor.

Leather belting and lacings show a strong tone and prices are higher. The discount on extra heavy, single and double, and likewise standard, is now 10 per cent. to the dealer and 6½ per cent. to the consumer. Cut lacings are quoted at $2.25 and $2.75 per pound, and sides at $2 and $2.40 per pound to the dealer and consumer respectively.

Dealers Quote Nominal Prices

Reports of old material dealers are to the effect that business is relatively quiet in most lines. A steady demand for cast scrap is the principal order of the day, and the difficulties of securing this class of scrap is quite pronounced. Dealers are reluctant to quote definite prices as conditions are such that fixed prices are almost out of the question. The nominal quotation on machine cast iron has been advanced $2 to $26 per ton. All scraps, both metals and steels, are firm.

EXCHANGE HURTS BUSINESS HERE

TORONTO. — Between the exchange situation and the difficulty in securing material, there is a feeling of uncertainty in the market this week that is not desirable.

The talk has been for some weeks that the exchange difficulty would right itself in short order—that it was only a temporary displacement, etc.; but the trade is getting weary waiting for that time to come. As a matter of fact, it is not any use disguising the fact that there is no small amount of nasty feeling cropping up over the way in which some of the U.S. firms are insisting on the last pound of flesh in the matter of exchange. Every place the representative of CANADIAN MACHINERY called this week the question of exchange was discussed before anything else, and many of the dealers were outspoken in regard to the situation.

"Here is the way we look at the thing," remarked the manager of one of the largest selling organizations in the Dominion. "There are some firms in the United States to which we are going to send all the business we can get our hands on. There are other concerns that, as far as we are concerned, are not going to get anything. The former class are doing their best to help their Canadian trade in this financial crisis. The only interest the latter class are taking in the matter is to gouge us for the last half per cent. they can on every sale. The firms that are looking to the future, when this matter will come to normal again, are the firms that are going to find the open door here for them. It is a very short-sighted policy, and is much opposed to the idea of building up a trade that is going to be on anything like a firm foundation in the future."

Another dealer put it this way: "We have shipments on the way now in fulfilment of orders that were placed months ago. At that time, we were able to quote a definite price—a thing we do not do now. We allowed a fair margin for the exchange rate, as there was nothing in sight then to indicate that it might go worse. Five per cent., a few months ago, was considered ample allowance. Well, these shipments that are due now will mean lost money for us, as we have quoted a definite price. The difference between the amount we had allowed for exchange and the exchange rate to-day will more than take away the profit that there was for us in the deal. We do not like to keep running after a customer after we have named a definite price, so there is a loss to be met, and we are going to meet this one ourselves."

Of course, this is not done now, as prices are quoted in every case based on the exchange at the time of delivery. As a general thing, the trade is watching this very closely; but there are numerous cases where it is impossible to pass on all the exchange to the consumer, and, in such instances, the dealer or jobber has to lose part of his profits on the business.

Apart from that—and the above has reference largely to the sale of machine tools, where the sums involved are large—there is a nice demand for machine equipment, and a number of sales have been closed that run into nice figures for those handling the orders.

Increases in Supplies

According to reports in the trade to-day, taps, carbon drills and cutters are due for an increase, to become effective on the 23rd of this month. Taps have been selling at 45 off, and the opinion seems to be that the new figure will be 40 off.

Carbon drills to large buyers have been at several prices, although the smaller buyer has probably not secured as close figures. It is likely that 40 and 5 will be the best for any of them now.

Cutters, for some time, have been selling at 10 off, but the chances seem to be that the 10 off will be withdrawn, making the cutters net list. Of course, it must be understood that there has been no official announcement on this, and CANADIAN MACHINERY is simply repeating stories that are current in the trade, at the same time stating, though, that they come from very reliable sources.

There is a nice list out by the Canadian National Railways this week for the Toronto shops. This list is for carbon drills, and calls for 164 dozen of various sizes.

General business is reported as being very good.

Some of the supply departments are going a little more carefully in their purchasing now than they have been in the past. They have, heretofore, ordered enough at one time to keep them going for a normal six months or a year's business. "We are buying for three month periods in our supply department," reported one house this morning. "We figure it out that we would rather run a little short now and then than to get stocked to the neck with goods that might recede in price. There are others, no doubt, who will differ with this policy—and they have very good grounds for so doing, for it is hard to see any drop in sight. The only thing is this—we are doing too much business in this country on the amount of money in circulation."

A Lean Market Here

"Absolutely no improvement." That is the way the steel trade can be sized

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh advices state that the question of prices is causing considerable discussion. At present the forces are about equally divided, making the condition of the market very uncertain.

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The U. S. Steel Corporation believe that the March 21 price of steel, as set by Industrial Board, should still be adhered to, the 10 per cent. increase in wages granted on February 1 making no difference to the selling price. This decision confirms our statement of last week.

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Toronto experiences a double trouble. Between the exchange situation and the difficulty of securing material there is a feeling of uncertainty that is far from desirable.

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The scrap iron situation is likewise uncertain, $25 being the price quoted for No. 1 machinery scrap. Some dealers, however, are holding on for about $40, which proves that there is really no definite price, the feeling being, "Bring us the material and we will pay the price for it."

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There is considerable talk of an advance on taps, carbon drills, cutters, etc. While this is not official it comes from reliable sources sufficient to warrant attention.

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A considerable number of machine tool orders have been placed this last week, and the possibilities are for a continuance of this condition. The automotive industry are the chief buyers, several concerns of this nature being at present in the market for new equipment.

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The chief feature in all markets at present is the uncertain condition existing. No one seems to be desirous of predicting the possibilities, but are content to sit tight and await developments.

up this week; and it is the truth. At the offices of the U.S. Steel Products, the information is given out that they are booking very little, as deliveries are too uncertain. That must not be taken like many of the mills, there is always the chance of a very needy customer getting through.

Plates and sheets have been marked up again this week. One Toronto warehouse was offered plate this week by a premium mill at $4 base Pittsburg, that being the highest price asked yet; but with it went a guaranteed delivery in 60 days. Were that material brought in here by a jobber, it would have to bring a re-sale price of 7 cents.

Some sheets came in this week to local houses, the Hamilton mills being the only place in Canada where any relief can originate.

Get Them Forged

An official of one of the Canadian forging plants, speaking to CANADIAN MACHINERY about the shortage in bars, stated that some places where they were held up for round or square bars were turning to the forging plants for their immediate needs, and in this way were avoiding a shut-down. Forging plants always have experts who could advise regarding this method.

Jobbers admit that the most serious shortage in bars is in the three inch and heavier. Mills are sold out for some time to come on all sorts of bars. In fact, about nine months would be a fairly correct estimate of the time for which their mills are full. One thing that helps out is that there is a fairly warehouses, from which a fairly quick delivery can still be made.

The shortage of tubes is also getting to the stage where it is becoming acute. CANADIAN MACHINERY heard of one firm in a good manufacturing centre in Ontario where they have to close the power plant because they cannot secure the tubes to make the necessary repairs, and they do not wish to operate their plant as it stands now. The peculiar part is that the tubes required are standard three-inch sixteen-foot, and yet, as far as we can learn, none of the stocks were able to supply the demand for this mill.

The exchange situation is troublesome in the steel market; but they simply pass it on to the customer.

The Scrap Metal Market

Prices that are quoted for scrap metal can hardly be accepted as the real strength or weakness of the market, as the case may be. The word "peculiar" describes the scrap metal situation about as well as anything at the moment. No one seems to want to state just exactly what is going to happen. The exchange rate has the market on red and yellows, all tied up. For instance, were an Old Country firm to buy copper in the United States now, instead of paying 19½ cents (the market price) the firm would have to pay 25.76. This means that they are not going to buy. In fact, there are large shipments going from England to the States, to take advantage of the exchange situation.

No. I machinery scrap is quoted at $25; but it is well known that the metal would bring more than that. The reason that the figure is left there is that we could not find a dealer who wanted to name a definite figure as the market price. The feeling is: "Bring us the material—a good tonnage of No. 1 machinery scrap—and we will pay the price for it." There is practically none coming in now, and the dealers that have it—and there are some—are holding for about $40. Of course, that price is f. o. b. consumer's mill at Ontario points.

VARIOUS AUTOMOTIVE PLANTS IN EAST DESIRE MACHINE TOOL EQUIPMENT

Special to CANADIAN MACHINERY.

NEW YORK, February 11.—During the past week the placing of orders for machine tools has kept up at a good rate, but much of the business may be ascribed to the scramble of prospective buyers to take advantage of the few days of grace permitted them by machine-tool manufacturers who have advanced prices. Since the first of the year practically every line of machine tools has gone up, and on some lines two advances have taken place within the past thirty to sixty days. Prices are now on the highest level ever known, considerably exceeding, in many instances, the prices existing during the war period.

While business has been exceptionally good for the past sixty days or more not all in the trade are optimistic as to the future. The sensational drop in foreign exchange and the tightness of the money market are regarded by some as danger signals, and a policy of conservatism among bankers as a result of these events may hold up many industrial projects which have been planned.

Prices on all raw materials and manufactured goods are mounting so high that prices sooner or later must fall of their own weight, due to the withdrawal of buyers. In the iron, steel and machinery trade the possibility of any marked curtailment in demand or reduction in prices does not appear imminent, but as the metal industries are dependent to a large extent on other industries there is some apprehension lest the foreign exchange situation may affect other lines, notably foods and textiles, and in time destroy business confidence, which is the basis for prosperity. It appears certain that exports of American merchandise to Europe will be materially reduced. Actual wants must be provided for, but there has been a great deal of speculative purchasing, which will be eliminated. Denmark is now in complete control of the purchase and sale of exchange, and is thereby regulating imports and exports, and other European countries are likely to take some similar action.

It is singular that much of the present activity in machine-tool circles is due to the incessant demands of the automotive industries. If anything should happen to check the expansion of the automotive industries the machine-tool industry would immediately feel the slack. Among the automotive plants in the East now in the market for equipment are the International Motors Co., which is buying for its three plants at Plainfield and New Brunswick, N.J., and Allentown, Pa.; the Willys Corporation, Elizabeth, N.J., which has been an almost continuous buyer for the past two or three months; the Stevens-Duryea Co., Chicopee, Mass., and its affiliated interest, Rauch-Lang, Inc.; the Rolls-Royce Co. of America, Springfield, Mass.; the Wright Aeronautical Corporation, which will build a new plant at Newark, N.J., for the manufacture of Wright-Hispano airplane motors; the Rochester Motor Co., Rochester, N.Y., which is building an addition to its plant, and others. The Murray Motor Car Co. is moving its plant from Pittsburgh to Newark, N.J., and is expected to buy additional equipment. Companies making gears, transmissions, etc., for automobiles have been especially active, nearly all recently added to their shop equipment. The American La France Fire Engine Co., Elmira, N.Y., is buying tools for motor truck production.

In the export field there has been buying by Fiat of Turin, Italy. The purchases of machine tools in the United States by this Italian company in the past few months total nearly a million dollars, with much more still to be bought. In all the Fiat Company will require about one thousand tools, about half of which will be purchased in the United States. A representative of a large British automobile company is in this country and is reported to be ready to buy a large amount of equipment and automobile accessories and parts.

One of the largest purchasers of small machine tools is the Columbia Graphophone Co., Bridgeport, Conn., which is placing orders for the equipping of its new plants at Toronto, Ont., and Baltimore, Md. Purchases, including woodworking machinery, will aggregate several hundred thousand dollars.

Ottawa.—So far only ten applications have been received by the Air Board for private pilot certificates. The board has announced that all former members of the Royal Air Force are entitled to private pilots' certificates providing they were physically fit when leaving the force. It is advisable for them to submit their applications as soon as possible. A number of applications for airdromes have also been received.

CONTEST EXISTS IN PRODUCING RANKS AS TO WISDOM OF ADVANCE IN PRICES

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 11.—Everything in the iron and steel market situation is made by one thing, the fact that there is a contest between two almost equally divided forces in the producing ranks, the two classes being respectively those who do not wish prices to advance and those who wish to secure the highest prices obtainable. All producers are in business for the purpose of making money, but those who object to advancing prices feel that they can see farther ahead than the others, and maintain that in the long run it would be to the pecuniary advantage of all producers if prices were not permitted to advance at this time. The precise mental attitude of those who favor price advances is not known. It may be that they think the added profits now would more than compensate for the losses later, if prices were largely advanced now, or they may have the opinion that the market is marked to go to smash at about the same time, whether or not prices are advanced.

The United States Steel Corporation adheres to its principle that steel prices should not be advanced above the March 21 or Industrial Board schedule, the 10 per cent. wage advance instituted by the corporation as of February 1 not affecting its position a particle. One large independent has pursued up to this date the definite policy that its prices should be the "January 1" prices, i.e., the prices ruling between the post-armistice reduction and the Industrial Board reduction. Another large independent, holding the same general idea, interprets it differently and holds that prices should be $7 a ton higher than those in general effect a few months ago. This means the same thing in most products, as the Industrial Board reductions were $7 a ton on all products except grooved skelp and wire products, in which the reductions were $5 a ton. Last summer all the independents advanced wire products $5 a ton. The second independent mentioned, therefore, regards $3.85 as the proper price for nails, which were $3.50 under the war control and were not reduced at all until the Industrial Board reduction of $5 a ton, this being taken off by the independents last summer. The first independent makes an exception of nails in its adherence to "January 1" prices.

The Steel Corporation and each of the independents mentioned has entered on books very considerable tonnages, for forward deliveries, at prices ruling at time of shipment. They wish to hold prices down, but they do not wish to throw money away if it will do no good.

The other independents occupy either of two positions. Some have not formally advanced prices, but will book no orders, simply promising their regular customers that they will take care of them as best they can, at such prices as they choose to set upon the tonnage when the time comes. Others are quoting higher and higher prices and selling outright such tonnages as buyers will take, all such business being for relatively early delivery, which now means second quarter, as there is practically no rolling space open this side of April 1st.

Thus while the market situation appears on the surface to be a very complicated one, it is readily understood when the governing forces are recognized. In ordinary times, the Steel Corporation has always been able to control the market against advances, though not always against declines. Now steel is so extremely scarce and some buyers are so ready to pay fancy prices, that it is a question whether the Steel Corporation with the assistance of the two large independents referred to above, will be able to control the market, even though their combined tonnage is well above 50 per cent. of the total. The thing will be decided by the relation between supply and requirements, the supply being insufficient now, but capable of a very considerable increase if operating conditions become normal.

Production

The limiting factor in production is transportation. While the labor supply may not be ample, it is at least moderately adequate. The common talk in the iron and steel trade is that transportation is curtailing production, but that is not correct. It is simply restricting production, which has increased, but has not increased as rapidly as if a full supply of transportation had been available.

Throughout January there was much complaint of shortage of cars in the Connellsville region, limiting the shipment and therefore the production of Connellsville coke, and of cars at coal mines, limiting shipment of coal to by-product ovens. Yet the blast furnace reports now show that 15 per cent. more pig iron was made in the United States in January than in December. The increase in steel production was at least as great, and perhaps it was greater, for some steel producers drew upon stocks of pig iron, and developments in the scrap market indicated that there was heavier consumption of scrap than had been counted upon.

Car shortage has also affected the shipment of finished steel products, and at many mills now there are large accumulations of unshipped material. In some cases the accumulations are such that if transportation conditions do not improve, production will be interfered with, as storage facilities are limited.

There is a very strong probability, however, that transportation conditions will improve, for much of the trouble has been due to winter weather, which cannot last much longer. The opinion is commonly expressed that return of the lines to their owners March 1 will bring about a greater esprit de corps and thus increase efficiency.

Ore Prices Fixed

Lake Superior ore prices for the 1920 season have been established by the making of sales at $1 a ton advance over the 1919 schedule, the 1920 prices being therefore as follows: Old Range Bessemer, $7.45; Old Range non-Bessemer, $6.70; Mesabi Bessemer, $7.20; Mesabi non-Bessemer, $6.55 per ton at Lake Erie dock, price being based upon 55 per cent. iron content, natural state, in the case of Bessemer ores, and 5½ per cent. for non-Bessemer ores. The statistics show that about 1.85 tons of ore is consumed per ton of pig iron, so that the cost of making pig iron will be increased about $1.85 per ton. There is an extra in the freight charge on ore from mine to lake dock of 30 cents a net, or about 34 cents a gross ton, imposed as a war measure, which will probably come off, and in that case the benefit will be handed on to the ore buyer. The lake carrying rate will probably be $1 this season, as against 80 cents last season, so that the ore producer gets only an 80-cent advance net. The advance is very moderate, considering all the circumstances. While the new ore prices are about 95 per cent. above their ten-year pre-war average, 1904-13, pig iron is more than 150 per cent. above its corresponding pre-war average.

The common disposition to misuse facts in order to provide price boosting arguments is well illustrated by what is now being commonly said about pig iron prices in connection with this ore advance, it being claimed that pig iron ought to advance $2 a ton for the second half of this year on account of the ore advance, whereas the fact is that pig iron had already advanced $13 to $15 a ton before the ore advance occurred. If the ore producers had appropriated the logic of the blast furnacemen they could have justified an advance of $7 or $8 a ton in ore, on the basis of the pig iron advance.

Sales of foundry iron at $40, valley, seem to have exhausted about all the offerings, but little if anything has been done above that price so far for extended delivery. Basic, however, has sold at $43, valley, a sudden jump of $3. Bessemer remains quotable at $41, valley, with several 200-ton lot sales just made at $43.

A new fly trap for household use employs an electric fan, to be connected to a light socket, to draw insects into a receptacle.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	**3 62**
Structural shapes	**3 72**
Plates	**3 90**
Small shapes under 3"	**3 62**

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	71 00	60 00
Spelter	12 50	10 75
Lead	10 25	8 75
Antimony	14 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

Plates, ¼ up	$ 5 00	$ 6 50
Plates, 3-16 in.	5 25	7 00

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	26 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

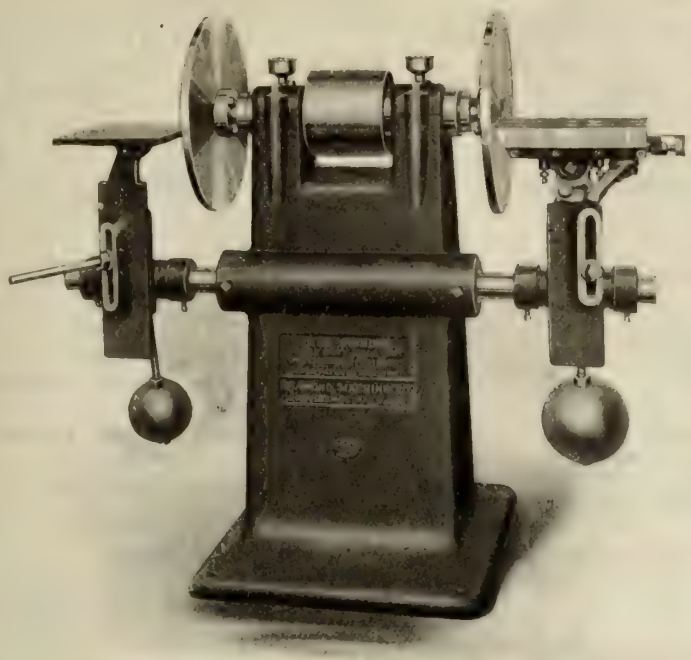
Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net



DIAMOND
DISC GRINDERS

Good grinding in fast time has made the Diamond popular in a host of shops. The right design and build eliminate vibration and give the operator a perfect surface every time. There is a suitable size and equipment for every surface grinding job you have. Workmanship and material of "Diamond" quality throughout.

May we send you catalogue?

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

64 Front Street West
TORONTO

Acid Electric
STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

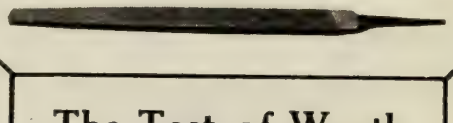
Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal
Head Office: 187 Delisle St. MONTREAL
Phone Victori. 1482



The Test of Worth Is Service

P.H. and Imperial Files by exceptional service have become the standard machine shop files of Canada. Efficiency in practice and economy in use are the two main factors of their success.

"They Cut Faster and Wear Longer"

Always specify them on your file requisitions. Your jobber has them.

P H

IMPERIAL

Ingersoll File Company Limited
John Morrow Screw & Nut Co., Limited
Sole Distributors
Ingersoll, Ontario

INGERSOLL

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American plus	40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 8 00
Sheets, black, No. 10	6 50	7 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 50	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 50
Premier, 10¾ oz.	....	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

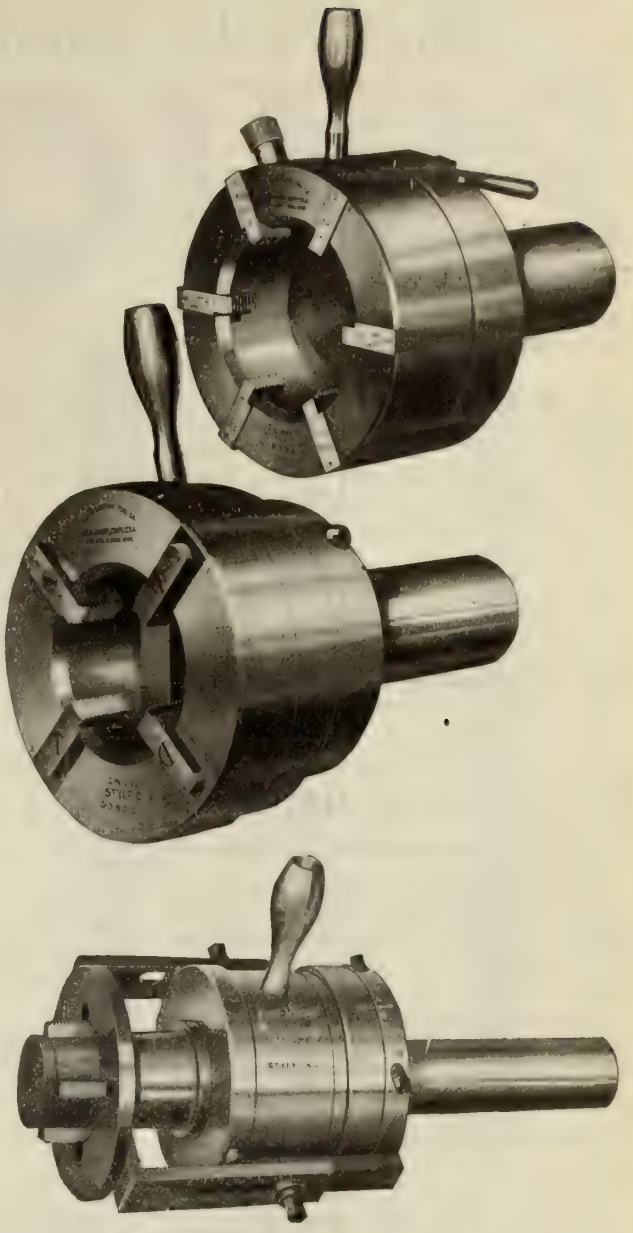
Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

A GOOD BOON

"Geometric Tools are a good boon in our business. Always reliable and sure of turning out a class job; in fact, I don't know how we could secure a decent output without them."

This is what the Works Inspector of a London (England) shop says. He adds that they are making screw and small parts for air craft, and have quite a lot of Geometric Dies in constant use.



Because of the fact that Geometric threading tools are "a good boon" in the thread cutting business, the maority of screw machines and turret lathes are equipped with Geometrics.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.
Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan. Alberta

For any thread, any size, any pitch,—there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need—whatever it may be. Ask us.

If interested tear out this page and place with letters to be answered.

The Week's Events in Montreal Industry

C. C. Tennant, of the Hyde Engineering Works, Montreal, has left on a two months' business trip to England.

The Gates Refractories of Montreal have opened a Toronto office in the St. James Chambers, at the corner of Adelaide and Church streets, in charge of J. F. Alexander.

T. W. Lesage has resigned from the position of superintendent of the Montreal waterworks, after being in the services of the city for nearly forty years. H. A. Terreault, of Sorel, has been appointed to the position vacated by Mr. Lesage.

In view of the proposed reorganization of the system of civic government for the city of Montreal, and the fact that the Canadian Manufacturers' Association has not been requested to appoint representatives, the latter body has forwarded a resolution to Premier Gouin, and his colleagues, asking that the Provincial Government provide for representation of the C. M. A. on the Commission.

Joint action has been taken by the Government of Canada and the United States to refer the deepening of the St. Lawrence for navigation, and the utilization of the river for power development purposes. In a note addressed to C. A. Magrath, chairman of the Canadian section of the commission, the Hon. N. W. Rowell stated that the scheme would be made the basis of an investigation, so that the commission may submit a report to the two countries, together with such conclusions and recommendations as may be considered pertinent. The appointment of engineers will be the first step, and they will be empowered to obtain all the necessary data and information, which will be placed in the hands of the commission before the close of the year, and the commission in turn is requested to forward to each Government the final report, with recommendations, not later than three months thereafter.

James Rogers, a veteran railroad contractor, died at his home in Montreal last week, at the age of 83 years. The greater part of his active career was spent in railway engineering work. As a contractor his first work was the construction of the Lake Superior division of the C.P.R., under R. G. Reid, general contractor. Among his other undertakings was the building of the Intercolonial Railway near Chatham, N.B., and double tracking of the Grand Trunk between Hamilton and Niagara Falls. He was likewise superintendent and inspector of many engineering enterprises, both in Canada and the United States.

U.S. SCRAP METAL

Reports from U.S. centres would indicate that scrap metal prices are not in a stable condition. Prices vary slightly, both advances and declines being reported.

PHILADELPHIA.—With the exception of one large sale, the scrap market, although active, has been engaged in the sale of small lots at the current market price. Cast scrap is in demand, and, in some cases, slightly higher prices are asked.

NEW YORK. — Machinery scrap is being sold at last week's price. Stove plate has been advanced 50 cents. This advance is due to a scarcity of general foundry material.

PITTSBURGH.—Heavy melting steel shows a slight decline in price, owing to buyers' requirements having been met for some time to come. The lowest price which seems to have been quoted is in the neighborhood of $28.50 delivered.

BUFFALO. — Scrap iron generally shows little advance, although the market is active and the demand strong. Cold weather has affected the quantity of scrap available.

CLEVELAND.—A slight reaction has set in, prices in general being lower than those reported last week. Heavy melting steel is now quoted at $27 to $27.50, while cast scrap shows a slight advance, now selling at $39 and $40.

CHICAGO.—Prices in general show a tendency to rise, quotations being made at prices above those of a week ago. Considerable activity is apparent, although car shortage is responsible for all shipping difficulties.

ST. LOUIS.—No. 1 railroad scrap is now selling at $39 to $39.50 a ton, an advance of $2.50 over last week's price. Agricultural scrap is quoted at $38.50 to $39.

CINCINNATI.—This market is still active, and prices are remaining about the same, although there is a tendency on the part of some dealers to advance prices.

PIG IRON TRADE

Various U.S. centres report very heavy sales of pig of all grades. Much of this has been for last half delivery.

CLEVELAND.—Foundry and malleable buyers are being placed on rations, and their purchases are being apportioned, so that many have received quantities less than those for which they have been asking. Foundry iron has been selling at between $40 to $41.

PHILADELPHIA.—Foundry iron has advanced in price over former quotations, and is now selling at $43 to $44.25 furnace for last half delivery (2.25 to 2.75 silicon). For first half delivery, some sales have been made at $45.00.

NEW YORK.—A record sale of iron took place during the past week at, in some cases, slightly advanced prices. One producer advanced its base price to $42 from $40 for 1.75 to 2.25 silicon.

PITTSBURGH. — Producers are becoming reluctant to sell, and for this reason the market may be described as quiet. Sales of small lots of No. 2 foundry (1.75 to 2.25 silicon) for prompt delivery are noted as high as $42 furnace.

WELL, WHAT HAS THIS CHAP TO SHOW?

Young Inventor in Seattle Has an Atmospheric Power Generator

Alfred M. Hubbard, a 19-year-old Seattle boy, announced the perfection of an invention he terms an "atmospheric power generator," and made claims that recently caused Seattle's leading electrical engineers, according to newspaper reports, to doubt the evidence of their senses and to pause before they condemned as folly the assertions of the youth.

With the apparatus, in appearance a small coil of wire about 6 inches in diameter, surrounding a permanently magnetic core, 8 inches long, the entire contrivance easily carried in a man's hand. Hubbard gave a demonstration miles from his laboratory that, regardless of the principles involved, several Seattle engineers declared without parallel in electrical history.

An ordinary incandescent electric lamp connected with the two terminals of the "atmospheric power generator" glowed to a cherry red for nearly one hour, and Hubbard volunteered to permit the lamp to burn for as many hours as was necessary to satisfy the most skeptical.

The young inventor claims that there are no moving parts connected with his generator, that there are no hidden batteries, storage or primary, and those who witnessed the demonstration made sure that there was no outside connection with any source of power.

Hubbard's explanation of the phenomenon is that he has succeeded in transforming the earth's lines of magnetic force into electrical energy available for use.

MORROW'S



ALL STYLES OF DRILLS

All **Morrow** Drills made as the highest type of High Speed Drills should be made.

Proper Chip Space
—Note the Difference

Proper Thickness of Webb
—Strength and Accuracy

Scientifically Tempered
—Rigid Inspection

Buy only **Morrow Drills.** The makers guarantee each tool and you get increased production on every drilling operation where **Morrow** Drills are used.

JOHN MORROW SCREW & NUT CO., LIMITED

Also manufacturers of Cap Screws, Set Screws, Semi-Nuts. Sole distributors of P/H and Imperial Brand Files.

INGERSOLL, CANADA

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



PRODUCTION BEING SECURED AT NEW PLANT OF CONRADSON MACHINE TOOL CO.

ANNOUNCEMENT has recently been made of the incorporation of the Conradson Machine Tool Company of Green Bay, Wisconsin, of which Mr. C. M. Conradson is president. Mr. Conradson is well known in the machine tool field, at one time being associated with the Gisholt Machine Company of Madison, Wisconsin.

The new concern is associated with Joseph T. Ryerson & Son, who will market the complete output of the new plant, consisting of plain and universal milling machines, selective head lathes, planers and radial drills. "Ryerson-Conradson" is the trade name under which these machine tools are being sold. The new line embodies radical departures from present design of similar machines, and the new features aim to fill present day heavy duty production requirements.

Ground was broken for the Conradson Machine Tool Company plant in the spring of 1918. The building has recently been completed, equipment has been installed, and production is now under way. The plant is ideally located on the outskirts of the city of Green Bay, and the property comprises a ground area of approximately twelve acres on the west bank of the Fox River.

The initial unit of the proposed plan of buildings consists of machine shop and main erecting bay, both of saw-tooth construction, a power house heating plant, and office building.

Joseph T. Ryerson & Son, the selling representatives, have been in business for over seventy-five years, and during the past several years have been making large expansions in the machinery division of their business. They have steel and machinery warehouses at Chicago St. Louis, Detroit, Buffalo and New York, with district offices in practically all of the larger cities, and maintain a foreign selling organization and agents and direct representatives throughout the world.

ABOUT READY TO TURN OUT PLATE

Sydney Plant is Getting Toward the Stage Where Production is Possible

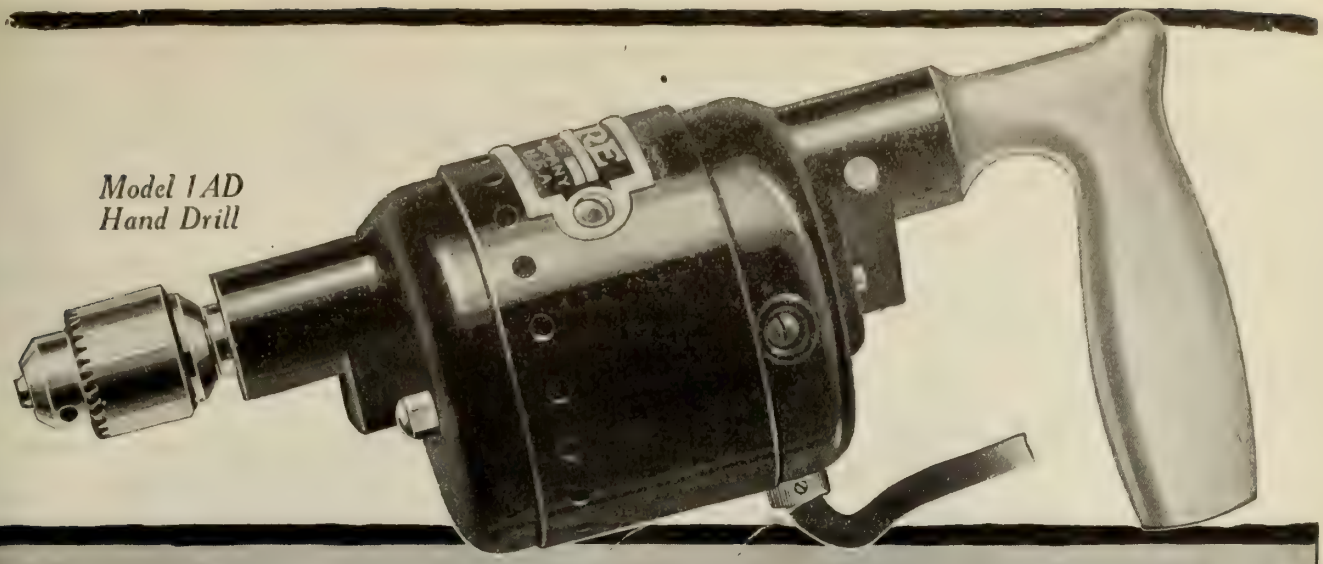
SYDNEY, N.S.—They'll be rolling ship plates in Sydney by February 20.

Information obtained from official sources at the Dominion Steel Corporation's offices is to the effect that the new plate mill will be ready for operation by the 20th of the month. Some minor pieces of equipment have yet to come to hand and be installed, but all is expected to be in readiness for operation by the date named.

The mill, as most people already know, is the first of its kind in Canada It will roll all the plates required for Canadian shipbuilding. The company already has a contract with the Dominion Government for 50,000 tons of plates annually for five years.



NEW PLANT OF THE CONRADSON MACHINE TOOL CO.



Model 1AD Hand Drill

MODEL 1AD Hand Drill

Length—10 inches.

Weight—4¾ pounds.

Capacity—Steel, brass, aluminum and alloys, 0 to $\frac{3}{16}$ inches.

Motor—Universal, operates on either direct or alternating current. Diameter of motor 3⅜ inches.

Spindle—Offset from center $\frac{25}{32}$ inches.

Drive—Helical gears.

Handle—Aluminum. Complete with 10 foot cord, plug, switch and chuck. Jacobs chucks used as regular equipment.

MODEL 2AD Sensitive Drill

Height—18 ins. **Weight** 18 lbs.

Stroke—3¼ ins. **Feed**—Rack and pinion. Helical gear drive.

Capacity—Steel, brass aluminum and alloys, 0 to $\frac{3}{16}$ inch. Drills to center of 7½ inch piece.

Motor—Universal, operates on either direct or alternating current. **Diameter**—3⅜ inches.

Spindle—Offset from center $\frac{25}{32}$ inches.

Thrust—Ball bearing.

Table—Adjustable, may be raised, lowered or swung entirely out of the way. Complete with 10 foot cord, plug, switch and chuck. Jacobs chucks used as regular equipment.



Model 2AD Sensitive Drill

Wisconsin Electric Company

2920 16th Street RACINE, WIS.

DUMORE GEARED ELECTRIC DRILLS

If interested tear out this page and place with letters to be answered.

MERIT AND DEMERIT MARKS IN C. P. R. FEBRUARY LIST FOR N. B.

S. WINCHESTER, conductor, Woodstock Division, 10 merits. While watching running gear of passing train detected wheel under car not running true. Had train stopped, and upon examination wheel was found to be loose.

E. Bulmer, conductor, Woodstock Division, 5 merits. Vigilance displayed in detecting en route that heater protecting perishable shipment was not burning. He lighted the heater and kept it burning until reaching terminal.

C. Ralston, conductor, Woodstock Division, 5 merits. Detected car with two numbers.

B. A. Craig, conductor, Woodstock Division, 10 merits. Detected car in passing train with truck off centre and king pin broken.

C. Taylor, conductor; J. T. Smith, engineer; C. A. Stewart, fireman; T. F. Griffin, trainman; J. F. Flemming, trainman, Woodstock Division, 10 merits. Good service rendered in handling train with hand brakes after air pump failed, taking train to end of branch run and then making return trip to terminal.

J. P. McMullen, conductor, Woodstock Division, 5 merits. Detached rigging dragging on car.

E. E. Kaine, engineer, Bay Shore, 7 merits. Good service rendered in leaving his engine in charge of fireman and going to assist another engineer to disconnect his engine, which had become disabled between stations.

R. D. Hickey, engineer, Bay Shore, 10 merits. When main reservoir pipe failed had train handled by hand brakes to station, where there was a plumbing shop. Purchased necessary fittings, borrowed a set of dies and effected repairs.

J. A. VanWart, trainman, Woodstock Division, 5 merits. Detected brake beam down on car.

L. O'Hagan, trainman, Woodstock Division, 5 merits. Detected broken arch bar strap and brake rigging dragging on car.

D. M. Slipp, trainman, Woodstock Division, 10 merits. Fired engine Woodstock to McAdam when fireman was taken sick.

Hatfield Burtt, trainman, Woodstock Division, 10 merits. Detected and extinguished fire in heater car.

W. J. St. Thomas, trainman, Woodstock Division, 10 merits. Detected bent anxle on car.

Discipline

Agents (2), 1 demerit. Did not promptly report departure of train.

Agent, 5 demerits. Billed out two cars in violation of embargo.

Head biller, 2 demerits. Showed incorrect destination on waybill pocket.

Car inspector, 5 demerits. Careless inspection of coach, resulting in heater pipes being damaged.

Night clerk, 7 demerits. Responsible for delay to important shipment.

Conductor, 10 demerits. Directed engineer to back up before he received signal from rear of train, or knew that switch was set for siding, resulting in rear of train running through switch and when moving ahead caused derailment of car.

Conductor, 7 demerits. Failed to make wired report of damage to switch which was run through by engine of his train.

Conductor, 10 demerits. Failed to comply with third paragraph of Rule 204.

Checker, 5 demerits. Neglected to turn in tally check of car.

Checker, 6 demerits. Made incomplete "On Hand" list, causing delay in disposing of shipment. Second offence.

Checker, 2 demerits. Incorrect loading of shipment.

Despatcher (reduced to operator). Lack of diligence in watching train movements, which, in a measure, contributed to two trains meeting head on.

Engineer, 15 demerits. Failed to comply with Special Instruction "E."

Engineer, 5 demerits. Disregarded Special Instruction "K."

Hostler, 5 demerits. Responsible for cylinder head blowing out, due to water not being worked out of cylinders.

Operator, 30 demerits. Being absent from duty without permission on Christmas Day.

Operator, 10 demerits. Failed to have a coach lifted by first train as directed, by which neglect heater pipes came to be frozen.

Trainman, 20 demerits. Neglected to place torpedoes as required by rule, when protecting the rear of train.

Train baggageman, 3 demerits. Overcarried locked mail bag.

Trainman, 7 demerits. Failed to turn up retainers on forward portion of train as required by special instructions.

Trainman, 30 demerits. Incorrect reading of train orders handed him by conductor, thereby contributing to head on collision.

Section foreman, 10 demerits. Allowed piped rail to remain in track, which failed under train and caused derailment.

Yard foreman, 5 demerits. Responsible for damage to car by rough switching.

Checker, dismissed. Violation Rule "G."

Conductor, dismissed. Failure to keep clear of superior train by misreading a train order, which resulted in his train colliding with another head on.

Fireman, dismissed. Unwarranted refusal of duty.

Fireman, dismissed. Absent from duty without permission.

Laborer, dismissed. Theft of company's material for which he was tried and convicted.

Night operator, dismissed. Violation Rule "G."

Operator, dismissed. Careless handling of train orders.

On train No. 426, January 1, weld on engine No. 558 gave out in right back corner outside fire box, opening up for about nine inches. Steam and water as a result leaked very badly in the cab, making it almost impossible to see. Engine crew, Engineer Wm. Rhodes, Fireman Thos. Hogan, blocked up hole with curtain and brought train through to terminal on time, although they were themselves drenched with steam and water. Their action was very commendable.

BIG EXTENSION WILL BE MADE TO PLANT OF ALGOMA STEEL

IT is announced that arrangemments have now been completed for the immediate commencement of construction of a new structural steel mill by the Algoma Steel Corporation at Sault Ste. Marie, Ont., at a cost of $6,000,000 to $7,000,000. The product of this new mill is expected to replace the greater part of the present imports of this material. About 90 per cent. of the consumption in Canada of structural steel is now imported, and it is the hope of the Algoma Steel Corporation to supply that, or the greater part of it, from the Sault mills. Work will begin at once, and the construction is expected to take 12 or 15 months. The Corporation already has four blast furnaces, which will furnish much of the steel necessary for the new mill. It is expected that 500 men will be required for the construction work this winter, to be increased to 1,000 in the summer, and when the mill is completed it will require 600 operatives. The immediate financing of the venture is made easy by the possession of ready cash and other liquid funds of the corporation. The last annual report shows current assets of $13,834,842, while the current liabilities were only $2,449,790.

Wanted for Steel Making

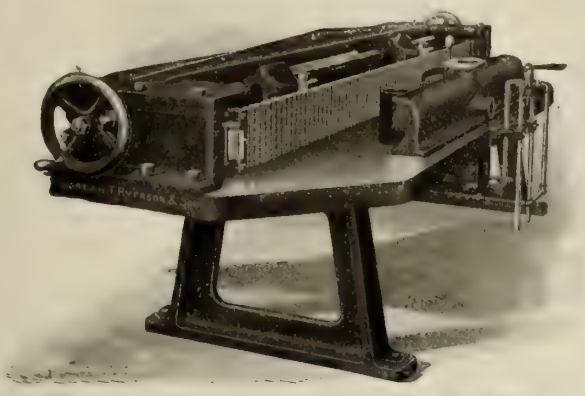
The corporation's plans for this mill have been under consideration for some time, but it was doubtless felt that the present enormous demand for steel, together with other favorable conditions, made it desirable to commence operations. In the last report of the Board the plan was thus described:

"During the past twelve months the services of capable constructing engineers were secured to prepare engineering plans for a new universal mill, consisting of a 40-inch blooming mill, 36-inch rougher and three-stand 28-inch

RYERSON

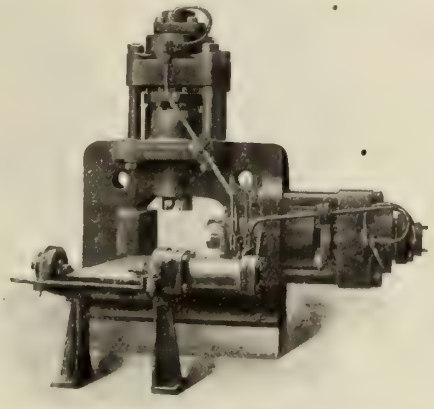
Spring Shop Machinery

We manufacture a complete line of machinery for the railroad spring manufacturing and repair shops. We will furnish upon request plans and layout of a modern spring shop. Write for complete descriptive bulletin on each machine.



Ryerson Universal Elliptic Spring Forming Machine

This machine will form elliptic spring leaves of any size and curvature used in ordinary practice requiring but one spring maker for its operation.



Triple-Pressure Hydraulic Spring Banding Press

This machine is of the triple pressure type capable of exerting a maximum pressure of 100 tons and with minimum and intermediate pressure of 33 and 67 tons.

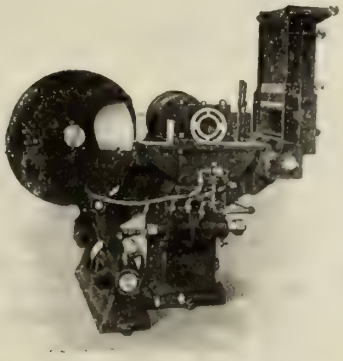
Flue Shop Equipment

We manufacture a complete line of machinery for cleaning and repairing boiler flues and will furnish upon request layout of a modern flue shop.



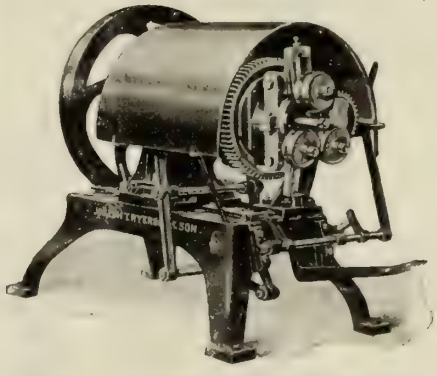
Ryerson Improved Universal Flue Cleaning Machine

This machine will clean and cut tubes, both standard and superheater sizes.



Ryerson Combination Hot Saw and Tube Expander

This machine is built in both standard and superheater sizes and will handle three operations in the repair of boiler tubes.



Hartz Superheater Tube-Welding Machine

This machine will handle either standard or superheater tubes with equal facility and economy.

JOSEPH T. RYERSON & SON

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ST. LOUIS
DETROIT

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combination structural and rail-finishing mills, all motor driven. This mill, in addition to rolling beams and channels up to 24 inches, will be able to roll a substantial steel rail tonnage to meet the increasing demand for heavier and longer rails.

"Your directors are well satisfied that not only is there prospective business to warrant the proposed new construction, but that the new mills of the kind contemplated are vital to the continued success of the Steel Company. It may be mentioned that at the present time Canada imports all structural steel and and shapes in excess of 35 lbs. per yard."

Sault Ste. Marie.—The work of clearing the ground for the new structural mills has been going on for some time, and every train from the East brings in a new batch of men for the steel plant, but nothing is given out by the company as to plans.

MASSEY-HARRIS CO. OFFERING TO PAY FOR SUGGESTIONS OF EMPLOYEES

THE MASSEY-HARRIS CO., LTD., have issued the following letter to their employees at the various plants, the idea being, as set forth in the letter, to secure greater co-operation from the employees in the betterment of conditions and working arrangements:

To all Factory Employees at
Toronto and Weston Works.

Dear Sirs:—From time to time the company has received from some of the employees who are interested in the efficient and economical operation of the business, various suggestions of improvement in some practical or mechanical feature with which the employee is familiar.

These suggestions have shown the personal interest in the business of the company, of those who made them and have been greatly appreciated by the management.

On the proposal of the employees' representatives on the industrial councils of both the Toronto and Brantford plants, a committee was appointed to investigate and recommend some plan whereby the making of such suggestions might be participated in on a competitive basis by all the employees with some monetary reward for those that were considered worthy.

In view of a favorable report from this committee and with the object of enlisting the personal and active interest and co-operation of not only a few but of every employee in the factory, the directors have decided to offer the following prizes:

One prize	$30.00
One prize	20.00
Two prizes of $15 each	30.00
Five prizes of $10 each	50.00
Fifteen prizes of $5 each ...	75.00
Thirty prizes of $3 each	90.00
Fifty-four prizes, totalling .	$295.00

The prizes will be competitive and will be awarded upon the basis of merit to those who, in the judgment of the Awards Committee submit during the period of January 1st to June 30th, 1920, the most valuable suggestions of plans resulting in more efficient or economical methods of operating the factories of the company under such subjects as:

Improvement of product.
Improvement of manufacturing methods.
Elimination of waste.
Reduction in costs.
Reduction in accident or fire hazard.
Convenience and working conditions.

Prizes will not be awarded for any suggestions which are not regarded of sufficient value for such consideration.

No employee will receive more than one prize for the period. If, however, two or more suggestions are submitted by the same person, the accumulative value of the suggestions will be considered.

Prizes will be awarded only to those who are in the employ of the company at the time of prize distribution.

If similar suggestions are submitted by two or more persons, the one first received shall be given preference.

The decision of the Awards Committee shall be final.

The plan is open to all factory employees not in receipt of monthly salaries. Foremen, assistant foremen and officers of the company are not eligible.

In order to make the plan easily available, a suggestion box will be placed in each department, and all suggestions must be deposited in one of these boxes, from which collections will be made at regular intervals.

Suggestions must be written plainly and on the form provided for the purpose. A pad of these forms will be located at each box, and further supplies can be obtained from the time clerk.

Every suggestion must be signed with the full name and clock number of the employee offering it, and must be addressed to the company and enclosed in a sealed envelope, which will be provided for the purpose.

Employees are requested to give careful thought to each suggestion before submitting it, to explain it clearly though briefly, and to indicate the object to be attained if the suggestion is adopted.

Every employee is earnestly invited to offer suggestions. All of these will have most careful study and investigation in order to arrive at a fair and satisfactory decision as to the merits of each and as to the awarding of the prizes. It is hoped that the interest shown and the talents manifested will be sufficient to encourage the continuance of the system beyond the period proposed.

The success of the plan depends upon the interest and individuality and initiative of the employees who are eligible to take part in the plan.

JOS. N. SHENSTONE,
First Vice-President.

ORGANIZING TO BRING NIAGARA PENINSULA TO ATTENTION OF WORLD

THE municipalities of the Niagara district have organized the Niagara District Industrial Association, with the object of holding, during the present year, an industrial congress. By this means they will endeavor to attract responsible people who may be interested in the power shipping and industrial facilities of the district, and also in the fruit and farm areas. Plans will be made to have their guests visit the power development at Niagara Falls, the Chippawa Power Development, now under way; the Welland Canal enlargement, and the fruit belt. Literature will be prepared describing these outstanding features of the district, and each municipality will also give wide publication to its advantages from an industrial viewpoint. Lists of representative men will be prepared, with the object of inviting them to the congress as the guests of the association.

The officers are:—

President, W. M. German, K.C., Welland.

1st vice-president, H. P. Stephens, Mayor Niagara Falls.

2nd vice-president, E. J. Lovelace, Mayor St. Catharines.

3rd vice-president, George W. Sutherland, Mayor Welland.

Secretary, Louis Blake Duff, Welland.

Treasurer, E. C. Graves, St. Catharines.

Publicity Committee:—W. B. Burgoyne, St. Catharines; F. H. Leslie, Niagara Falls; J. H. Thompson and J. E. Carpenter, Thorold; B. J. McCormick, Welland; P. B. Yates, St. Catharines; H. W. Shore, Port Colborne.

The members of the association are the representatives of the municipal councils of :—

(a) St. Catharines, Niagara Falls, Welland.

(b) Thorold, Merritton, Port Colborne, Bridgeburg, Niagara-on-the-Lake.

(c) Port Dalhousie, Fort Erie, Hubberstone Village, Chippawa.

(d) Crowland, Thorold Tp., Stamford, Bertie, Grantham, Niagara, Louth.

The representatives of the following Trade Boards:

(a) The Niagara Falls Chamber of Commerce.

(b) The St. Catharines, Merritton, Thorold, Welland, Port Colborne, Ridgeway, Fort Erie, Port Robinson and Stamford Boards of Trade.

TRADE GOSSIP

Will Build Foundry.—A building permit has been applied for by the Dominion Steel Products Company, Brantford, for the erection of a new foundry at a cost of $55,000. The building will be 160 feet by 100 feet.

The Canadian General Electric Co. of Peterboro, Ont., contemplate spending between $600,000 and $1,000,000 on new buildings and new equipment. This will include a moulding shop. Work is to commence on the new building in June, and, when completed, will add between a million and a million and a half to the Peterboro' company's payroll.

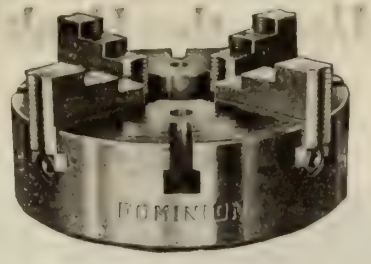
Hamilton.—W. B. Champ, president of the Hamilton Bridge Works Company, says that owing to the exchange situation they may find it necessary to close the plant, since the price of material that must be bought in the United States is almost prohibitive with the exchange added. Other local firms are also hit hard.

Galt Plant Grows.—For the third time in four years Galt Brass Company has found it necessary to enlarge its plants to handle increased business. Plans have just been prepared for a new foundry building 138 by 58 feet and an extension to vitriol plant 90 by 40 feet. Both buildings will be of concrete, steel and brick construction, and work will be started as soon as weather permits.

U. S. Firms in Canada.—An interesting comparison of the number of outside manufacturing firms having branch factories in Canada has been compiled by the Canadian Trade Commission. This shows that while there are scarcely half a dozen British manufacturers with branch factories here, there are some 530 American manufacturers, whose products range from farm machinery and tractors to packing house products.

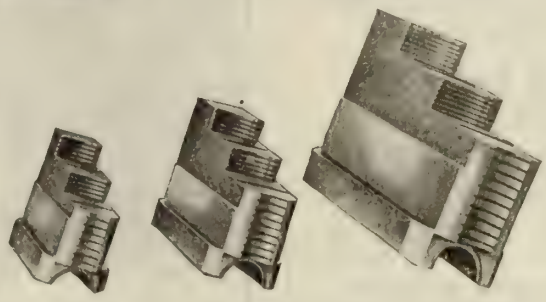
Short of Material. — Speaking of shortage of material, a Hamilton despatch says: The high rate of exchange is seriously affecting local industries which have to buy materials from the neighboring republic to any large extent. All importations have to be reduced to a minimum. W. B. Champ, managing director of Hamilton Bridge Works, said that their plant might have to close down owing to inability to secure materials.

Messrs. Hall and Pickles, 64 Port St., Manchester, England, have issued a booklet descriptive of their well-known "Hydra" brand of high speed tool steels. An account is given of the different brands of tool steels made by this firm and the work to which each is adapted, together with instructions for heat treatment. The major portion of the booklet is given over to data relative to high speed steel and tables listing sizes and shapes carried in stock. A valuable feature is seen in the excellent tempering chart and chart of heat colors, which have evidently been prepared with considerable care.



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STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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Engineers • Manufacturers
BRANTFORD, CANADA

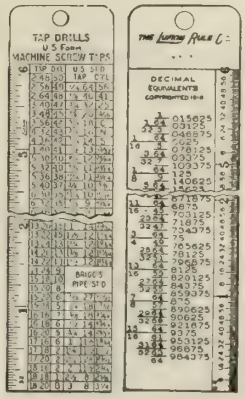
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Combining measurements 1/32nds—1/64ths together with tap drill sizes and decimal equivalents.

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PORTABLE PLANERS
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"HAWK" BRAND STEEL



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TOOL STEEL

Remarkable in its glass Hardness, Toughness and Cutting Efficiency.

Will give twice the cut of a regular tool steel at one grinding.

Order "Hawk Vanadium" for your End Mills and cutters. Once known—always used.

Large Stock. Prompt Shipment.

Write for full particulars to

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OF EVERY DESCRIPTION
SEND US YOUR ENQUIRIES.

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Don't be contented with half-way goodness or makeshift drinking arrangements

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

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SANITARY DRINKING FOUNTAIN



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. tell us how many men, how many departments and we'll tell you how much the cost will be.

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Builders of Heavy Duty Machines for over 50 years

PLANERS, BORING AND TURNING MILLS, HORIZONTAL BORING & MILLING MACHINES, LATHES, SLOTTERS.

Betts Machine Co., Inc. 408 Blossom Rd. ROCHESTER N.Y.

MACHINE TOOLS
for Shipbuilders and Iron & Steel Works
BERTRAMS LIMITED
SCIENNES EDINBURGH

Windsor.—With its stock of coal reduced to but a few tons, the Sandwich Windsor & Amherstburg Railway to-day issued warnings that street railway and power service will be cut 50 per cent unless the fuel situation improves by Monday.

City officials were at a loss to explain just why the company was without coal It was suggested by a member of the Transportation Committee of the City Council that the company had permitted its coal reserve to run down in expectation that the loss, after March 1, would be remedied.

Officials of the company deny this, saying that the Canadian Salt Company, which was under contract to supply power until 1925, had been unable to buy coal.

Plant to Reopen?—The St. Catharines "Standard" says: For several weeks the "Standard" has been asked if the Canadian Steel Foundries plant in Welland was to reopen. We tried repeatedly to get a definite line or the matter, but met with the old reply, "There's nothing definitely decided." However, the rumor has been so consistent that there is something to it. It is stated that it will soon re-open and employ a large staff. The company will begin the making of steel again, and will be in operation by springtime. This is the best piece of industrial news Welland has heard for some time. The plant which employed more hands than any other in Welland was closed last summer for want of business. Recently control in the Canadian Steel Foundries was purchased by New York interests.

DOCKER'S

Elastic Steam Jointing Cement
Its elastic properties allow for all expansion and contraction as well as oscillation and vibration.
It is unaffected by pressure 600 lbs. per square inch or temp. of 500° Fahr.
It will not **"blow"** expansion and contraction being same as iron.
Its bulk is more than double that of red lead.

Iron Cement
For blow holes, cracks and defects in castings.
Also for furnaces, boiler seams, leaks in tanks, etc.

J. N. WARMINTON & CO.
MONTREAL

Agents:
Boynton & Williams, Toronto
Engineering Apparatus Supply Co. Winnipeg

BLACK DIAMOND OVENS

OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co., Ltd.
Brantford, Canada.

BLACK DIAMOND OVENS

St. John, N.B.—Among the 1920 estimates of the Canadian Pacific Railway is the construction of a new steel cantilever bridge over the Reversing falls. The new bridge will have a steel span of 443 feet, supported by concrete substructures, and will have a large reinforced concrete approach from the west side. It will be located between the two existing bridges. The substructure work will be carried out this year and the contract for steel let. It is estimated that the bridge will be completed in the summer of 1921. The new structure will be able to support the heaviest trains.

St. John, N.B.—The Canadian Pacific Railway have included as part of their 1920 estimates an extensive programme of work in the New Brunswick district. One of the most important items will be the construction of a new steel bridge over the reversible falls. This bridge will have a steel span of 413 feet, and will be supported by concrete substructures. It will be located between the two present existing bridges. The substructure work will be carried out this year, and the contract for the steel let. It is estimated that the bridge will be completed in the summer of 1921 and will be able to support the heaviest of trains.

Other important work to be accomplished in this section is as follows:

The grain conveyor serving No. 2 berth, Sand Point, will be rebuilt and so placed that ships may be loaded at all tides.

Fredericton is to have a modern station on the present site, and plans are being drawn up in Montreal. A stores building is to be erected at Bay Shore.

The trackage in the Fairville yard is to be enlarged to accommodate the increased business.

Westfield is to have a new station, to be a two-storey wooden structure. It is also the intention of the C.P.R. to build four section foremen's dwellings at different points in Maine and to construct a 100,000-gallon steel water tank at Brownville Junction. While this is being constructed to supply engines with water the object in making it so large is for fire protection. Eighty miles of new rails will be placed on the main line between St. John and Megantic, and the rails taken up will be utilized to replace lighter rails on branch lines in this district. It is estimated that at least seventy-seven miles of replacements will be undertaken. There will also be fifty miles of ballasting done this year along the main line and branch lines.

MARINE

The annual report of the Department of the Naval Service for the year ending March, 1919, showed what Canada has really accomplished in shipbuilding line.

Early in 1917 orders were placed in Canada by the department for 12 patrol vessels, 60 trawlers and 100 drifters. Contracts for 11 trawlers and 30 drifters were placed in Montreal, for 6 trawlers and 20 drifters in Sorel, 6 trawlers and 50 drifters in Levis, 3 trawlers in Three Rivers, 6 trawlers in Kingston, 8 trawlers in Collingwood, 6 trawlers in Toronto, and 14 trawlers in Port Arthur. Contracts for the engines, boilers and auxiliary machinery were made with reliable firms throughout the country and the whole work proceeded with so that the vessels would be available in 1918. Many were available in 1917 and a few of the drifters were sent to European waters with Canadian crews. And this was not the limit of Canada's shipbuilding during the war. Our builders worked for various foreign Governments as well as our own, and during the period of the war built for the Imperial Government 12 submarines, 60 armored trawlers, 100 armed drifters, 550 coastal motor patrol boats, and 24 steel lighters for use in Mesopotamia and shipped there in sections. For the French Government there were built in Canada 6 armed trawlers and 36 motor patrol boats; for the Italians, 6 submarines, and for Russia 1 large armed ice-breaker and some submarines.

PERSONAL

Sault Ste. Marie, Ont.—Captain David Kyle, M.C., vice-president and a director of the Algoma Steel Corporation, died February 8 from pneumonia, following an attack of influenza.

Mr. Irving H. Jones, who is well known in machine tool circles in the Chicago field, has become associated with the machinery department of Joseph T. Ryerson & Son, and will specialize in sales engineering work on the Ryerson line of machine tool equipment.

Mr. G. J. Armstrong, director of the McKinnon Columbus Chain, Ltd., and McKinnon Industries, Ltd., of St. Catharines, Ont., Canada, who has been visiting Australia, returned to Canada during the past month. Edwin Wood Prop., Ltd., represent these manufacturers in Australia.

Mr. Kyle was born in Scotland and came to the Sault in 1910 as engineer in charge of the construction of the merchant mill, and was later in charge of the construction of the gas engines. When that work was completed he joined the staff of the steel plant and was placed in charge of maintenance.

In 1912 he was made general superintendent of operations, and in the fall of 1914 left the service of the company and went overseas and served in the war, during which he won the Military Cross. In 1917, by special arrangement with the military authorities in London, Capt. Kyle was allowed to come back to Canada, and again take his place in the executive offices of the steel company, and two years ago, when Mr. Franz came back to the Sault from Cleveland, Capt. Kyle was elected a director and vice-president of the steel company. Mr. Kyle was about thirty-six years of age, and his death brings a distinct loss to the steel plant and to the city.

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1—16" B.G. Steptoe Shaper with vise and countershaft.
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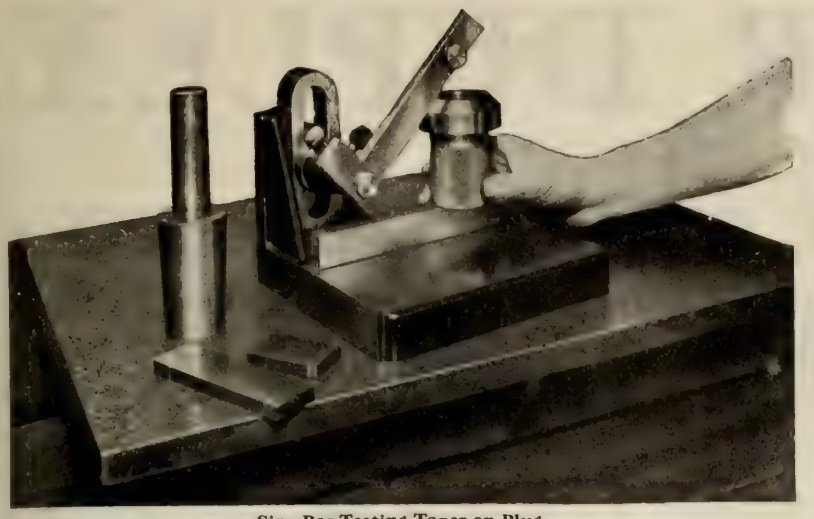
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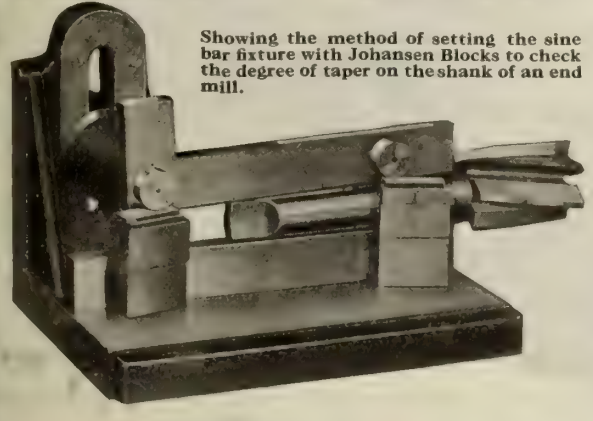
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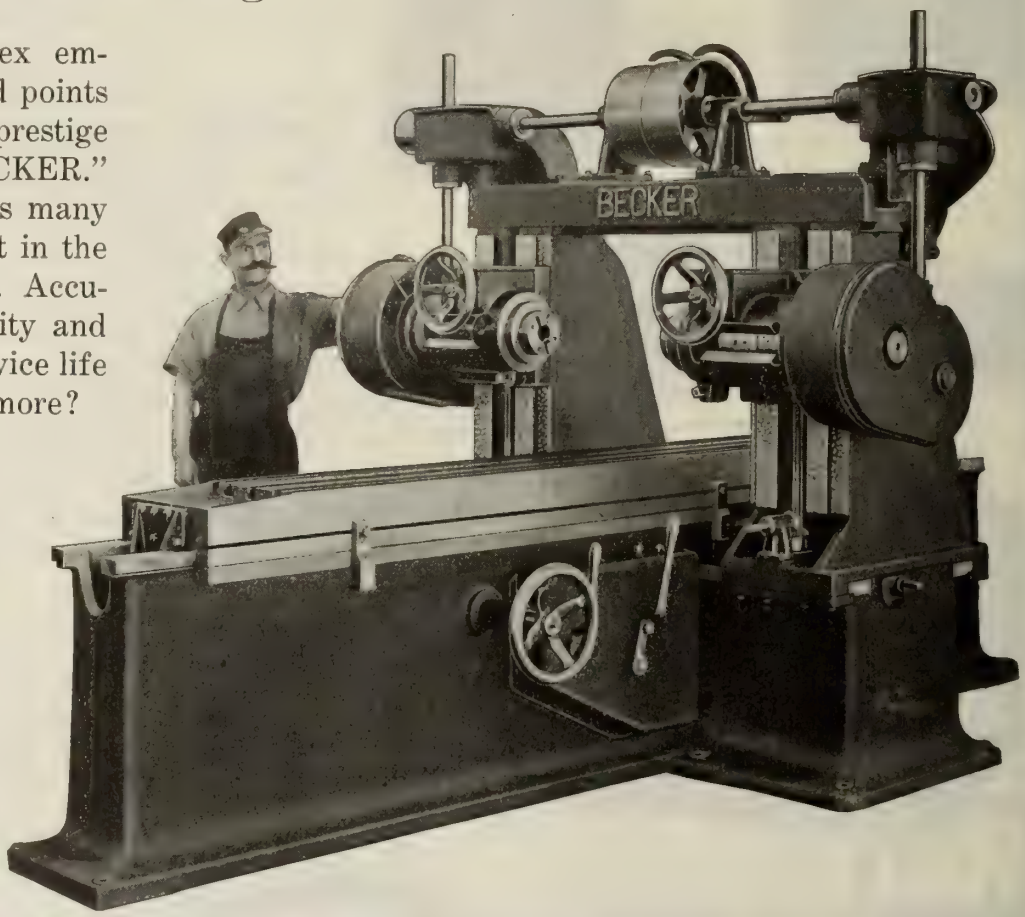
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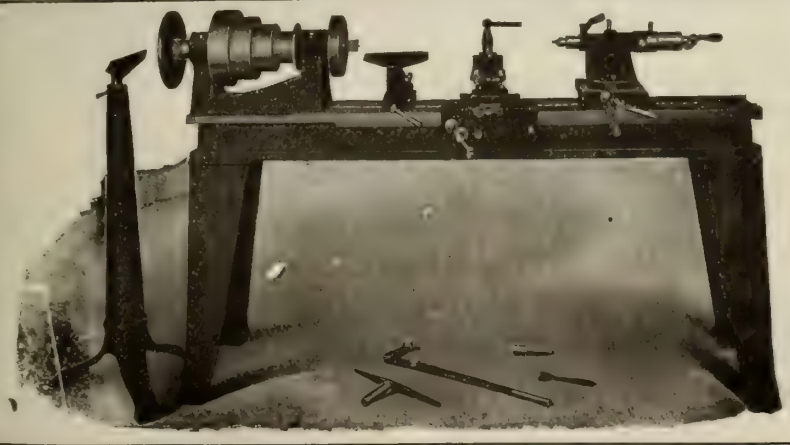
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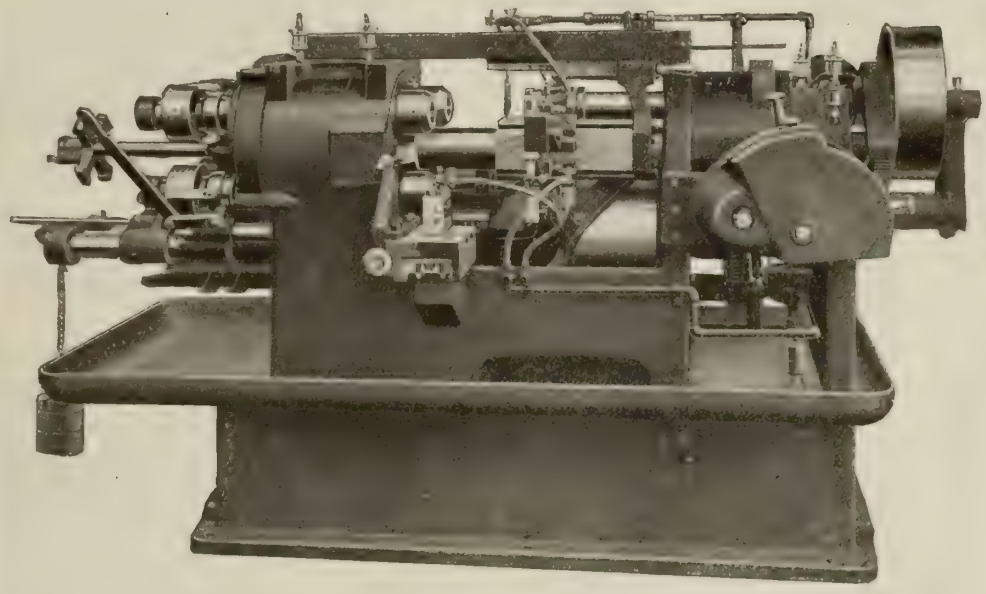
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In this leading article in the February 1st MACLEAN'S the mania for "taking a chance" is discussed and R. Laird Briscoe tells why there are not many losers—yet. Two men have made $6,600,000—this article tells how simply it's done. One typist bought a $2000 car with a $100 bill. It's really very simple when you know how—**IF** you guess right.

J. K. Munro Says:

THERE will be an election before Fall—it's among the probabilities. Sir Robert Borden took the Premiership with him to South Africa. What will he do with it when he returns? Why didn't he nominate a successor before he left? Why could Sir Thomas White have the job if he wanted it, and why wouldn't he make a good leader to go to the country?

These and other questions are discussed and answered in Mr. Munro's snappy, vigorous, pithy style.

Balking the Bolsheviks

A CANADIAN woman had some extraordinary adventures in Roumania with the Bolsheviks. She is Mme. Pantazzi, and was Miss Ethel Greening, of Toronto. She tells how she and her husband escaped death's door by the narrowest of margins—not once but several times. Incidentally, she tells more of the wonderful adventures of that Admirable Crichton of cosmopolitan free-lances, "Klondyke" Boyle—also Canadian as MacLean's readers know.

Flaherty of Belcher Island

THIS is where the natives wear duck feather kimonas, in a part of Canada which even the geologists and explorers didn't know existed until a few years ago. Of course, you would expect the discoverer to be an Irishman—and in February 1 MACLEAN'S you can read how Flaherty found his island, and what he discovered there—the richest iron ore deposit in the world, but—can it be transported to market?

Other Features are:

"Breed," by Archie P. McKishnie.
"The Thread of Flame," the Basil King serial.
"His Majesty's Well-Beloved," the concluding instalment of the Orczy serial.
"Canada Has a Movie Future," by Allan Dwan.
"Spanish Doubloons," more of Camilla Kenyon's rollicking adventure story.
"Mr. Phipps of the 'Old Firm'," by A. Appleby Terrill.

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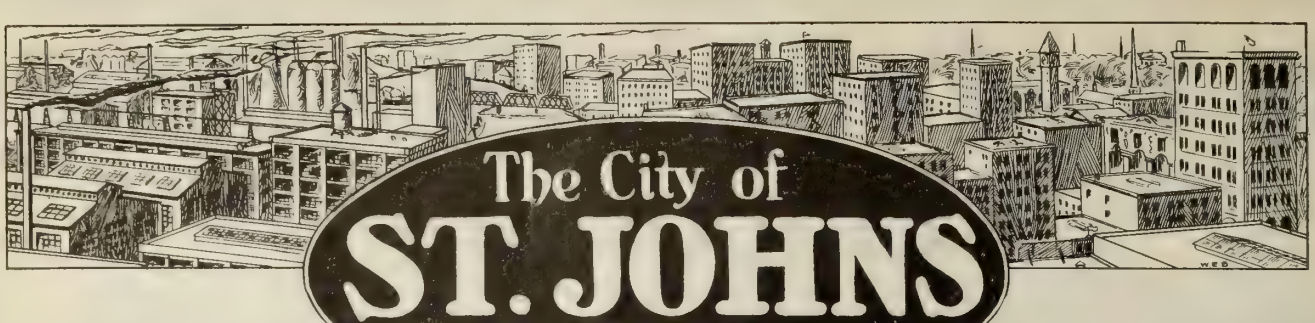
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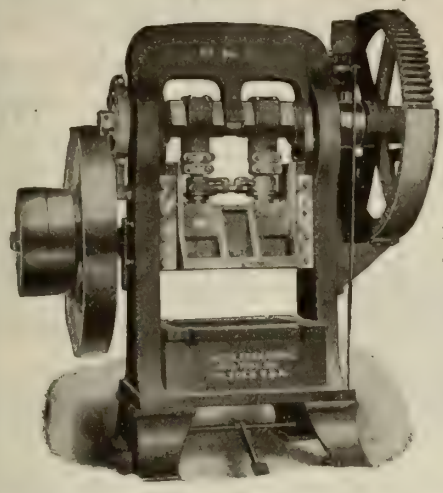
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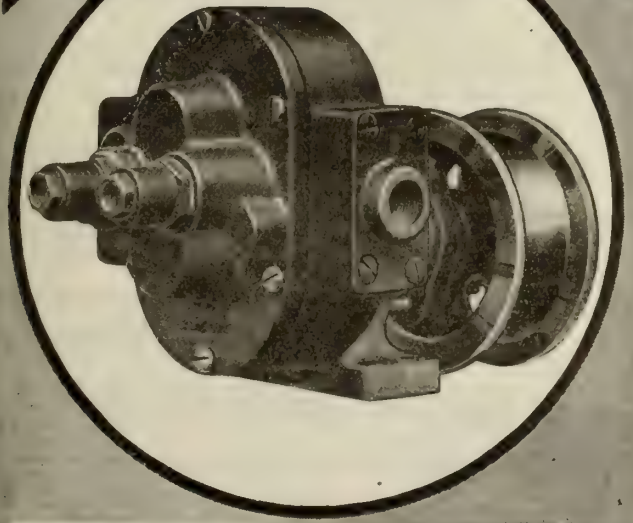
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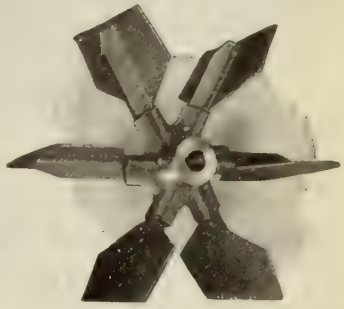
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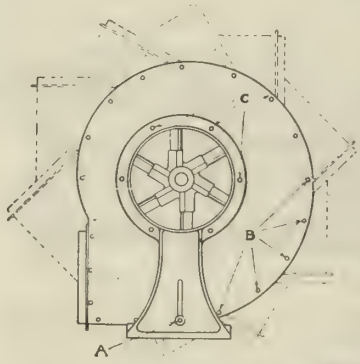
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

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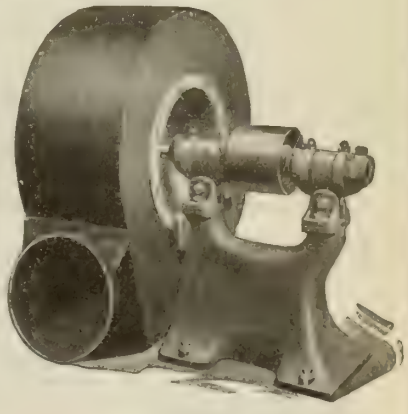


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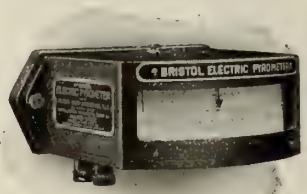
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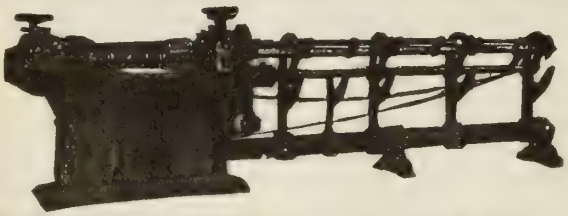
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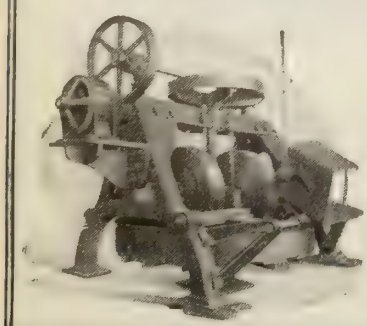
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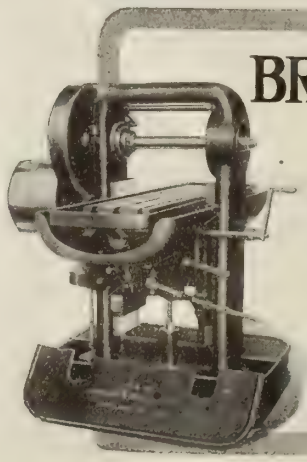
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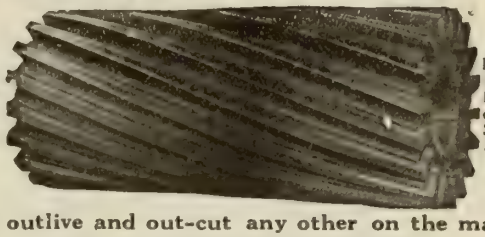
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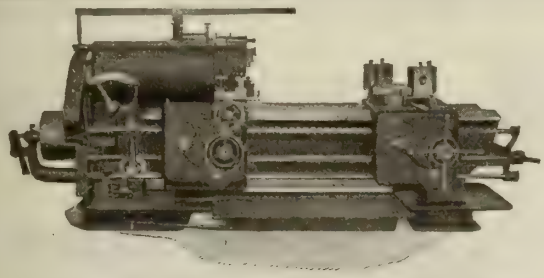
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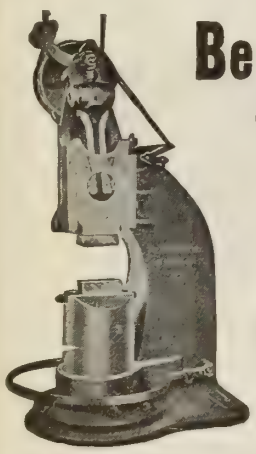
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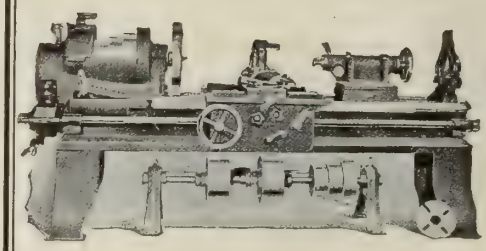
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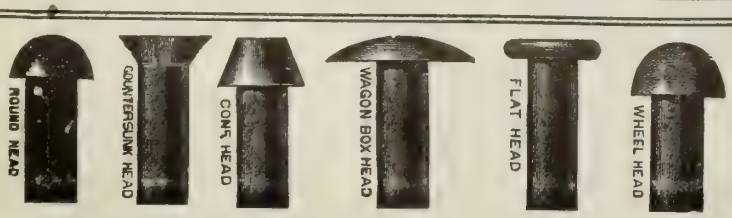
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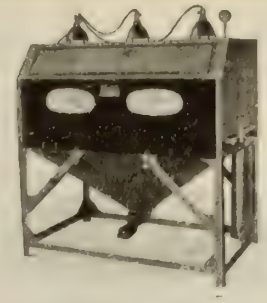
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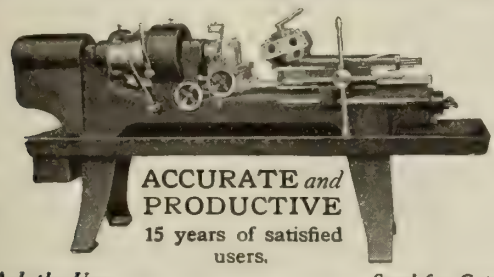
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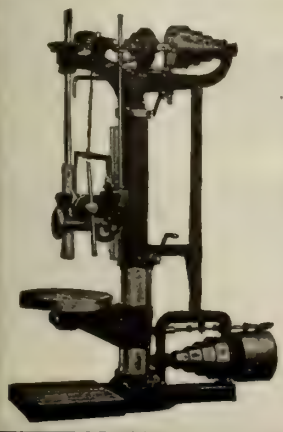
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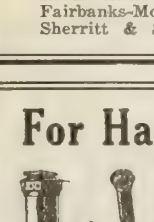
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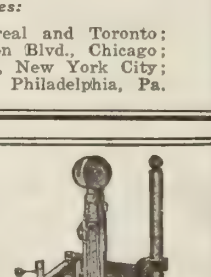
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Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glasseo, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
U. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St. Lawrence Welding Co. Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St Lawrence Welding Co. Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto, Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS. COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MAGHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES. CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
[illegible]ence Welding Co. Ltd., Mon[illegible]

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS. SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS. NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont

CHEMISTS
Toronto Testing Laboratory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Williams & Co., J. H., Brooklyn, N.Y.

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.



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WHETHER poring over a blue print, figuring a cost sheet, or mounting a ladder to inspect line shafting, the S K F representative virtually goes on your payroll the minute he enters your plant.

So every S K F man justifies the basic S K F policy. He is a salesman only as he serves.

Not to hear bearings exploited, but to absorb the latest ideas on reducing friction—this is why the manufacturer sends for the S K F sales engineer.

And what more authentic advice is to be had than the engineering knowledge of anti-friction experts, supported by the impartial research of thorough, well-equipped laboratories?

Manufacturers are invited to avail themselves of this service.

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412 St. James St.
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Hess-Bright Ball Bearings
S K F Ball Bearings
Atlas Steel Balls
Gronkvist Chucks
Transmission Hangers

If interested tear out this page and place with letters to be answered.

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Northern Electric Co., Ltd., Montreal Que

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Canada Found'a & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found'a & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co. Ltd. Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

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Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND (BORTZ)
Imiss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

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Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

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Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

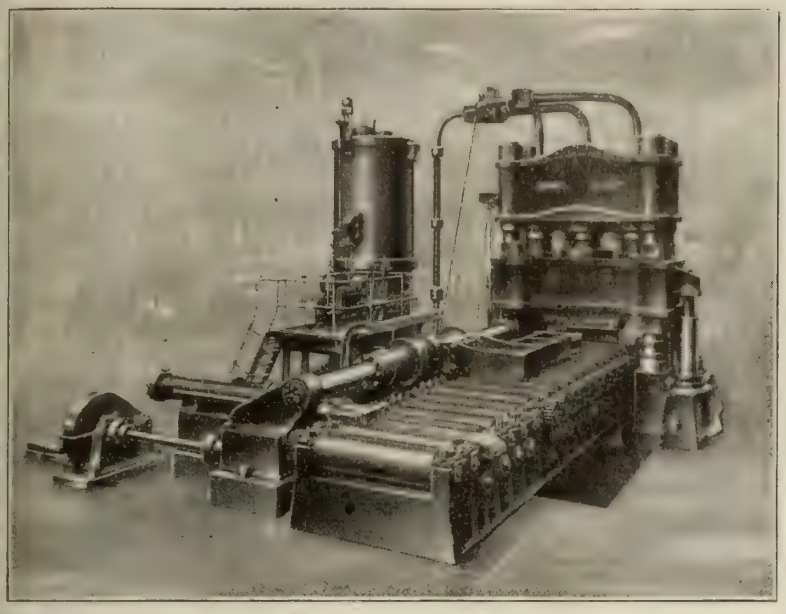
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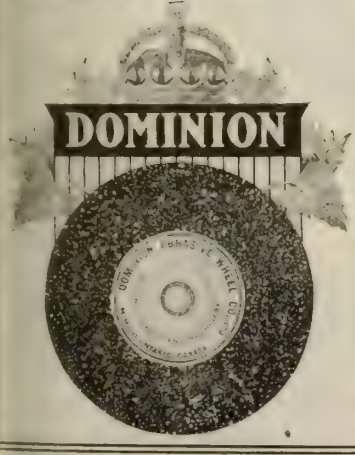
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Silver Mfg. Co., Salem, Ohio.

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Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
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Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
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Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

EMBOSSING PRESSES
Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que.
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

FILES, COMMUTATOR SLOTTING
Lyman Tube & Supply Co., Montreal, Que.

FILING MACHINES, BENCH AND MOTOR DRIVEN
Barry Mfg. Co., Chicago, Ill.

FILTERING AND CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamilton

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Lincoln Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

FORGINGS, DROP, AUTOMOBILE AND LOCOMOTIVE FORGING AND WELDING
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal.

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

FUEL OIL SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal.

FURNACES, ANNEALING, CASE HARDENING AND TEMPERING
Bellevue Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que

GALVANIZING FLUX
British Smelting & Refining Co., Ltd., Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Montrea, Que.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton & Mfg. Co., Boston, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Can., Galt, Ont
Wilton Tool & Mfg. C., Boston, Mass.

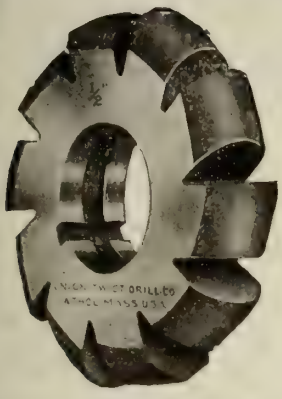
GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. C., Boston, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. C., Boston, Mass.

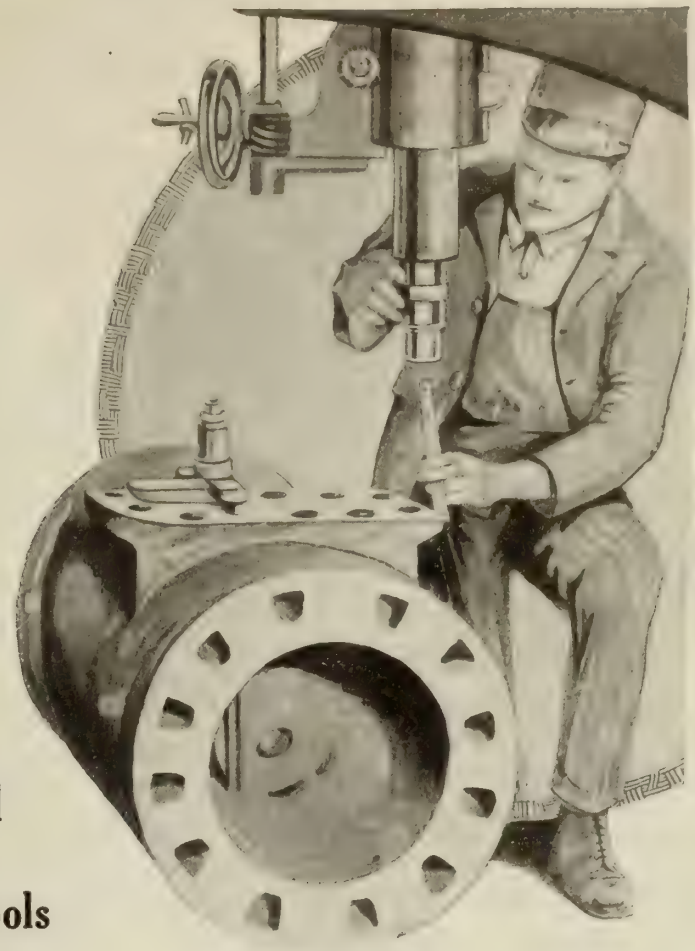
GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

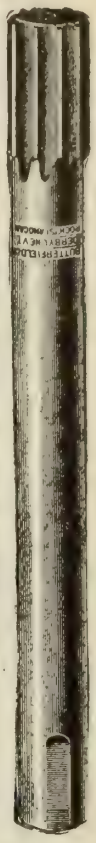






A Standard of Quality in Small Tools





BUTTERFIELD

Taps, Dies, Drills, Reamers, and Milling Cutters









Our concentration for thirty-five years on the construction of tools of the finest quality and our continuous striving towards absolute perfection in the art of tool-making, have resulted in the unexcelled qualities of Butterfield Tools, in their durability and keen-cutting qualities, in the economy which has made them standard equipment in shops which keep a careful check on tool expense.

Butterfield & Co., Inc.

Rock Island, Quebec

If interested tear out this page and place with letters to be answered.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mche. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston, Mass.

GEAR BLANKS
Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES ,REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEAR SHAPERS AND CUTTERS
Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

GENERAL MACHINE WORK
Elliott & Whitehall, Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

GOGGLES
Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAVITY CARRIERS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CUTTER
Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, PORTABLE, ELECTRIC HAND, TOOL POST, FLOOR AND BENCH
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

GRINDERS, UNIVERSAL, PLAIN
Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Atkins & Co., E. C., Hamilton, Ont
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING MACHINES, CAR WHEEL, CUTTER, CYLINDRICAL, CRANKSHAFT
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

GRINDING WHEELS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

GUARDS, WINDOW AND MACHINE
Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

GUTTERS AND SKYLIGHTS
H. H. Robertson, Ltd., Sarnia, Ont.

HACK SAW BLADES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
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Rice Lewis & Son, Toronto, Ont.
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Wells Bros. of Canada, Galt, Ont.

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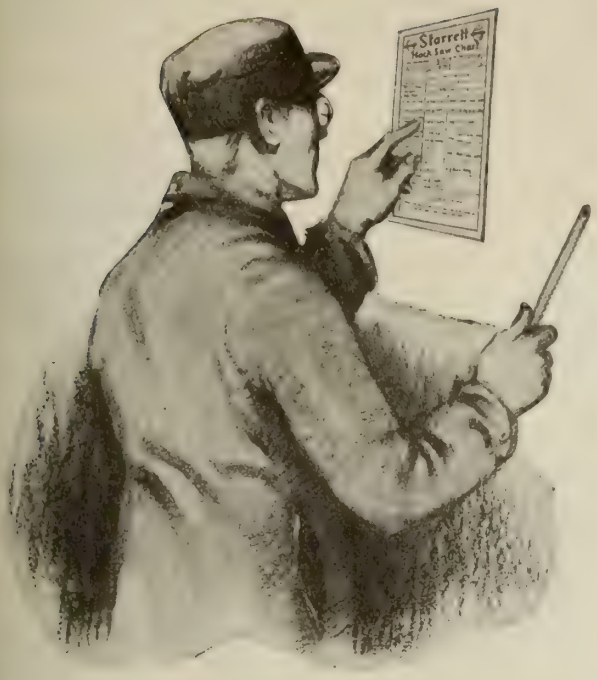
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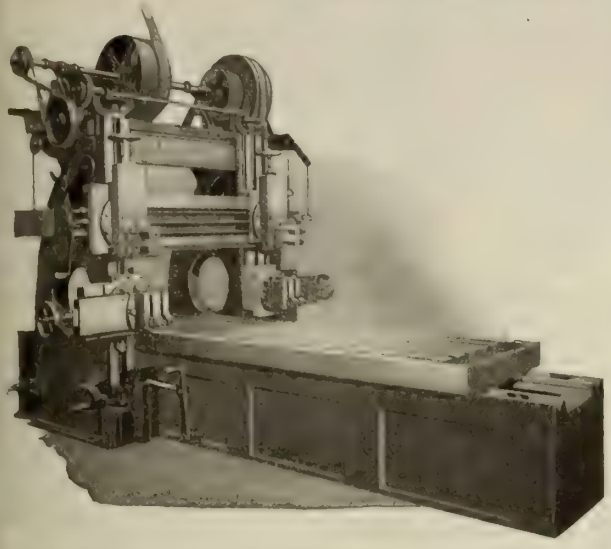
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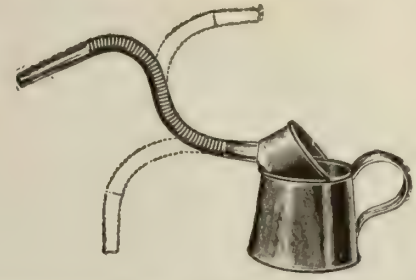


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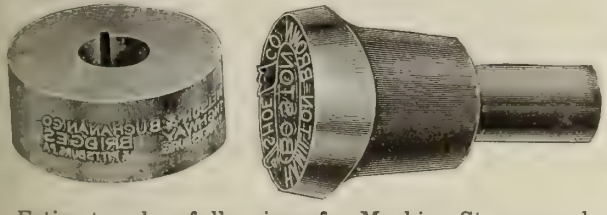
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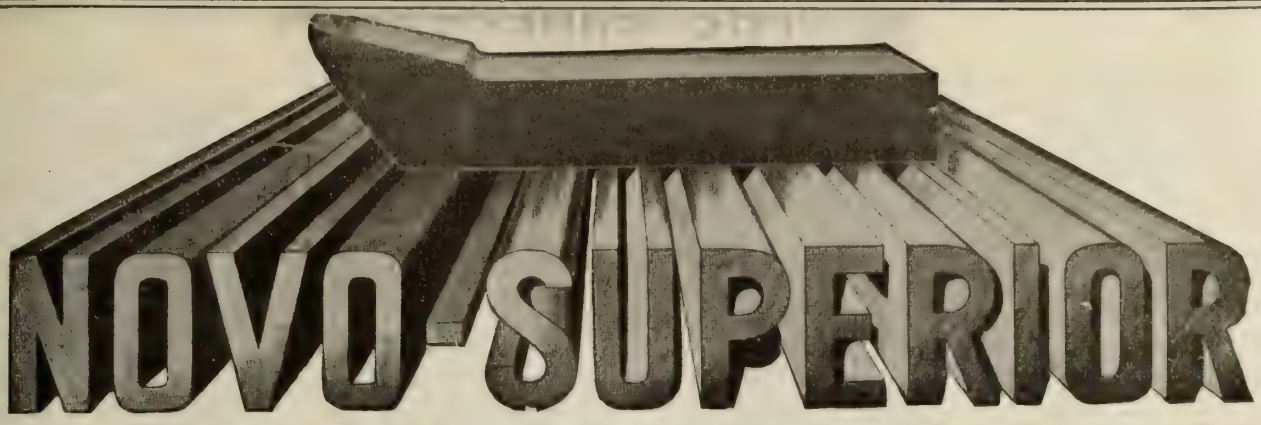
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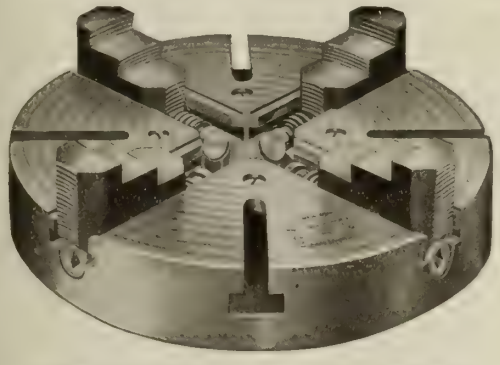
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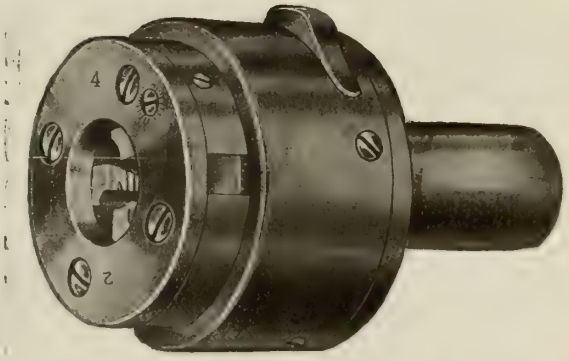
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Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York.
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 115 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.

REAMERS, HAND
Butterfield & Co., Inc. Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland.

RIVETS.
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Ganonoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX, MONEL METAL BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Dom. Steel Products Co., Ltd., Brantford

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd, Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT

SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Lawrence Welding Co, Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAIN
Puro Sanitary Drinking Fountain Co, Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng
Hunter Saw & Machine Co., Pittsburg
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburg
Wells Bros. of Can., Galt, Ont.

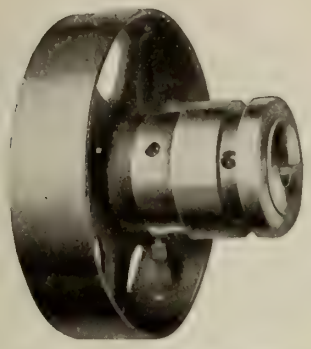
SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

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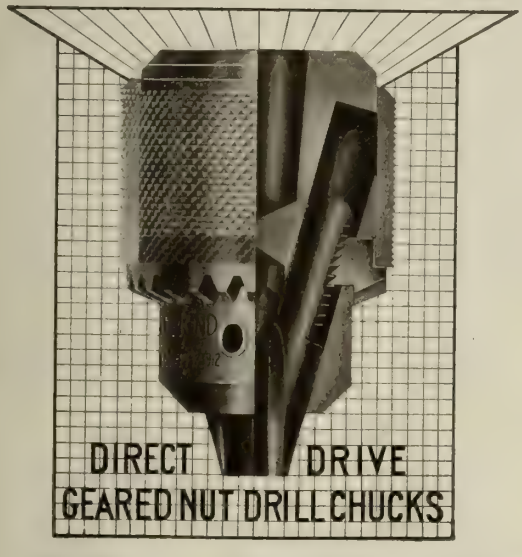
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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

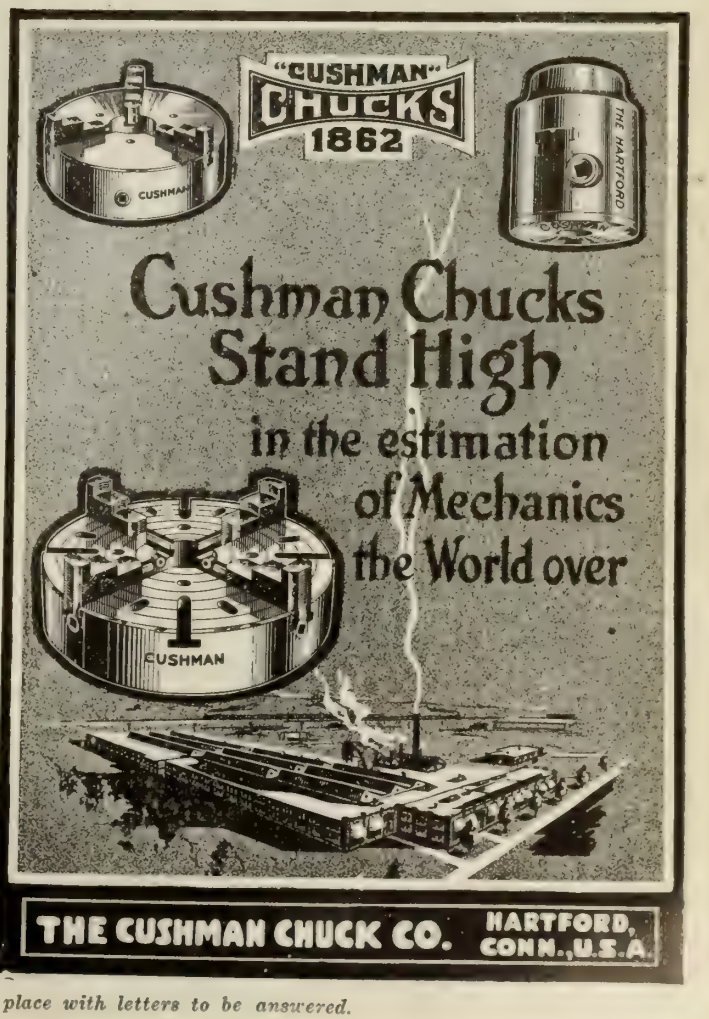
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TEETH cut on the nut giving DIRECT DRIVE and the hardened steel Pinion Bushings which prevent wear, insure long life.

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LATHE CHUCKS, RIGHT ANGLE TRANSMISSIONS, MICROMETER CALIPERS, FLEXIBLE STEEL TUBING

T. R. Almond Mfg. Co., Ashburnham, Mass.



THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

If interested tear out this page and place with letters to be answered.

SCALES
Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co. A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allestatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatter, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peek, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
J. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Vesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mchy. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss No., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa.
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont.
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Bolker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

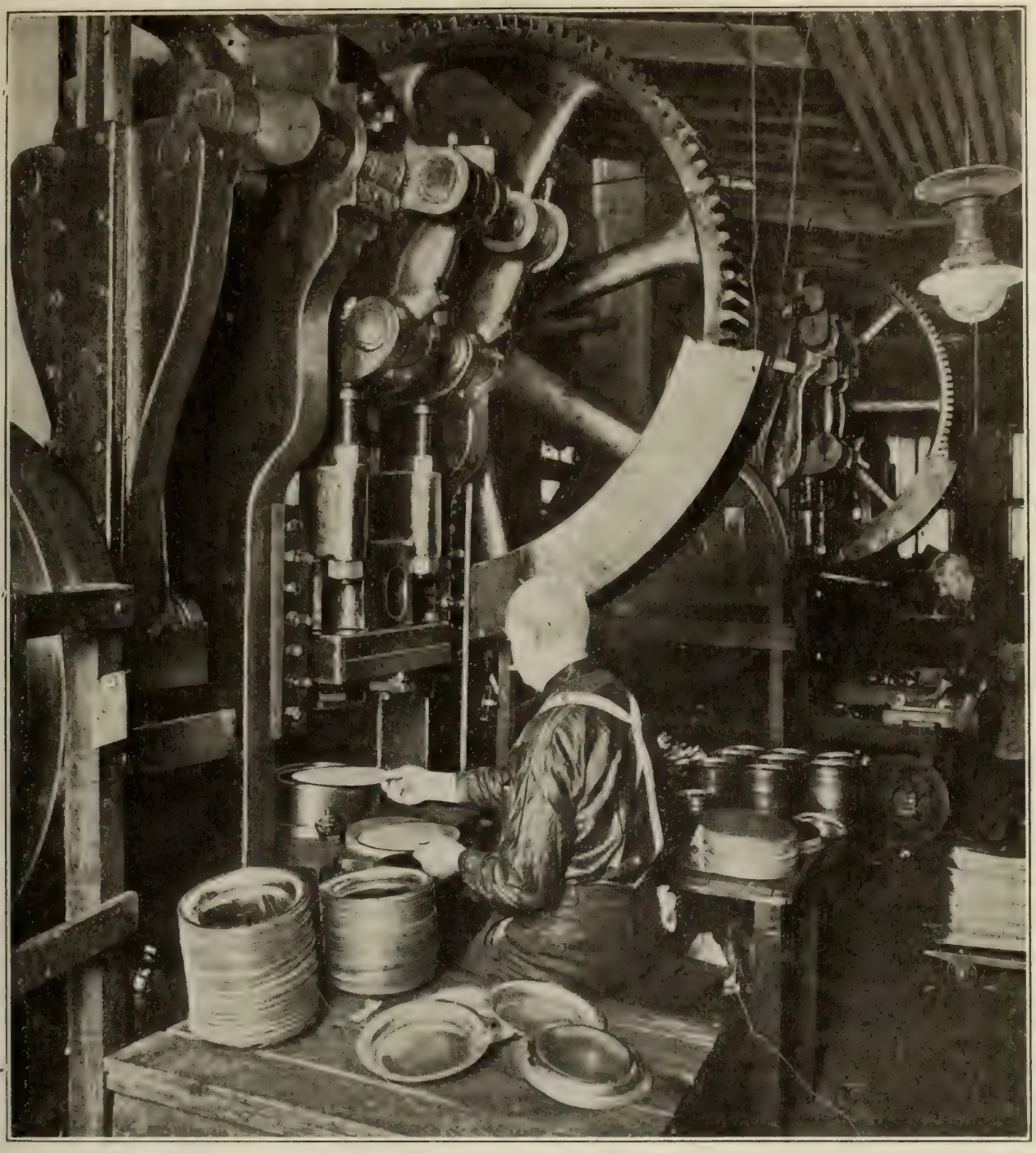
STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.



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If interested tear out this page and place with letters to be answered.

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Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co. Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co, Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd, Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Niles-Rement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED, TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont
U. S. Electrical Tool Co., Cincinnati, O

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.
U. S. Ordnance, Toronto, Ont.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal

Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.
U. S. Ordnance, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
U. S. Ordnance, Toronto, Ont.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass.

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES, LATHES
Acme Mach. Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto.
Greenfield Tap & Die Corp., Greenfield
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich.
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis.
Warner & Swasey Co., The, Cleveland, O.

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q.
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que.

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Rement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal.

VALVES, MIXING
Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, REDUCING, REGULATING
St Lawrence Welding Co, Ltd., Montreal

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.
St Lawrence Welding Co, Ltd., Montreal

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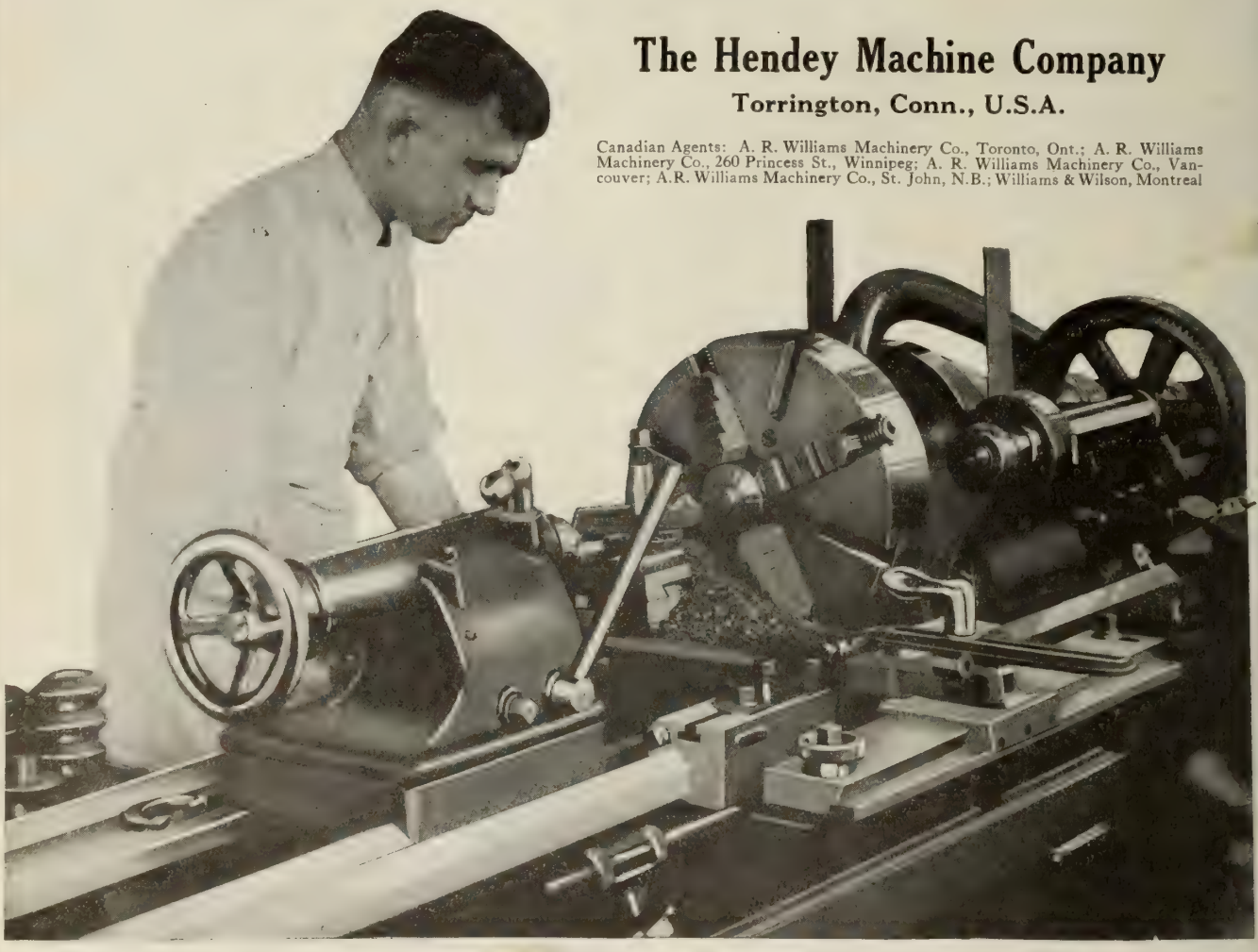
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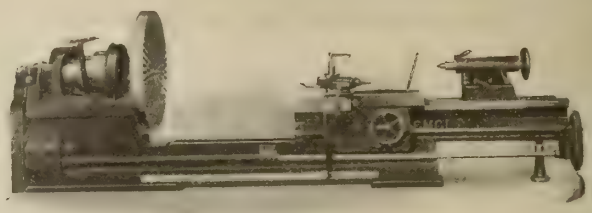
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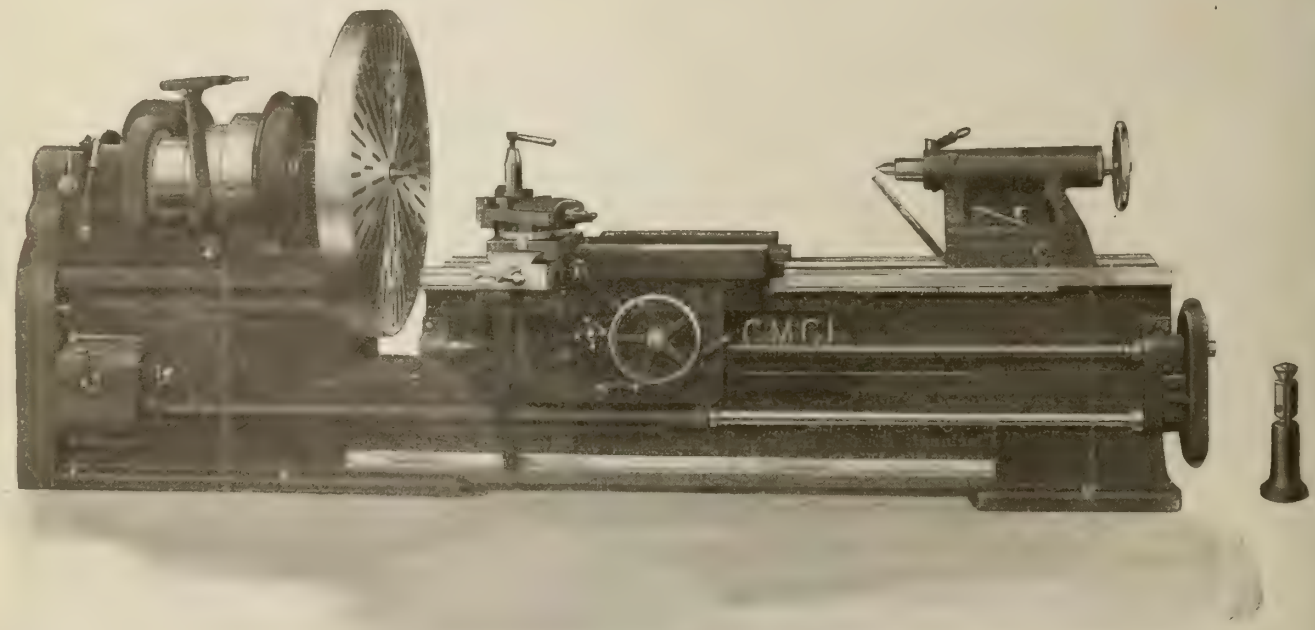
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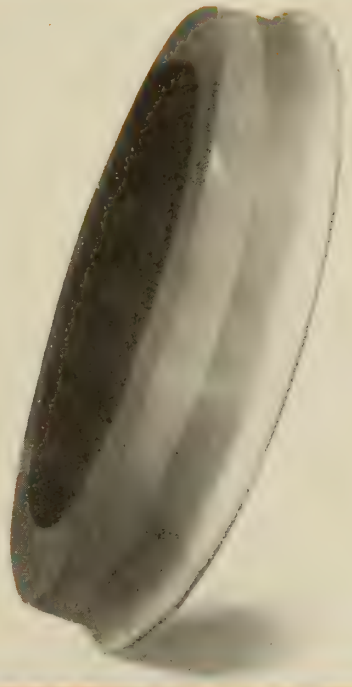
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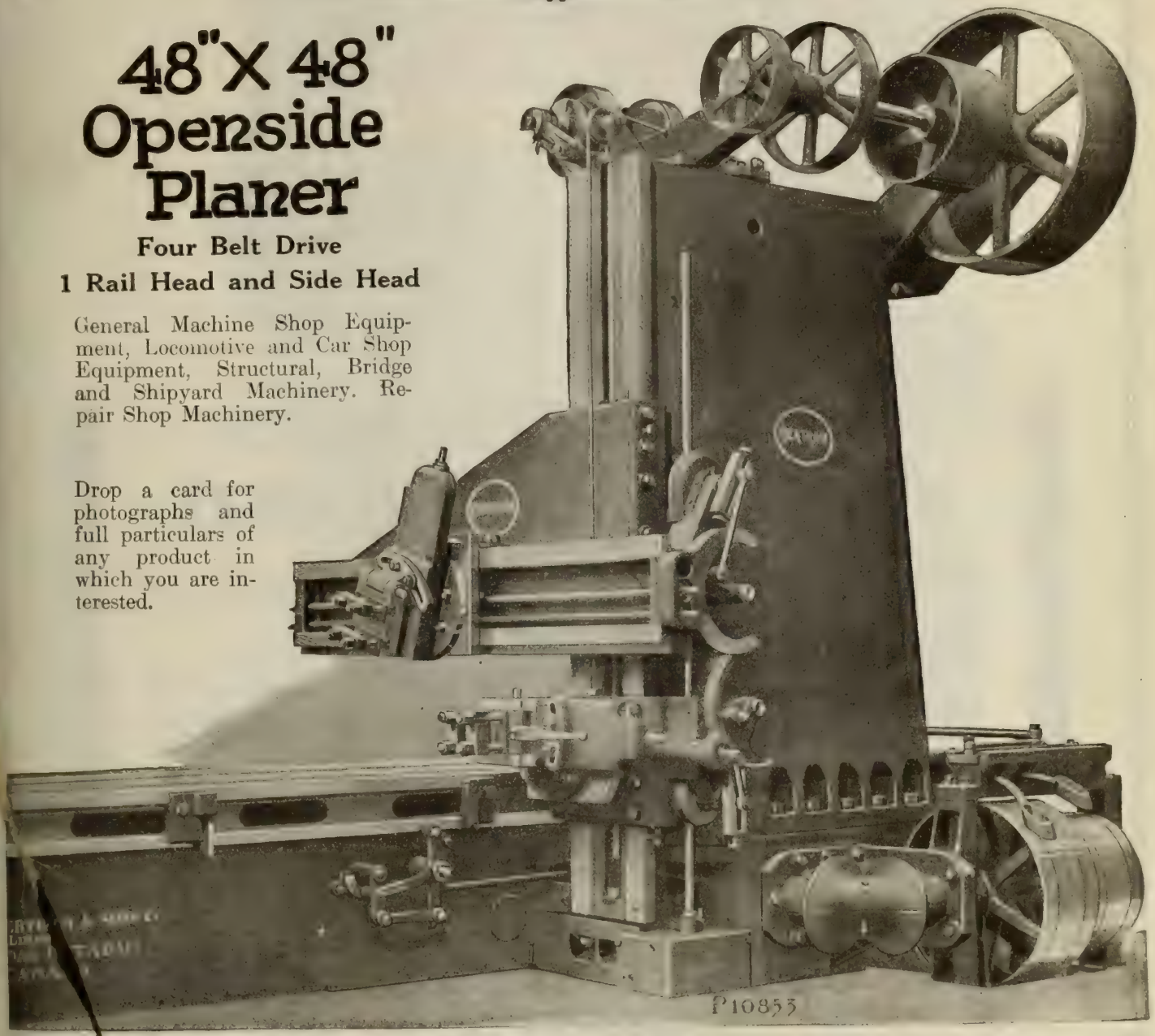
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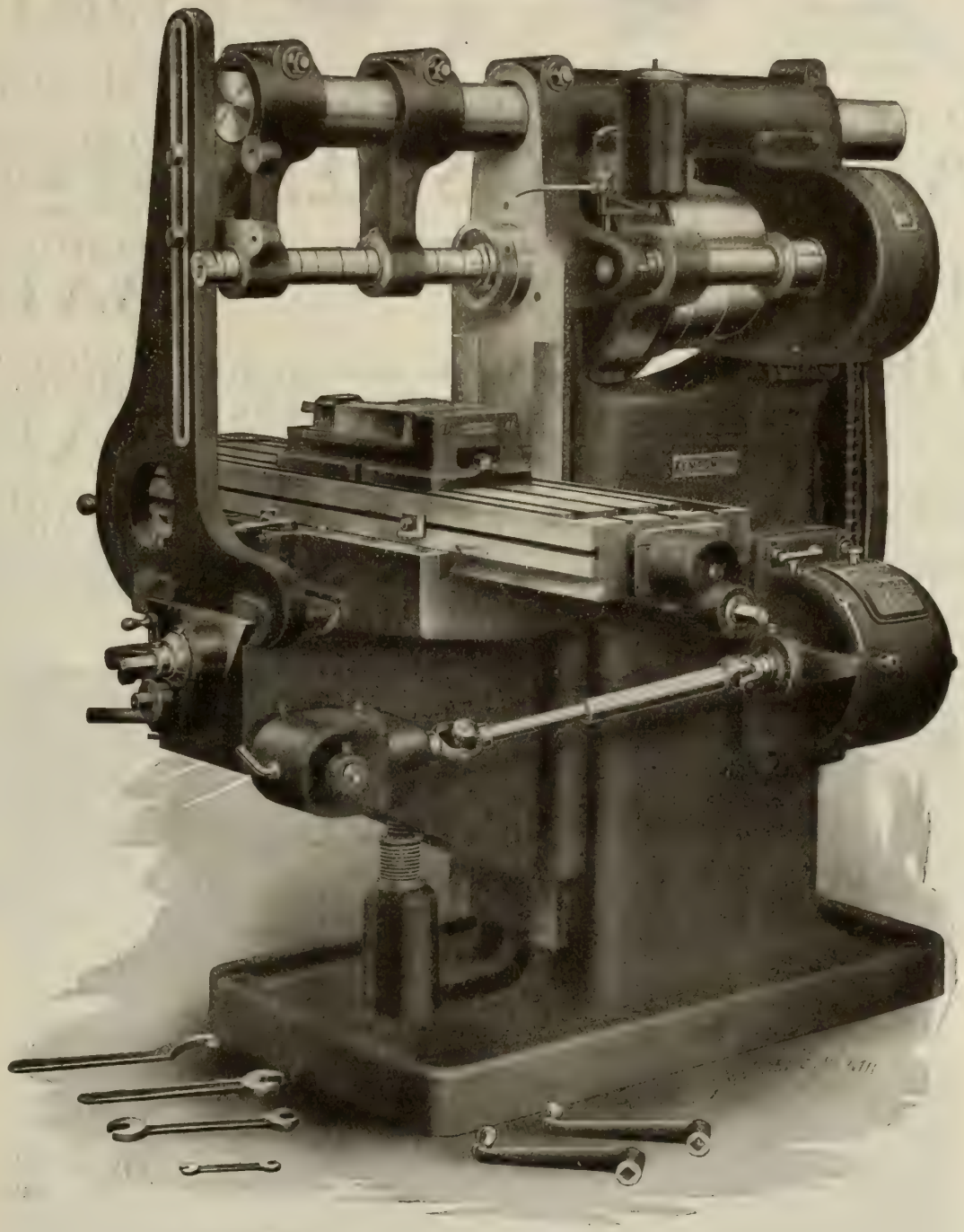


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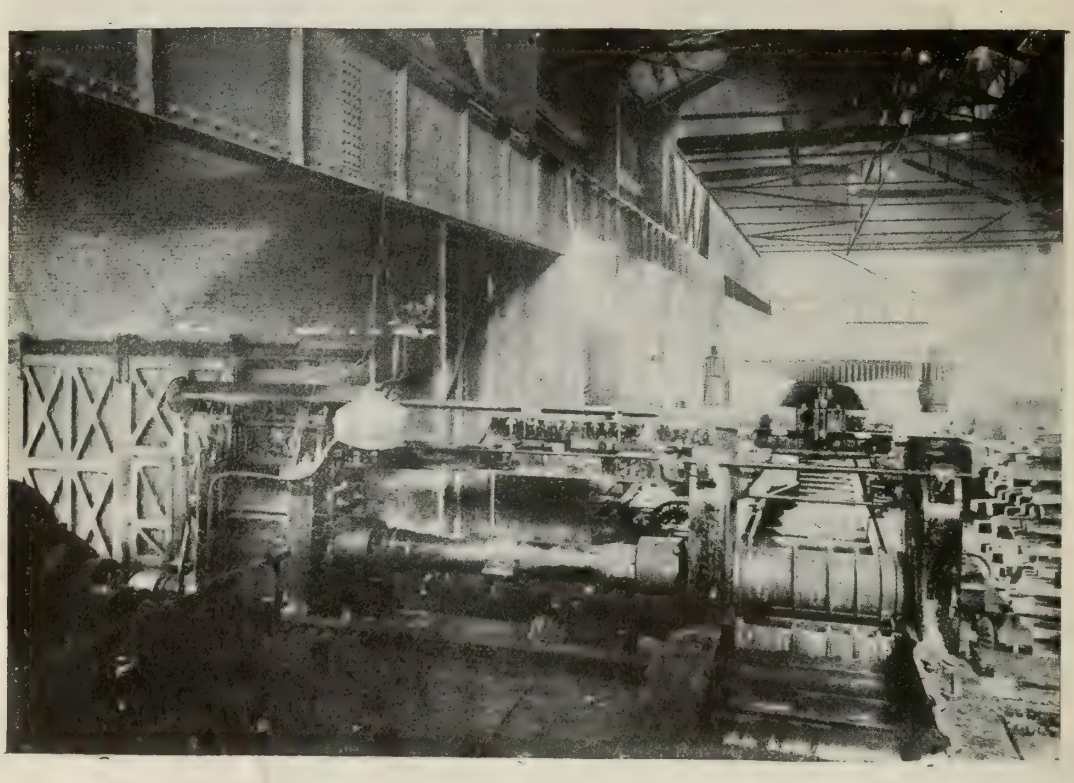
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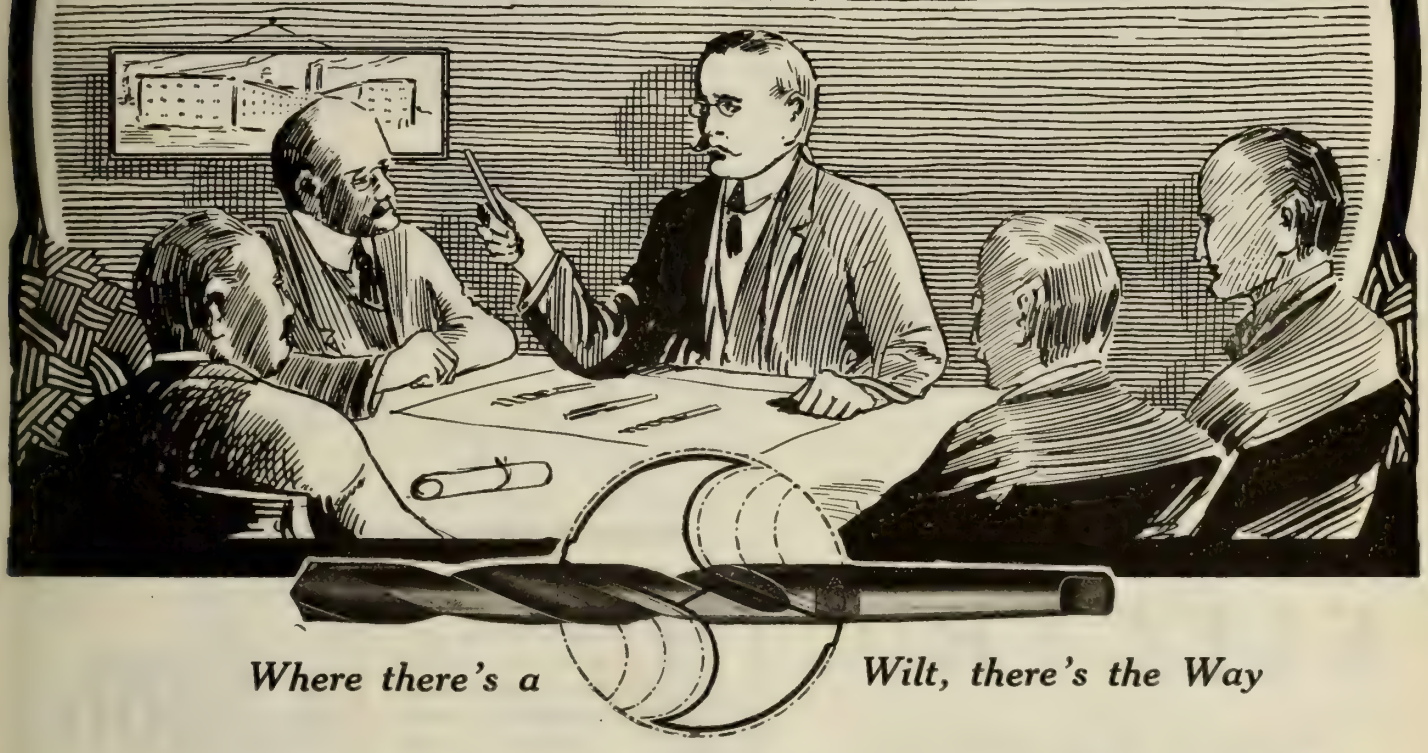
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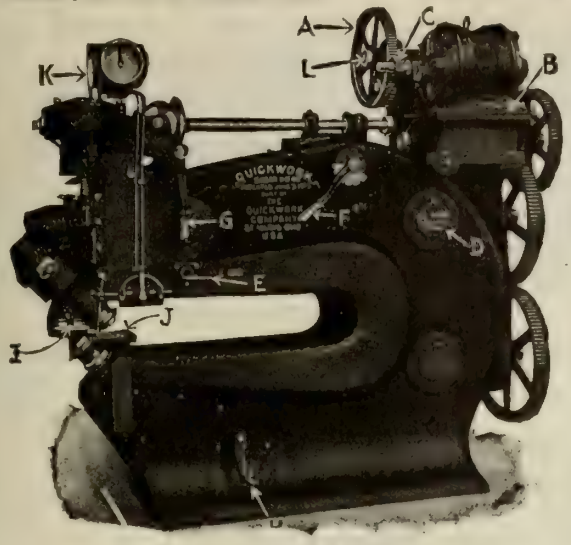
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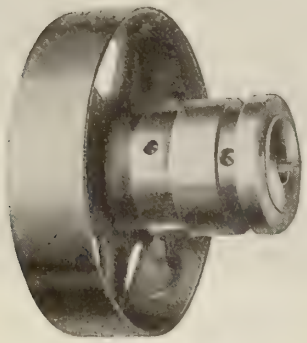
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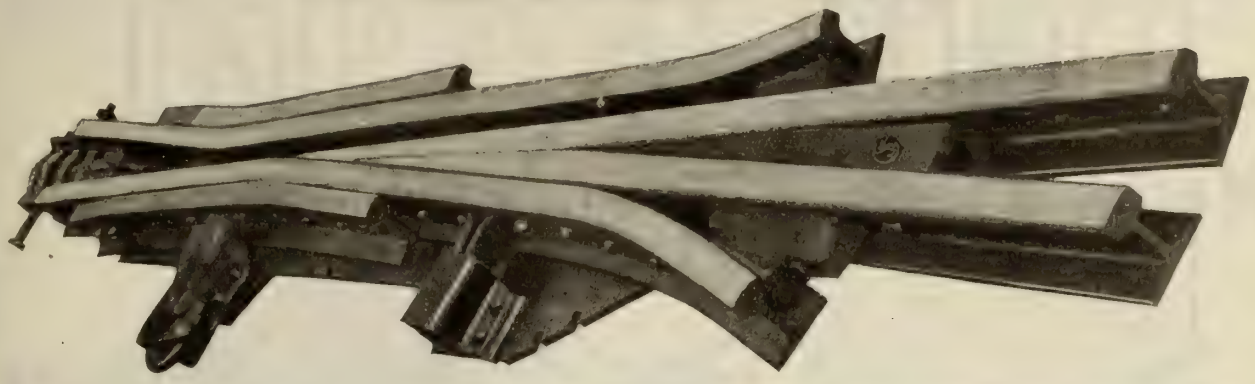
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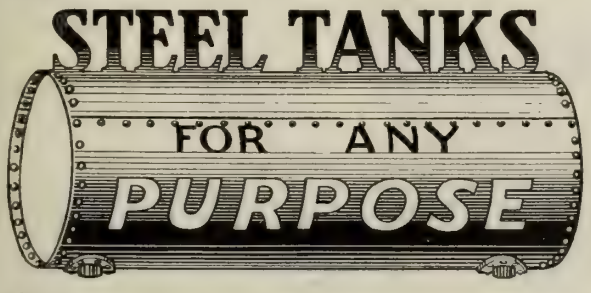
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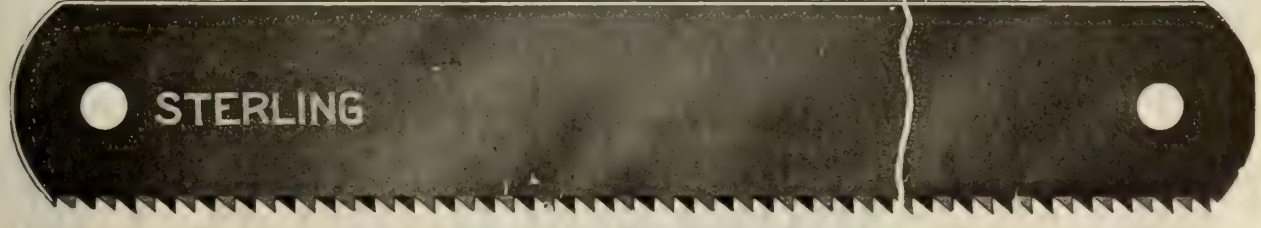
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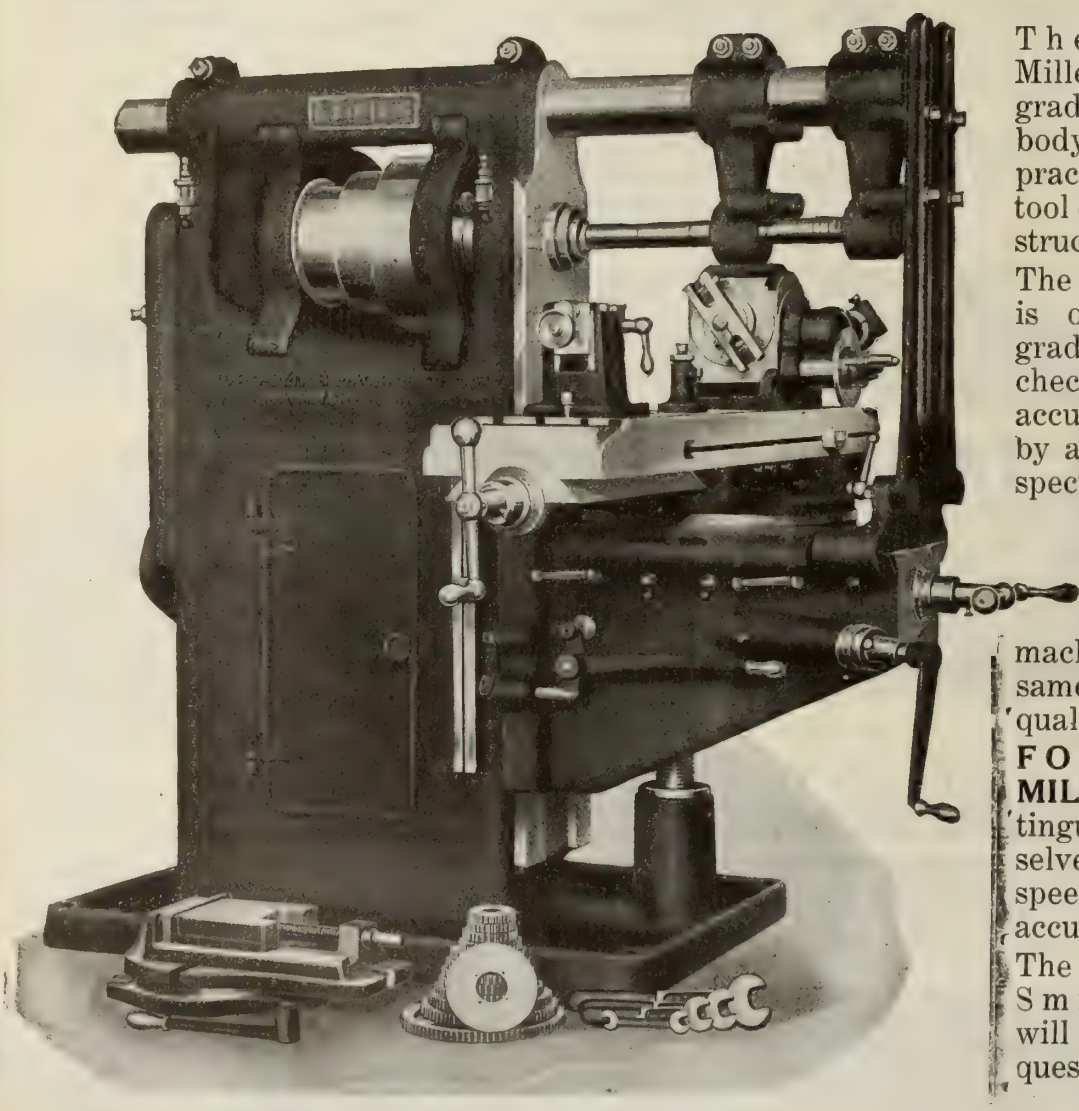
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The Ford-Smith Miller is a high-grade machine embodying the best practice in machine tool design and construction.

The workmanship is of the highest grade and is rigidly checked for both accuracy and finish by an elaborate inspection system.

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FORD-SMITH MILLERS have distinguished themselves for power, speed and unfailing accuracy.

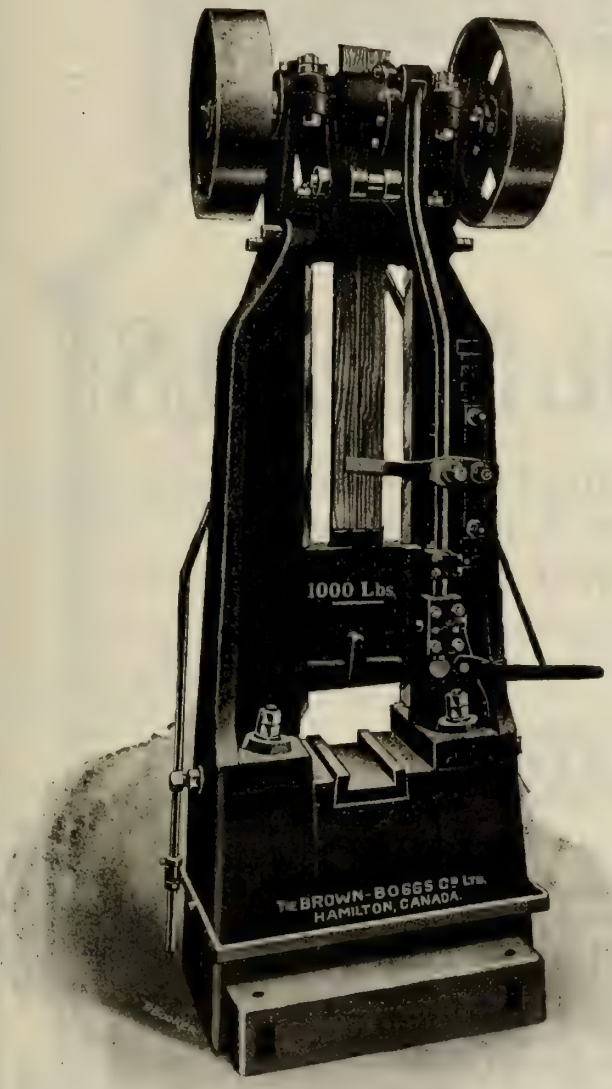
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Our latest type of hammers have exclusive features that add greatly to the life of the hammer as well as increasing the production.

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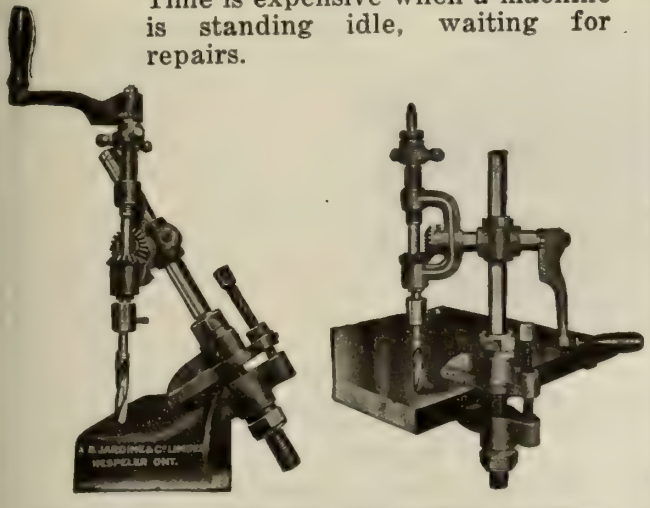
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Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

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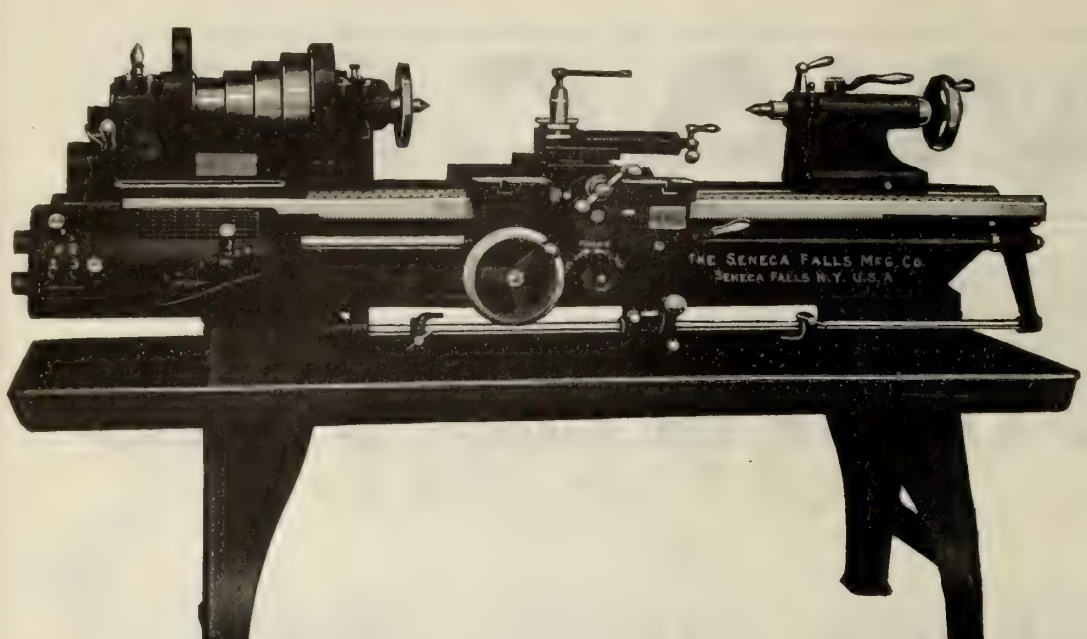
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A powerful rigid machine of the highest grade. A splendid lathe for the tool room or for accurate work in the machine shop.

Exclusive features which indicate the perfection of design are the Micrometer Adjusted Automatic Cross Feed Stop, the apron reverse for carriage and cross slide, and the range of 48 threads or feeds instantly available without removing a gear.

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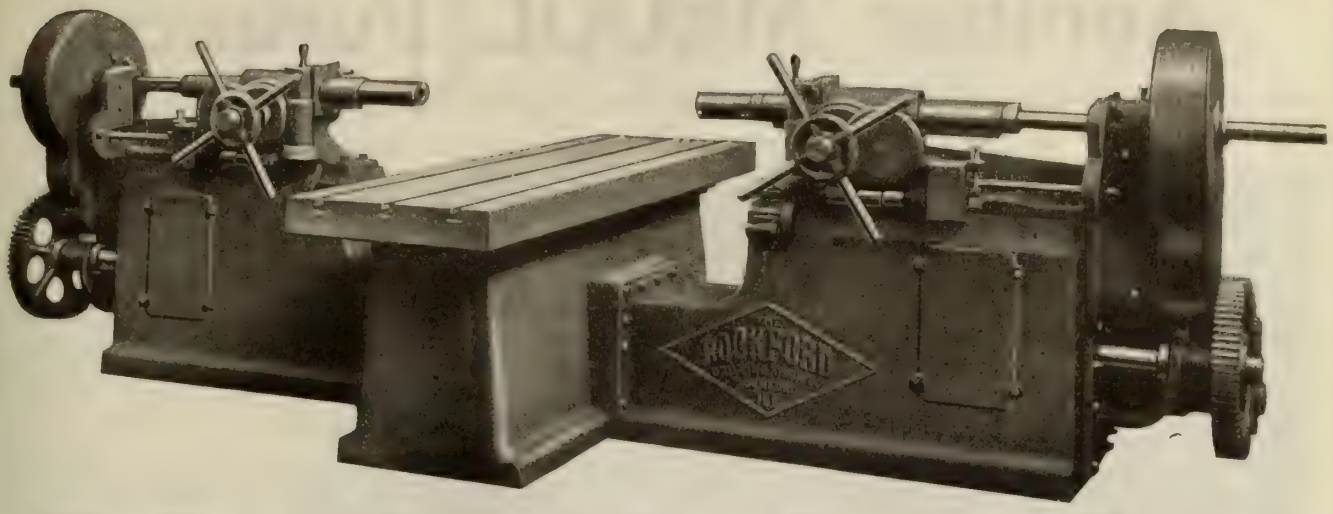
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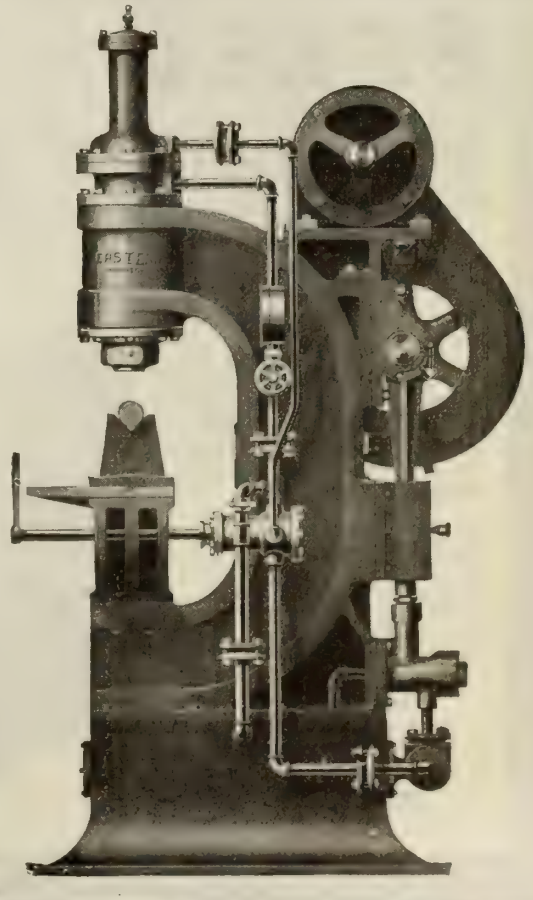
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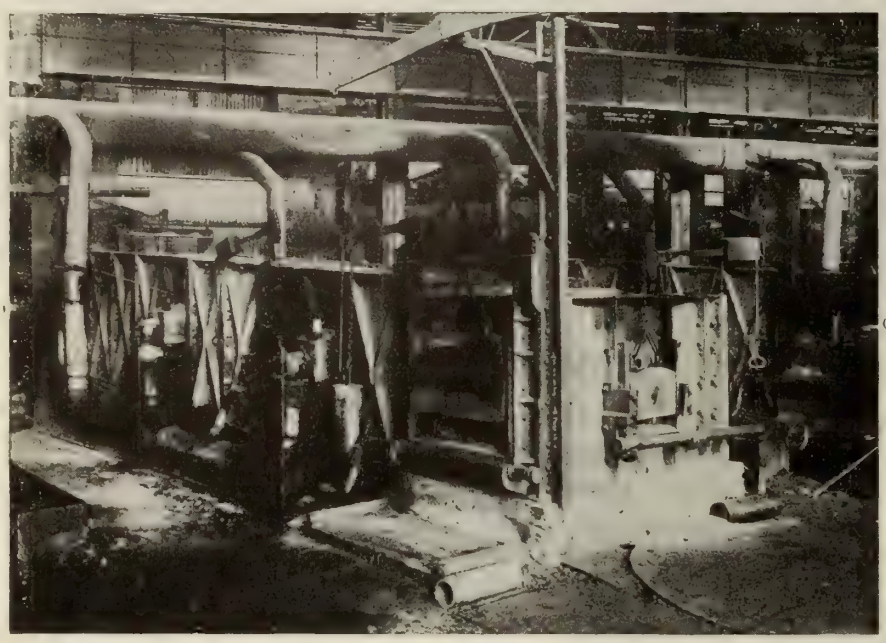
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demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

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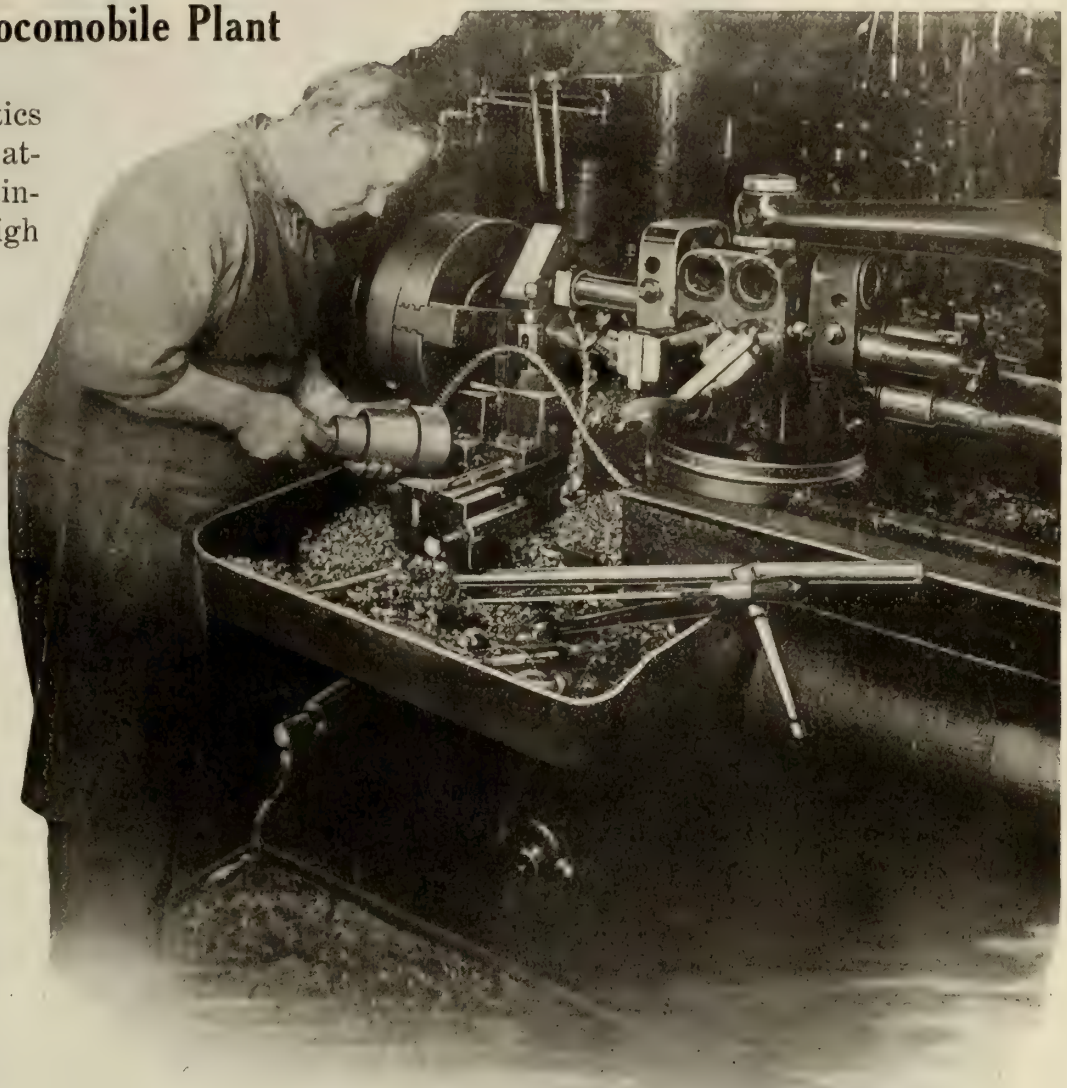
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These automatics are the means of attaining and maintaining the high standards of quality as required by these people.

Here we see the operator applying the plug gage, for he is held to very fine limits; but the automatics do it easily, no matter whether the work is reaming, boring, milling, threading or facing. In fact, in the making of duplicate parts, the number of operations that the P. & J. will handle is almost unlimited.

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Clutch Pinion Drive Sleeves 3¼ inches long, 3⅜ inches outside diameter and have 2¼inch hole.

On your work the operator may be able to handle two to six machines.

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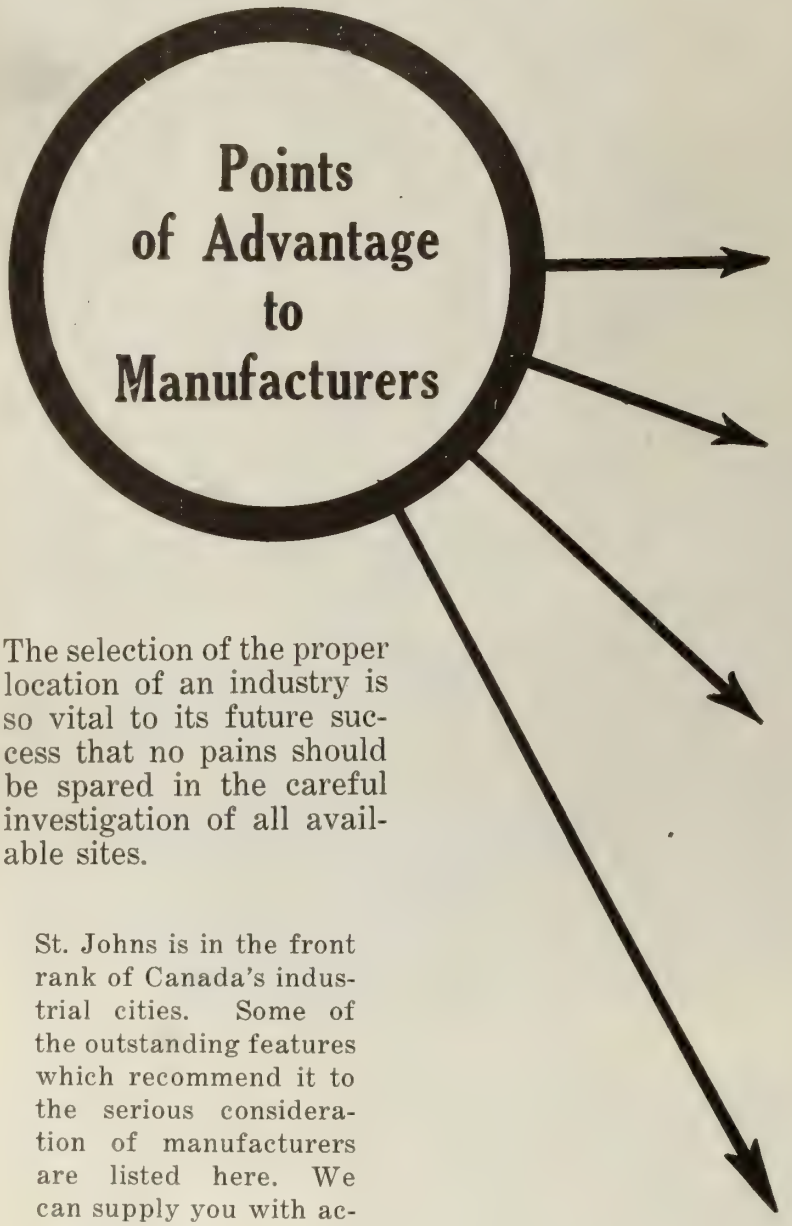
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A nerve centre for railway traffic in Canada and with the Eastern States. Seven railways, including the C.P.R. and G.T.R. run through the city and are interconnected in the St. Johns yards by a terminal switching company. St. Johns commands a lower freight rate and cheaper coal and labor than any other centrally located manufacturing city on the North American continent.

DIRECTLY CONNECTED BY RAIL WITH THE MONTREAL DOCKS, the finest facilities for ocean traffic in Canada, this city is peculiarly suitable for the American manufacturer locating in Canada for trade within the British Empire.

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St. Johns is in the front rank of Canada's industrial cities. Some of the outstanding features which recommend it to the serious consideration of manufacturers are listed here. We can supply you with accurate and detailed information on important conditions which are peculiar to **your** business. You risk a serious mistake if you do not include St. Johns in your investigations.

Secretary, Chamber of Commerce, St. Johns, Quebec, Canada

MILWAUKEE MILLING MACHINES



MILWAUKEE Vertical Milling Machines, like the horizontals, have a flanged spindle in place of a spindle with a threaded nose. The reverse for the spindle is self-contained—no overhead apparatus is necessary.

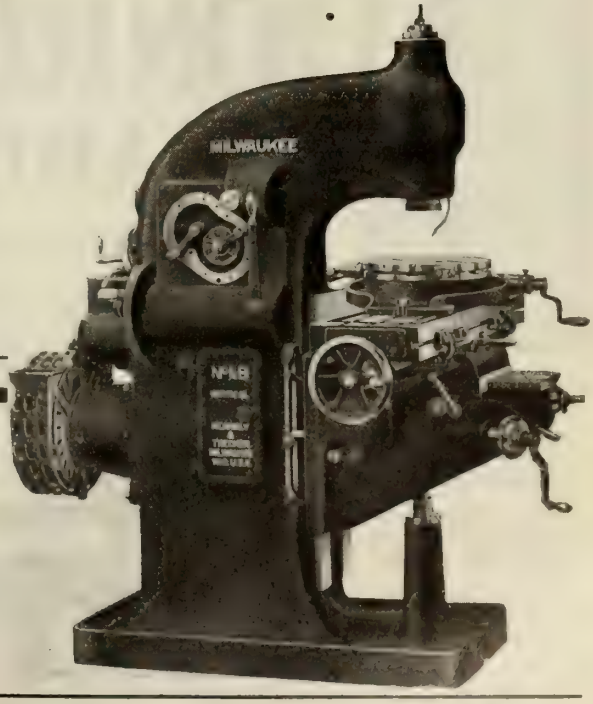
With the flanged spindle construction, cutters are held close to the spindle bearing and may be run in either direction that proves desirable. This is a most advantageous feature.

The spindle head is non-adjustable, except for wear, as sufficient adjustment for all practical purposes can be obtained by adjusting the knee alone. The non-adjustable spindle head construction is decidedly strong and rigid.

The main driving gear is always in a fixed position immediately behind the main bearing, reducing the torsional strain on the spindle and bringing the drive close to the cutter.

Milwaukee Vertical Milling Machines embody the same general features as the horizontal types. The column is a box section, semi-steel casting, reinforced with heavy vertical and horizontal internal walls. The knee is also a box section, semi-steel casting and has a solid top and extended slide. The table is of ample proportions and is not cored out but is finished all over, removing the possibility of distortion due to scale being left on one side.

Write for a copy of catalogue No. 21.



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Milwaukee, Wisconsin, U.S.A.

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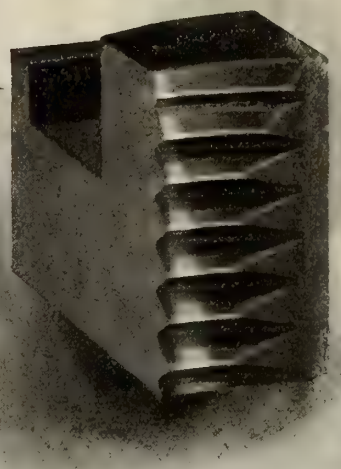
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The Chasers of the HARTNESS AUTOMATIC DIE hold this enviable position. Their superior efficiency is not a mere claim, but the verdict of expert mechanics based upon exhaustive tests covering many years of service.

For precision work, we can furnish chasers with a lead guaranteed within 0.001 inch per inch of thread.

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(AUTOMATIC DIE DEPARTMENT)

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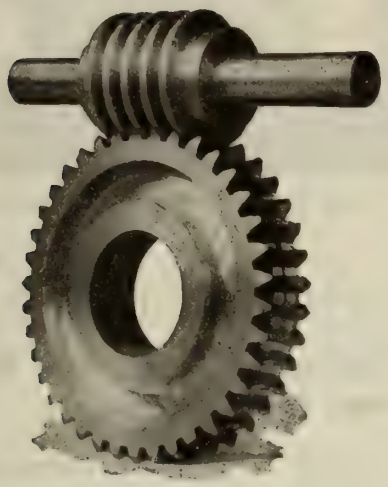
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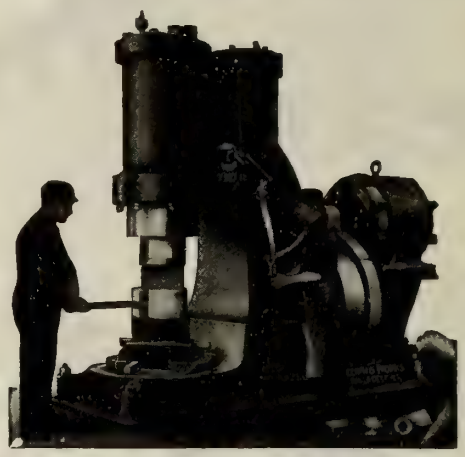
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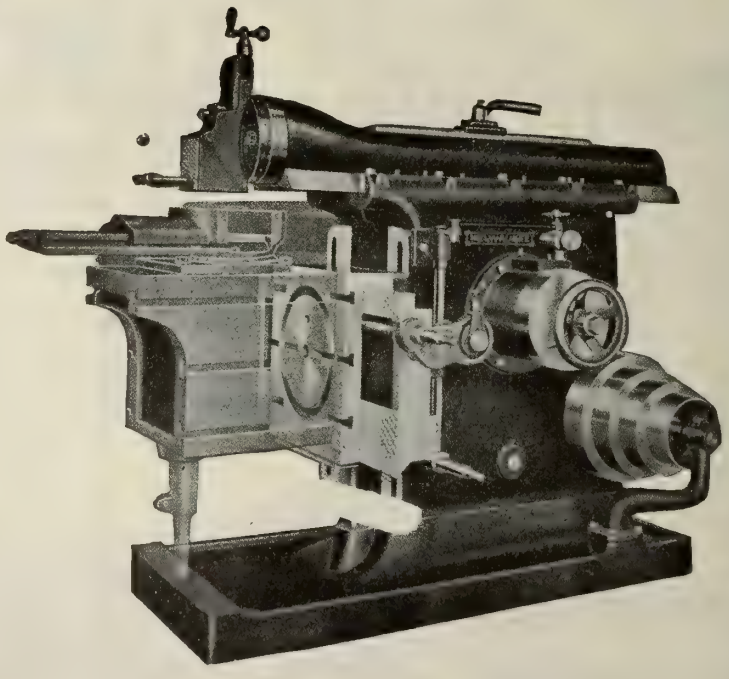
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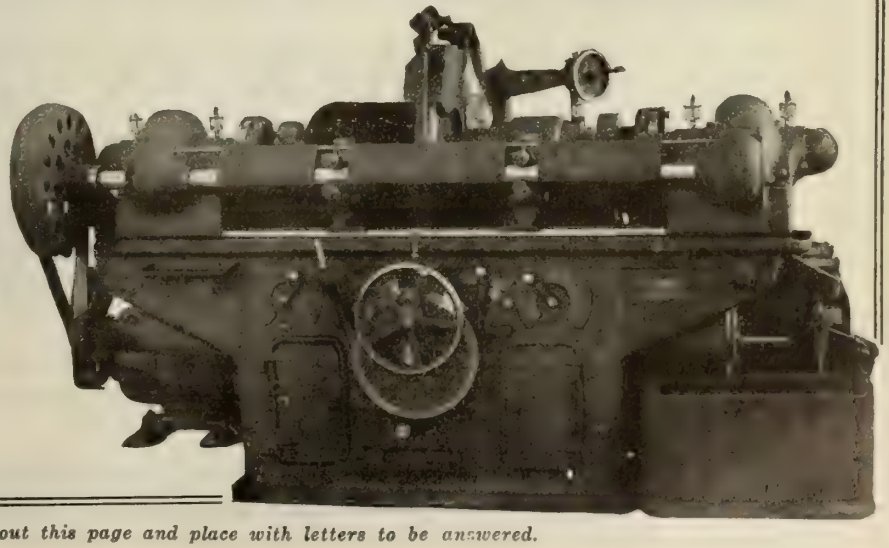
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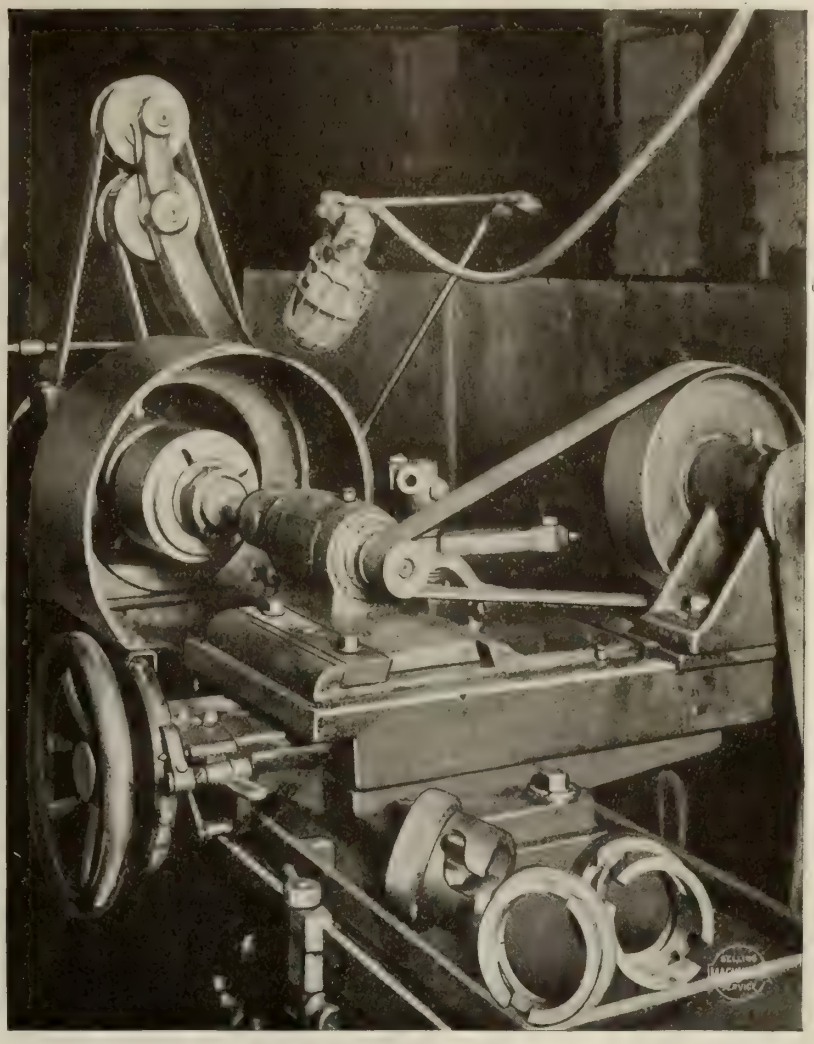
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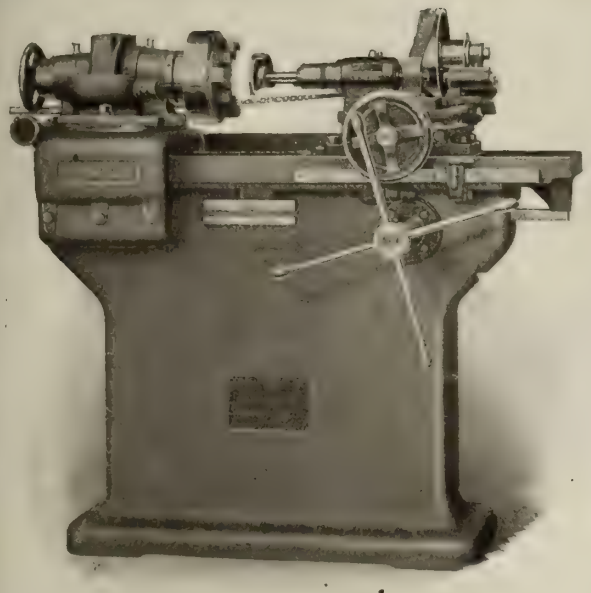
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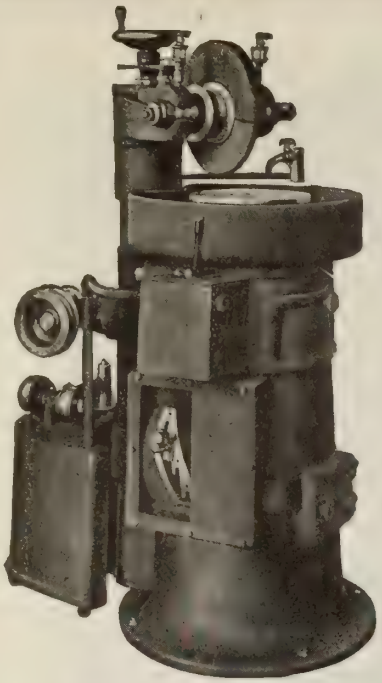
Note that the grinding in this photograph was not on a smooth, straight cylinder, but the walls were pierced by two irregular slots.

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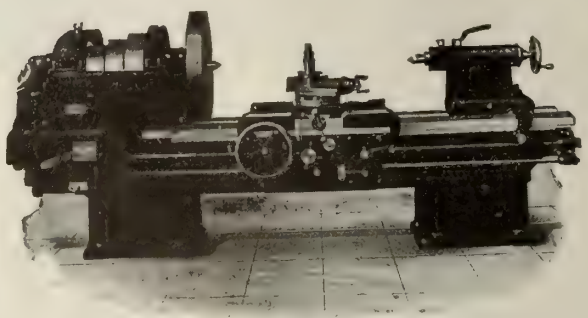
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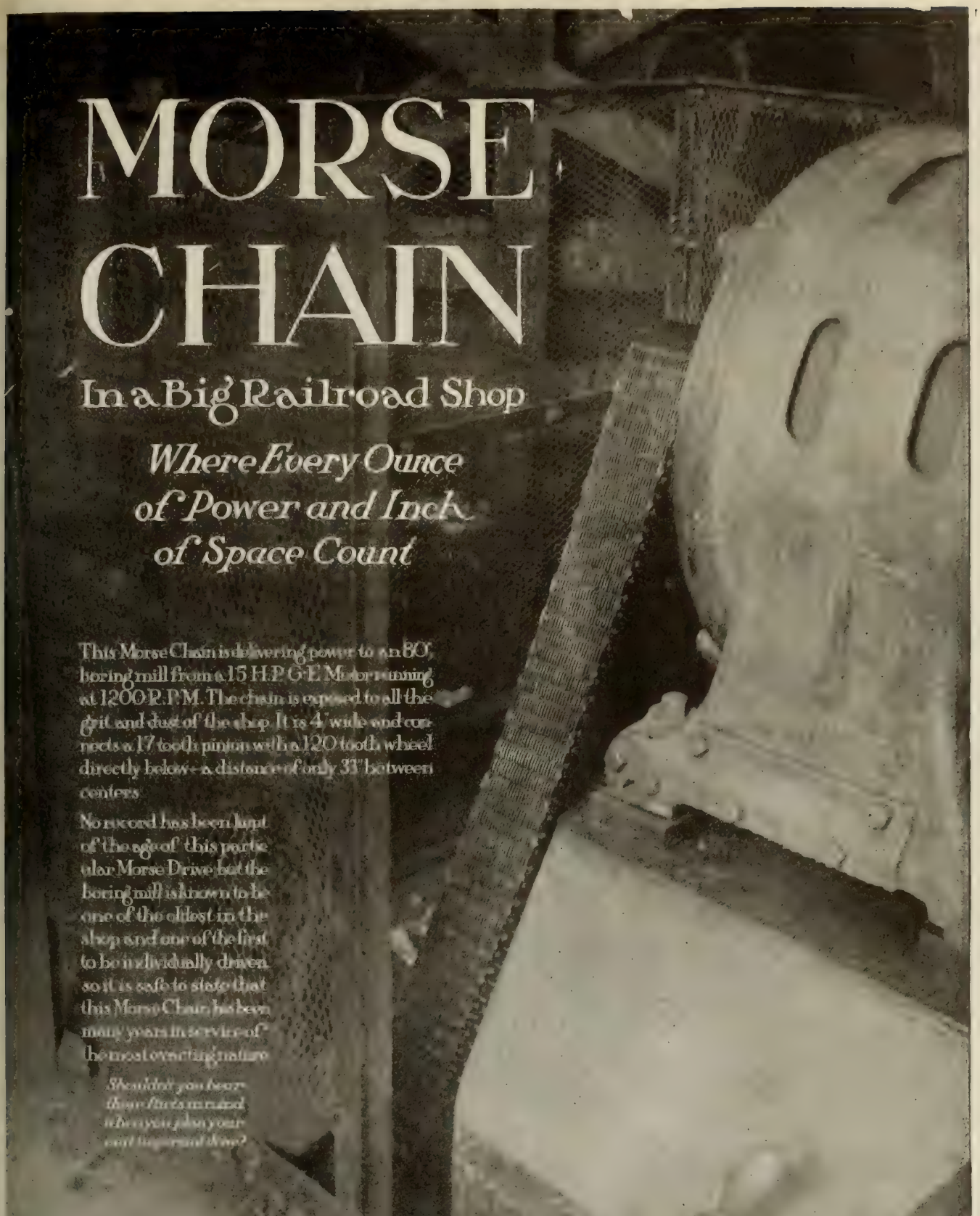
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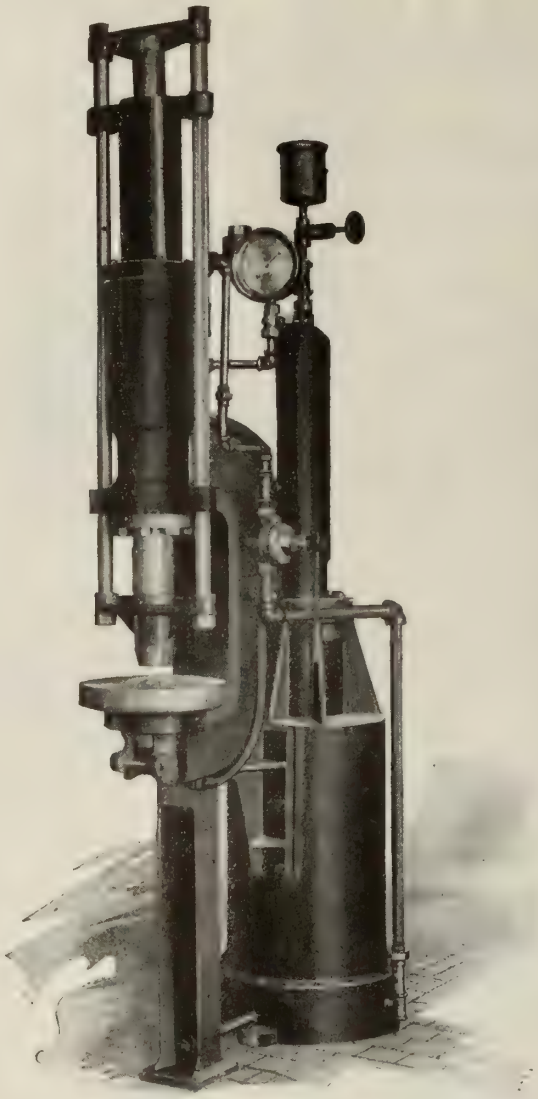
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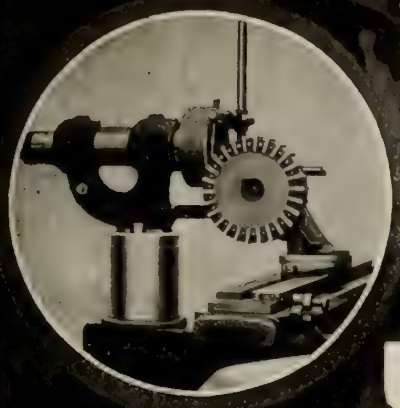
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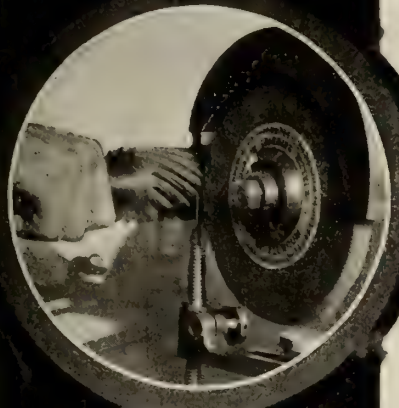
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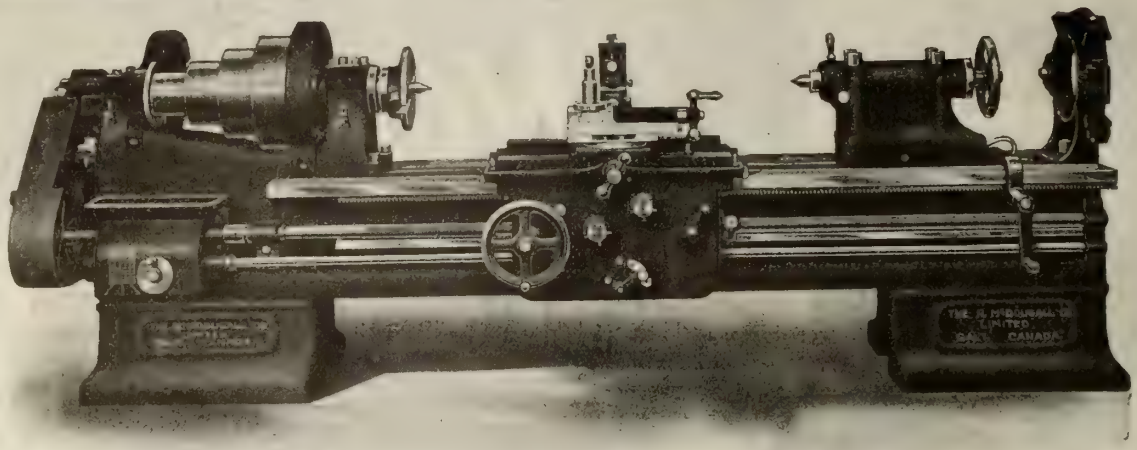
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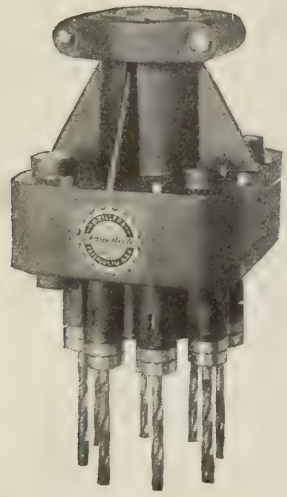
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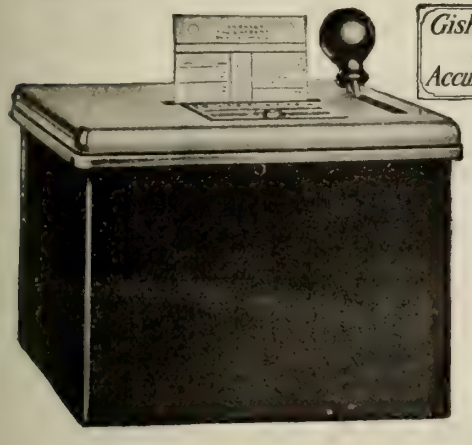
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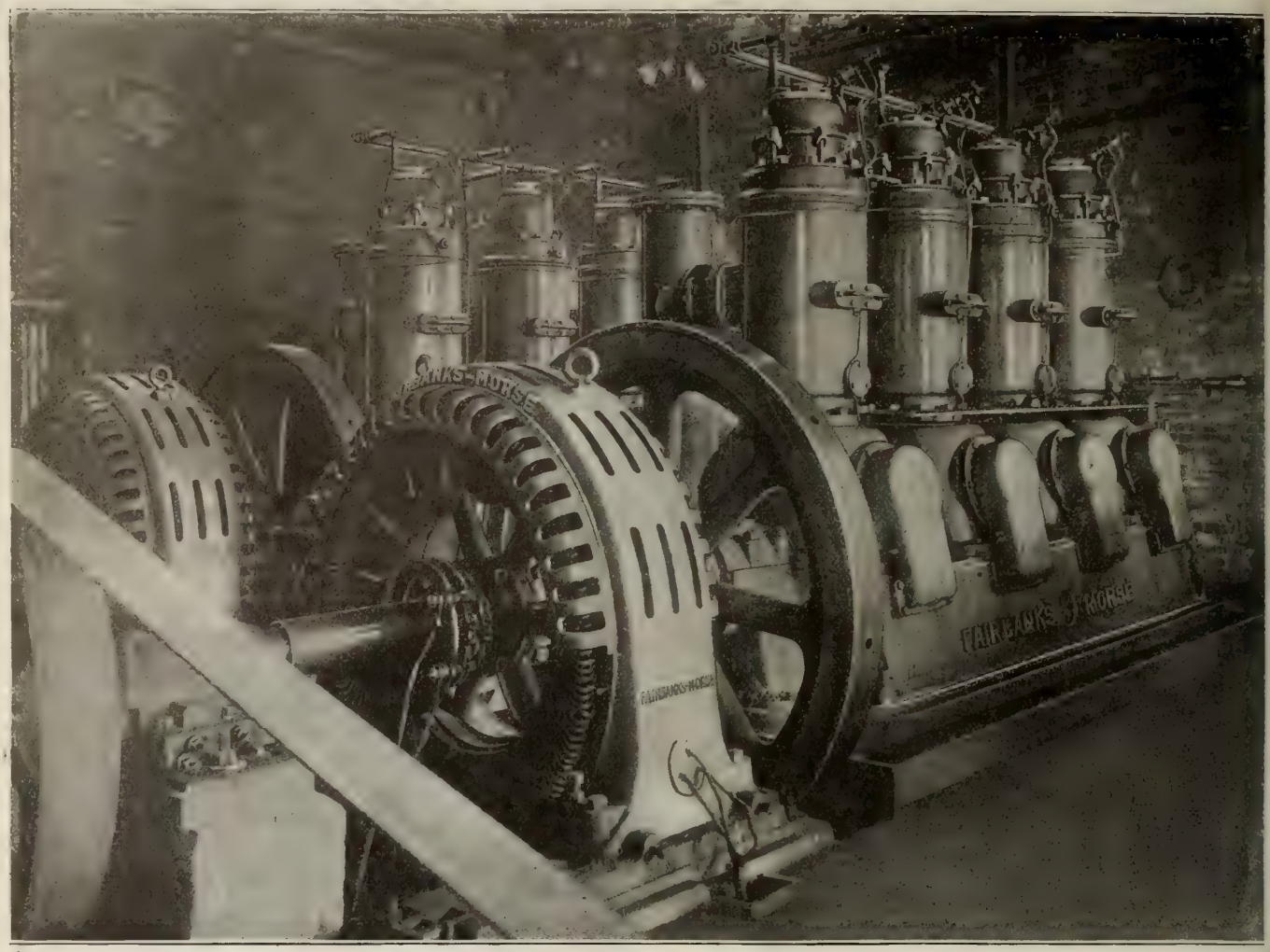
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CANADIAN MACHINERY
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Vol. XXIII., No. 8 February 19, 1920

Gauging American Standard Pipe Threads

Being a Summary of the Revised Formulation of the Briggs Standard and the Gauging System Adopted by Different Manufacturers of Pipes, Valves and Fittings

By J. H. RODGERS

STANDARDIZATION is rapidly becoming the keynote of every line of manufacture. Nowhere is this condition more apparent than in mechanical engineering, and yet the indifference shown in some directions regarding the inevitable trend of interchangeability shows a marked deficiency in progressive evolution.

There are probably very few engineering problems of to-day that do not, in some degree, require the use of piping in their ultimate solution. It is only in recent years that any concerted attempt has been made to place the threading of pipes and fittings upon the same footing as other and often less important details of mechanical equipment. There is no reasonable argument why pipe threads should not have the same fixed dimension tolerances that are considered imperative in other forms of threads. The fact that a pipe thread is out to a predetermined taper of ¾ inch to the foot has permeated the belief among many mechanics that accuracy of dimensions and thread lengths is a subject of little consequence. The fallacy of this practice is too frequently shown in faulty installations, where defective pipe joints have been the source of inconvenience or even more serious trouble.

Prior to 1882 the cutting of pipe threads was a question to be solved by individual manufacturers, and while the nominal shape and size was virtually identical, there was no recognized standard that would insure interchangeability of the parts of different makers of pipes and fittings. However, at this time, Robert Briggs, for several years superintendent of the Pascal Iron Works in Philadelphia, and later as engineering editor of the "Journal of the Franklin Institute," formulated a set of standards, which have since become universally known as the Briggs or American Pipe Thread Standard. In 1886 the manufacturers and the American

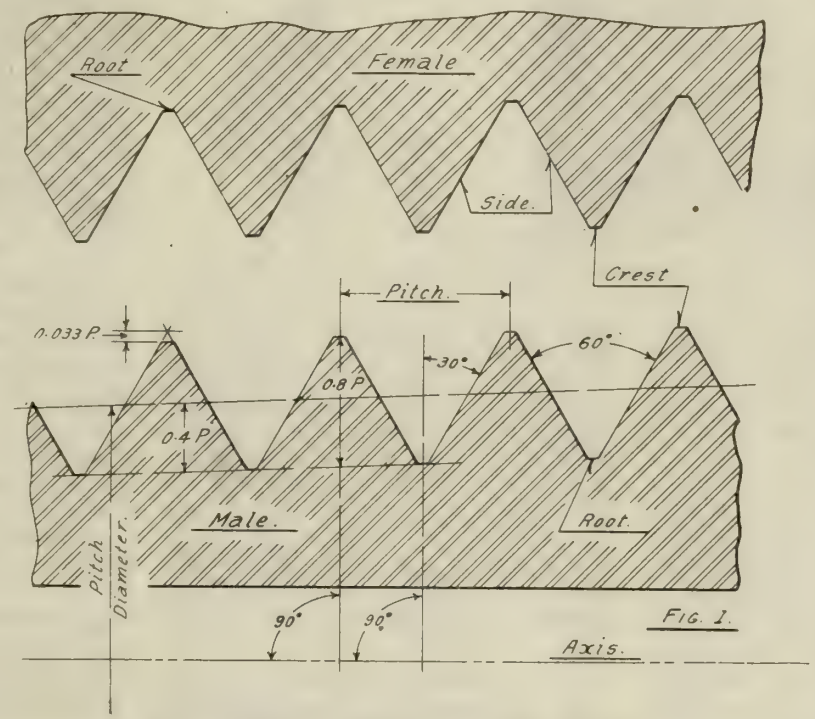


FIG. 1. GENERAL PROFILE OF TAPER THREAD

Society of Mechanical Engineers adopted it in detail, and master gauges were made. Following the general acceptance of the standard, conferences were held and several additional sizes, certain details of gauging, tolerances, and special applications of the standard, also the formulae and the dimensions were tabulated more completely than was originally done by Mr. Briggs.

The purpose of this article is to give a summary of the details and gauging methods underlying the production of accurate threads of the Briggs standard. The American pipe thread standard establishes the following: Outside diameter of pipe—diameter of male thread—diameter of female thread—profile of thread—length of thread—taper of thread—engagement (by hand) of male and female threads—construction and use of gauges—tolerances—use of taper threads—and the use of straight threads.

To eliminate error that might easily result from a divergence from accurate calculations, the various dimensions of this class of thread are expressed in inches to one one-hundred thousandth (0.00001) of an inch, and in millimeters to one-thousandth (0.0001) of a millimeter. For the convenience of those readers who may not be familiar with the metric system of measurement it might be well to state that the relation between the inch and the meter used in calculating the dimensions for the Briggs thread is that established by the United States Government and kept on record in the Bureau of Standards at Washington. This equation is:—

1 meter = 39.37 inches exactly, and is applicable to all practical engineering calculations on this continent. The conversion, or the reciprocal of this equation, expressed in millimeters, would be:

$$\frac{1}{39.37} = \frac{1000}{1} = 25.40005 \text{ millimeters}$$

= 1 inch. For work of ordinary character, however, the equation of 25.4 millimeters = 1 inch, is sufficiently accurate.

In the manufacture of pipe the nominal sizes (as known to the trade) vary to some extent from the actual sizes. This is particularly true on the smaller pipes, but on 14 inch and over the sizes as listed are identical with the outside diameter of the pipe.

General Profile

In formulating the original standards, Mr. Briggs was, no doubt, guided by the recognized practice of his day, where the procedure was to measure threads by their crest (outside) and root diameters. The revised formulae, as given here, are derived from the more modern method of gauging threads from the pitch diameters, the straight sides of the thread being less liable to error than the outside diameter. These formulae and the references are shown in Fig. 16.

The profile of the thread, which is clearly shown in Fig. 1, gives an included angle between the sides of the thread of 60 degrees, the centre line of this angle being at right angle (90 deg.) with the axis of the pipe. This applies to both straight and taper threads. Present practice provides for a truncated or flat crest and root equal to 0.033 p. This gives a depth of thread of 0.8 p. Thus, for a pipe cut with 8 threads per inch, the depth of thread would be 0.8 x .125 x 0.1 or 1-10 of an inch. The flat portion, then, would be 0.033 x .125 = .004 inch.

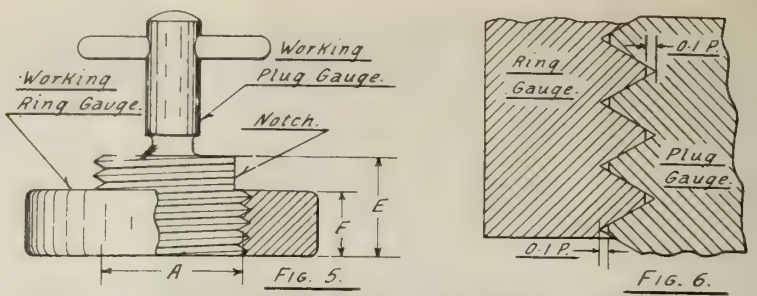
The original profile, as advocated by Mr. Briggs, provided for a slightly rounded crest and root, but the modified form now in use calls for the flat, as indicated. However, ideal conditions are only possible when cutting threads with new tools, and it will generally be found that commercial threads will appear slightly rounded under close examination. It is largely due to this condition that gauging points are now taken from the sides of the threads to minimize the errors arising from worn tools.

Length of Taper Thread

The length of the taper male thread is determined by the size of the pipe and may be calculated from the formula:—

$$E = (0.8\ G + 6.8)\ P$$

where E is the length of the taper portion of effective thread—G the outside diameter of the pipe—and P the pitch.



FIGS. 5 AND 6. WORKING GAUGES FOR CHECKING PRODUCT

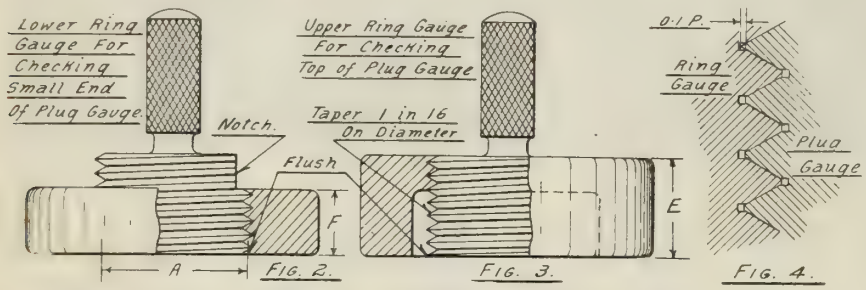
For example: Suppose it is desired to find the effective thread length on a 6 inch pipe, so that the thread would conform to the Briggs Standard. The 6 inch here mentioned is the nominal size, so that the outside diameter (G), taken from the table, would be 6.625 inches and the pitch, 0.125 inch. Therefore, from the formula, the effective length would be: $E = (0.8\ G + 6.8)\ P = (0.8 \times 6.625) + 6.8 \times .125 =$ 1.5125 inches, or a little over 12 threads. It might be mentioned here that this formula gives a length that includes two threads that are a little imperfect on the crest, but which has no material effect upon the efficiency of the thread.

Gauging Methods

It was previously stated that the taper of the thread was ¾ inch per foot on the diameter, or the difference of the pitch in the axial length of 16 threads. To insure interchangeability in the similar product of different manufacturers a system of gauging has been adopted for general use, and the basic dimension upon which this gauging is determined is the normal length of engagement (F in Fig. 16) between taper threads when screwed together by hand. This dimension for the various sizes is indicated in column F of the table.

Reference Gauges

As in all effective gauging systems three sets of gauges are used, namely, master, reference and working. The first two are practically identical in every respect, only that the master gauges, comprising one plug and two checks, are primarily intended for the use of gauge and tool manufacturers, and for very accurate reference in checking gauges. The reference gauges are shown in Figs. 2 and 3, and an enlarged view of a section of the thread is shown in Fig. 4. The plug gauge is made to the dimensions given in the table, and likewise includes the gauging notch. One ring gauge, used for external work, has a thickness equal to F, is the same diameter at the small end as the end of the plug gauge, and is flush with the plug gauge at the small end and at the gauging notch when screwed on tight by hand. See Fig. 2. For checking the upper end of the plug gauge a ring that is counterbored on the small end for a distance equal to F is used. It is the same diameter at the large end as the large end of the plug gauge. As shown in the enlarged section of the thread, the roots of both plug and ring gauges are grooved to facilitate the finishing of the thread by grinding.

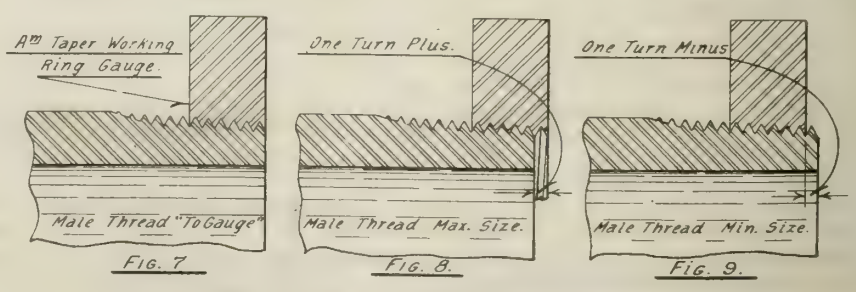


FIGS. 2, 3 AND 4. REFERENCE GAUGES FOR CHECKING WORKING GAUGES

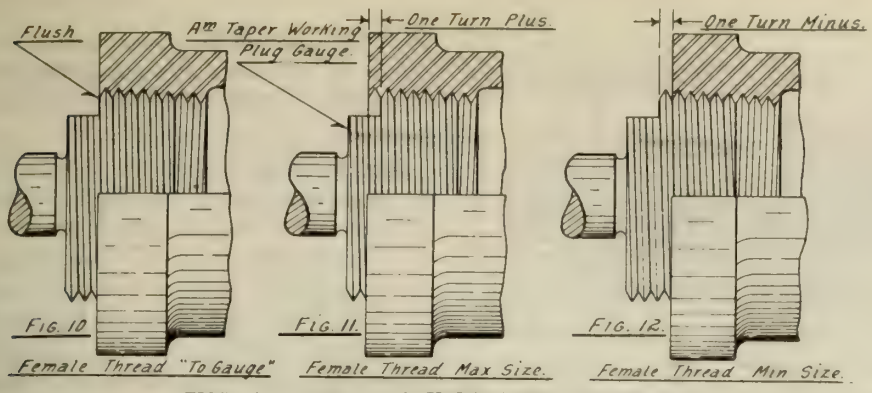
Working Gauges

One plug and one ring gauge constitute the working gauges. The plug gauge is made to the dimensions given in the table, and includes the gauging notch. The ring gauge is similar to that used for reference, only the roots are not undercut. This later detail is optional with the manufacturer. The crests are truncated to a depth of 0.1 P. The purpose of this is to avoid inaccuracy in gauging, as commercial cutting of threads is frequently done with dull tools, which may leave the crests slightly imperfect.

When gauging female threads the plug gauge should screw in tight by hand into the fitting or coupling until the notch is flush with the face. When



FIS. 7, 8 AND 9...GAUGING MALE THREADS



FIGS. 10, 11 AND 12. GAUGING FEMALE THREADS

the thread is chamfered, the notch should be flush with the bottom of the chamfer. This method is used either for taper female threads or for straight threaded female couplings, which screw together with taper male threads. See Figs. 10 and 13. For gauging taper male threads the ring gauge should screw tight by hand on the pipe or male thread until the small end of the gauge is flush with the small end of the thread. See Fig. 7.

Gauging Tolerance

In the manufacture of any article slight variation from basic dimensions are unavoidable. This is likewise true in respect to pipe threads and the different gauges used. The wear of the gauges must also be considered. To fix the allowable variation in gauging pipe threads, certain tolerances have been established. In the making of master gauges all dimensions should necessarily be kept within the narrowest possible limit of error, and each master gauge should be accompanied with a record of all measurements and a statement of the decimal part of a turn it varies (plus or minus) from the basic dimension. In column 1 of the table is given the maximum allowable cumulation of all errors in the thread surface of the reference gauges, expressed in terms of diameter. No point in the thread surface of the gauge should be outside of the zone of tolerance. Column 1 is used when checking gauges by measurement. If the errors in the gauge are reported in terms of pitch, angle of thread, and diameter, other methods are adopted to determine the cumulation of error.

Column 2 gives the equivalent of column 1, expressed in terms of distance parallel to the axis, and represents the maximum distance which a reference ring gauge of perfect thickness or a reference plug gauge of perfect length from small end to gauging notch may vary from being flush at the gauging notch or at the small end, when referred to basic dimensions. This column is used when checking reference gauges by comparison with a master gauge. The necessary allowance must be made for the error in the master. Column 3 gives the equivalent of column 2, expressed in terms of the decimal part of a turn from the basic dimension. Use of this column is similar to that of column 2. A tolerance of .0002 inches—plus or minus—is allowed on the distance between the gauging notch and the small end of the reference plug gauge, or on the thickness of the reference ring gauge. It is possible for reference plug and ring gauges which come within all of the above tolerances to vary from being flush with each other at the small end, or at the gauging notch, when screwed together tight by hand. The maximum variation which might occur, expressed in terms of distance, is given in column 4 and gauges that come within these limits should be checked by measurement before being rejected.

Column 5 gives a maximum allowable cumulation of all errors in the thread surface of new working gauges, expressed in terms of diameter, and no point in the thread surface should be outside of the zone of tolerance. This column is used when checking gauges by measurement. Column 6 bears the same relation to column 5 that column 2 bears to column 1. Dimensions in column 6 are 16 times those in column 5, owing to the basic taper of 1 in 16, measured on the diameter. Column 6 is used when checking working gauges by comparison with a gauge, the error of which is known. The necessary allowance must be made for this error. Column 7 gives the equivalent of column 6, expressed in terms of the decimal part of a turn from basic dimensions, and is used in checking working gauges as just stated.

A tolerance of .0005 inches—plus or minus—is allowed on the distance between the gauging notch and the small end of the working plug gauge, or on the thickness of the working ring gauge. The same rules apply for working gauge tolerances as those given above for reference gauges. The maximum wear on working gauges must not be more than the equivalent of one-half turn from the basic dimensions. The maximum allowable variation in the commercial product is one turn plus or one turn minus from the gauging notch when using working gauges. See Figs. 9, 9, 11, 12. This is equivalent to a maximum allowable variation of 1½ turns from the basic dimensions, owing to the allowance of one-half turn on the working gauges.

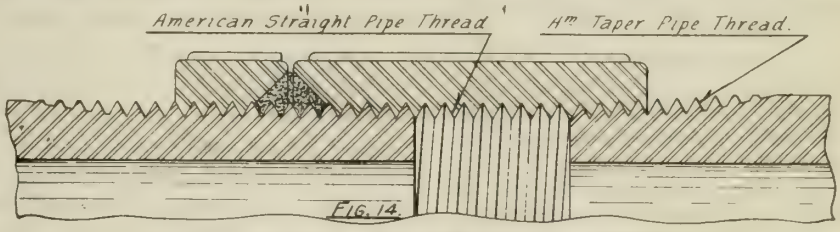


FIG. 14. STRAIGHT AND TAPER THREAD CONNECTION

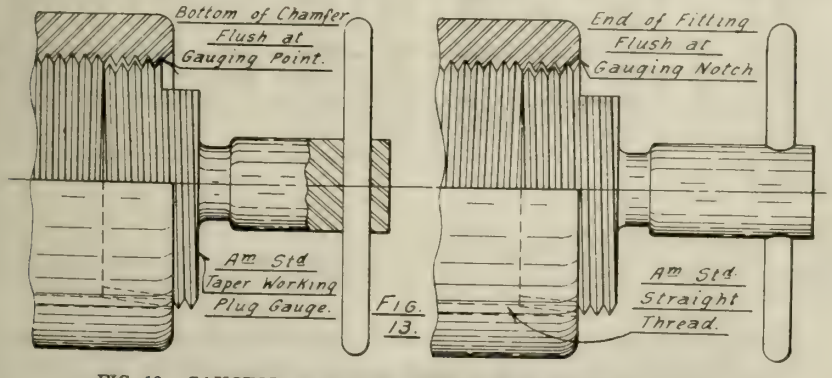


FIG. 13. GAUGING STRAIGHT THREAD OR CHAMFERED COUPLING

Straight Thread Application

In the case of wrought iron or wrought steel couplings, the straight thread is generally used in connection with tapered pipe threads and when used for ordinary pressures make a suitable joint, as they are sufficiently ductile to adjust themselves to the taper male thread when properly screwed together. For high pressure work, only taper male and female fittings should be used. Straight male threads are recognized only for such special applications as long screws for tank nipples, etc. An application of this character is illustrated in Fig. 15.

In gauging the straight thread the working plug gauge is used, allowing for the same tolerance from the notch as for the taper thread. See Fig. 13.

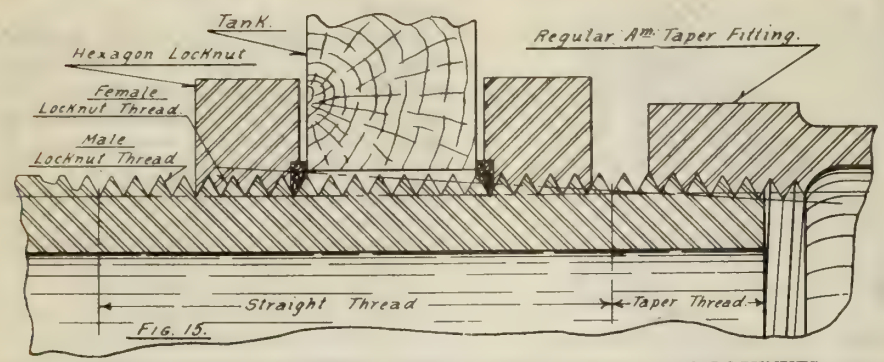


FIG. 15. TANK CONNECTION WITH STRAIGHT THREAD AND LOCKNUTS

The straight thread on the pipe enters the coupling freely by hand, the joint being made by a packing material between the locknut and the coupling. For obvious reasons this type of connection is not recommended, except in cases of necessity. An example of the locknut on a straight thread in conjunction with a standard taper thread is shown in Fig. 15. In this application an American standard taper thread is cut on the end of the pipe after having first cut the male locknut thread.

NOTE.—A companion article to this, covering a discussion on the American and the British standard systems, will appear in an early issue.

It is stated that American shipbuilding firms in the Delaware River are offering $100 per week to local machinists. According to Mr. Herbert Lewis, business agent for the machinists in Toronto, he has received a communication from the Delaware River district stating skilled shipyard mechanics can earn $100 a week. The letter asked for 400 men to be sent.

EMPLOYEES' CO-OPERATIVE GROCERY BUYING EXPERIMENT

An interesting experiment aimed to combat excessive living costs, is being conducted by the 12,600 employees of the Eastman Kodak Company in its six Rochester (N.Y.) plants. A committee consisting of one employee from each plant forms the nucleus of management for its co-operative purchase plan. Each week announcement is made on all bulletin boards of the sale for that week of one specified staple article of food at a definite price. Each employee desiring to purchase secures an order form in his department, fills in the necessary information, and forwards his individual order by the regular mailing system to a central point where a recapitulation of orders is made and the purchasing department is authorized to buy in that quantity.

Arrival of the goods for distribution is announced on the bulletin boards. Each employee calls at the co-operative store-room after working hours, pays his bill, secures his purchase and takes it home. The entire system is purely co-operative among the employees and carries its own overhead expense. Most of the labor is volunteered and a minimum of operating expense is incurred, resulting in the lowest possible price to the employee consumer. During the opening week of this plan 7,112 pounds of coffee were sold at an average saving of about 25 per cent. Flour is being sold at a saving of about 15 per cent., and canned vegetables including peas, corn, and tomatoes, at a saving of about 35 per cent. Other articles which will be sold are ham, bacon, butter, oleomargarine, and canned fish.

This co-operative purchase plan has been enthusiastically received by the employees, and will be continued as long as a material saving can be effected. Very little criticism has developed among the retail merchants of the city, and every effort is being made to keep away from a competitive condition that will materially injure their business.—"National Safety News."

N	T	A	B	E	F	G	D
Inches	Per Inch	Inches	Inches	Inches	Inches	Inches	Inches
⅛	27	.36351	.37476	.2688	.180	.405	.02963
¼	18	.47739	.48989	.4018	.200	.540	.04444
⅜	18	.61201	.62701	.4078	.240	.675	.04444
½	14	.75843	.77843	.5337	.320	.840	.05714
¾	14	.96768	.98886	.5457	.339	1.050	.05714
1	11½	1.21363	1.23863	.6828	.400	1.315	.06956
1¼	11½	1.55713	1.58338	.7068	.420	1.660	.06956
1½	11½	1.79609	1.82234	.7235	.420	1.900	.06956
2	11½	2.26902	2.29627	.7565	.436	2.375	.06956
2½	8	2.71953	2.76216	1.1375	.682	2.875	.10000
3	8	3.34063	3.38850	1.2000	.766	3.500	.10000
3½	8	3.83750	3.88881	1.2500	.821	4.000	.10000
4	8	4.33438	4.38713	1.3000	.844	4.500	.10000
4½	8	4.83125	4.88594	1.3500	.875	5.000	.10000
5	8	5.39073	5.44929	1.4063	.937	5.563	.10000
6	8	6.44609	6.50597	1.5125	.958	6.625	.10000
7	8	7.43984	7.50234	1.6125	1.000	7.625	.10000
8	8	8.43359	8.50003	1.7125	1.063	8.625	.10000
9	8	9.42734	9.49797	1.8125	1.130	9.625	.10000
10	8	10.54531	10.62094	1.9250	1.210	10.750	.10000
11	8	11.53906	11.61938	2.0250	1.285	11.750	.10000
12	8	12.53281	12.61781	2.1250	1.360	12.750	.10000
14 O.D.	8	13.77500	13.87262	2.250	1.562	14.000	.10000
15 O.D	8	14.76875	14.87419	2.350	1.687	15.000	.10000
16 O.D.	8	15.76250	15.87575	2.450	1.812	16.000	.10000
17 O.D.	8	16.75625	16.87500	2.550	1.900	17.000	.10000
18 O.D.	8	17.75000	17.87500	2.650	2.000	18.000	.10000
20 O.D.	8	19.73750	19.87031	2.850	2.125	20.000	.10000
22 O.D.	8	21.72500	21.86562	3.050	2.250	22.000	.10000
24 O.D.	8	23.71250	23.86094	3.250	2.375	24.000	.10000
26 O.D.	8	25.70000	25.85625	3.450	2.500	26.000	.10000
28 O.D.	8	27.68750	27.85156	3.650	2.625	28.000	.10000
30 O.D.	8	29.67500	29.84687	3.850	2.750	30.000	.10000

N	1	2	3	4	5	6	7	8	9
Inches	Inches	Inches	sed as dec of one tu	Inches	Inches	Inches		Inches	Inches
⅛	.00020	.0032	.086	.0068	.00040	.0064	.172	.0138	.0103
¼	.00022	.0035	.063	.0074	.00044	.0070	.126	.0150	.0112
⅜	.00024	.0038	.068	.0080	.00048	.0077	.136	.0164	.0122
½	.00026	.0042	.059	.0088	.00052	.0083	.118	.0176	.0132
¾	.00028	.0045	.063	.0094	.00056	.0090	.126	.0190	.0142
1	.00030	.0048	.055	.0100	.00060	.0096	.110	.0202	.0151
1¼	.00032	.0051	.059	.0106	.00064	.0102	.118	.0214	.0160
1½	.00034	.0054	.062	.0112	.00068	.0109	.124	.0228	.0170
2	.00036	.0058	.067	.0120	.00072	.0115	.134	.0240	.0180
2½	.00038	.0061	.050	.0126	.00076	.0122	.100	.0254	.0190
3	.00038	.0061	.050	.0126	.00076	.0122	.100	.0254	.0190
3½	.00041	.0066	.053	.0136	.00082	.0131	.105	.0272	.0204
4	.00043	.0069	.055	.0142	.00086	.0138	.110	.0286	.0214
4½	.00045	.0072	.058	.0148	.00090	.0144	.115	.0298	.0223
5	.00047	.0075	.060	.0154	.00094	.0150	.120	.0310	.0232
6	.00051	.0082	.065	.0168	.00102	.0163	.130	.0336	.0252
7	.00055	.0088	.070	.0180	.00110	.0176	.140	.0362	.0271
8	.00059	.0094	.075	.0192	.00118	.0189	.150	.0388	.0290
9	.00063	.0101	.080	.0206	.00126	.0202	.160	.0414	.0310
10	.00066	.0106	.085	.0216	.00132	.0211	.170	.0432	.0324
12	.00074	.0118	.095	.0240	.00148	.0237	.190	.0484	.0362
14	.00082	.0131	.105	.0266	.00164	.0262	.210	.0534	.0400
16	.00090	.0144	.115	.0292	.00180	.0288	.230	.0586	.0439
18	.00098	.0157	.125	.0318	.00196	.0314	.250	.0638	.0478
20	.00106	.0170	.135	.0344	.00212	.0339	.270	.0688	.0516
22	.00113	.0181	.145	.0366	.00226	.0362	.290	.0734	.0550
24	.00121	.0194	.155	.0392	.00242	.0387	.310	.0784	.0588
26	.00129	.0206	.165	.0416	.00258	.0413	.330	.0836	.0626
28	.00137	.0219	.175	.0442	.00274	.0438	.350	.0886	.0664
30	.00144	.0230	.185	.0464	.00288	.0461	.370	.0932	.0698

FIG. 16. PROFILE SECTION FOR TABLE REFERENCE

N — NOMINAL SIZE OF PIPE OR FITTING. T NUMBER OF THREADS PER INCH. A — PITCH DIAMETER OF THREAD AT THE END OF PIPE. B — PITCH DIAMETER OF PIPE AT GAUGING NOTCH. D — DEPTH OF THREAD. E — LENGTH OF EFFECTIVE THREAD. G OUTSIDE DIAMETER OF PIPE.

THE VALUE OF ANY OF THE TABLE DIMENSIONS CAN BE CONVERTED TO MILLIMETERS BY MULTIPLYING THE DESIRED DIMENSION BY 25, OR FOR MORE ACCURATE RESULTS, BY 25.4. THUS THE VALUE OF F, FOR A 5-INCH PIPE, WOULD BE 5 × 25.4 = 127 MM. THE NUMBER OF THREADS IN 254 MILLIMETERS CAN BE FOUND BY MULTIPLYING THE THREADS PER INCH BY 10.

Comment on Machinery Drafting Course, XI

We Believe a Further Talk on Part XI Will Not Be Amiss, as Some of Our Students Seem to Have Taken It For Granted That We Pointed Out All the Pitfalls Shown on This Plate

By J. H. MOORE, Associate Editor Canadian Machinery

IN our Feb. 5 issue we published Part XI of our drawing course. The text accompanying this plate pointed out some common pitfalls into which students might be tempted to fall. Every pitfall mentioned was referred to on the plate, that is, every error that was stated in the text was given in such a manner that each student could trace it to its proper place on the plate.

In order to see if students were following the instructions closely, we left off other important dimensions. These dimensions, while important, could be traced by steps and stages to what they should be marked. In other words, the omission of these figures in no way interfered with the completion of the plate.

Our chief reason for omitting them was to demonstrate how easily one could get into a slipshod method of dimensioning drawing. We stated in this text as follows: In concluding this portion of the course we wish to give students a little advice. Do not merely copy the plate. Study it. Figure why each piece is made the way it is. Study your projection. Watch all dimensions, **and above all, do not make the same mistakes on your plate as we have on ours.**

We have done so purposely to point out the common pitfalls, and thus keep others out of them. Evidently, some of our students did not read this paragraph closely, for we have been told that there were quite a few errors on the plate. There were, we will admit—and with good reason.

For the benefit of others in like difficulty, we will go over every error on the plate, so that they can go ahead and draw up the plate and send it in to us.

Starting at piece No. 1. There is an arrow head and line which should lead from the other countersunk hole to the dimension ⅜ drill and c'sk. Three views are shown where two are sufficient. The end view (providing this was necessary), has no dotted outline of the countersunk screw holes. Lastly, the jaws are merely marked steel, while they should be marked as to the grade steel used. Tool steel, or a high carbon steel, is usually used for such work.

Piece No. 2 has the following errors: The method of dimensioning the two 17-32 in. holes is entirely wrong. A better plan would be to write a notation 17-32 in. drill, calling attention to this dimension by means of lines, as shown at piece No. 1 for the ⅜ drill and countersunk item.

Piece No. 3 should first be marked 7 square thd's per inch L. H. The diameter of the screw should be given, and the length of the taper pin, a dimension 9-16 in. sq. in place of the one shown, and last, but most important of all, every student should be sure of their overall dimension. Total up the dimensions shown on this piece and you will see that 9 in. is incorrect. This should be 8 15-16 in. Students may say that this error should not have been made, but when they figure that they were supposed to lay this piece out to scale, they had an ideal opportunity to prove the 9 in. figure as incorrect. It will be found a very easy matter to make a blunder when totalling dimensions, so that we purposely left this error unmentioned in our text, so that readers might have an opportunity of finding it out for themselves.

At piece No. 4 there is nothing to mention except that in the end view there is no dotted outline of the screw hole.

Fig. 5 should have a dimension 9-16 in. square core in place of the one shown.

At Fig. 6 we have made numerous errors. We have omitted to mention the size of the tapped holes on the portion of the moving jaw, where the steel jaw fits. Various students told us that by scaling this they figured it was to be ⅜ tap. All this scaling, after we stated "Never take anything for granted—find might have an opportunity of finding it out for themselves.

What was to hinder figuring it out in this manner? If the steel jaw goes against this moving jaw, the tapped holes in the moving jaw will have to suit the size of screw that goes through the steel jaw. As this hole is ⅜ in. drill and countersunk, it naturally follows that the tap hole will likewise be ⅜ in. diam. Thus, by common sense deduction we arrive at a definite conclusion. Next, we omit to state the position of these holes, from the top of the moving jaw. This can easily be arrived at. Look at the steel jaw. Here we see that it is 1 7-16 in. high, while the moving jaw is only 1 5-16 in. high. This means that the steel jaw sticks up ⅛ in. above the moving jaw. As the dimension is 13-16 in. in one case, and ⅝ in. in the other, on the steel jaw, it is easily figured that the ⅝ in. dimension is toward the bottom.

From this we can either measure on the moving jaw as follows: ⅝ in. up from the bottom, or 13-16—⅛, which is 11-16 in. from the top. We also left off on this view the fact that square heads were required. We placed a 1⅜ in. dimension in place of a 1⅛ in. dimension. We also left off various arrows and dimension lines, which, no doubt, students easily discovered. We also left off on this piece one dimension, which should be 3⅛ in. centres to certain ½ in. tapped holes. Students will from this find out where we infer, that is, if they have been following instructions closely.

Having touched on these various details, no doubt students will be better prepared to go ahead with their plate, so that we can only emphasize once more the importance of sending in your work, as it is the only means we have of ascertaining how you are progressing.

The next plate on this vise will be published in our issue of Feb. 26.

REPAIR OF A BROKEN DROP HAMMER COLUMN BY THE ELECTRIC ARC PROCESS

Large industrial plants, especially those connected with metal working, are realizing more and more every day that to be equipped to handle all classes of welding jobs in the most efficient and economical manner, it is desirable to have installed both electric arc welding equipment as well as oxy-acetylene apparatus. Each process has its own particular field where it may be said to function more efficiently, and for any given case of manufacture, repair or reclamation, that process can be selected which is best adapted to the work in hand from the standpoints of quality, convenience, economy of time or cost of operation.

A recent case in point can be cited in the plant of a large manufacturer of forgings in the Chicago district. One of the columns of a 6,000-lb. steam drop hammer developed a fracture at the inside edge of the face of the column and near the top of the gib which guides the hammer in its reciprocating motion. The column was of cast steel and a large chunk of the metal had simply "jumped off" from the face of the column as expressed by the foreman. The hammer was not entirely out of commission, but was not being operated at its maximum capacity because of the possibility of inches across and the depth of the fracture was 3½ inches.

The Black and Decker Mfg. Co., of Baltimore, Md., have just issued a handsome catalogue, which covers very thoroughly their line of electric air compressors, portable electric drills, and electric valve grinders. To anyone interested in these lines a copy of this catalogue should prove well worth while, and can be secured for the asking.

Bill Blithers Almost Becomes a Chief Engineer?

This Little Tale is the First of a Series on the Adventures of Bill in Search of a Higher Education. Although He is Not Successful in This Story, We Still Have Hopes That He Will Succeed

P. O. Box 23,
Ruebenville

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.

To Whom it May Concern

Deer Sir:

Having notised your ad in the paper as how you can make a common hunkie into a chief engineer, I wish to tell you I want to be one of those as soon as possible. I am sending in the envelope, the little coopon which you have in your ad, and have marked an X at the place and job I want to be in. Please tell me how much this is going to cost me and how long it will be before I can be a chief.

I am also sending you the picture that first made me think as ow I'd like to be a chief. The picture in the first part, looks just like me, and I work on sewers just as this fellow is doing. I want to be like the other part of the picture, but without the cigar, as my wife don't let me smoke.

Will I have to study hard, or will I be able to read your lessons without much trouble, and what wage will I get in a job you show in the last part of your picture, for you don't say in your ad.

Please answer quick, telling me all particulars, for I've got awful discontented since reading your ad, and seeing what I should have been. With best regards,

Yours,
BILL BLITHERS.



BILL COULDN'T HELP BUT SEE A FAMILIAR SIGHT IN THIS PICTURE — No. 1



THIS IS PICTURE NO. 2, WHICH SET THE FIRES OF AMBITION BURNING IN HIS HEART

To WILLIAM BLITHERS, ESQ.,
Ruebenville, Ill.

My dear Mr. Blithers,

To say we were pleased to receive your recent letter of the 18th is to put it mildly.

We can immediately see that you are fired by that noble spark called ambition, which, once it sets in to work (as it has in your case), means success. SUCCESS is the way we should like to write it. May the writer be allowed to get away from the we standpoint, and talk to you rather like a friend than a stranger, for after reading your splendid letter I feel more like a friend than anything else, so for the balance of my letter, it will be the I, rather than the we, that shall speak.

First I was pleased to see you had carefully read our advertisement. This is a good sign, and denotes caution on your part You know Mr. Blithers there are so many so-called schools, who claim to be ten day wonders, that one, is apt to become confused in trying to separate the bad from the good. In your case, however, I see your keen judgment has stood you in good stead, for you have written to not only one of the best, but *the* best school in the entire country. As our name implies we are the Verybest correspondence school.

You have marked your coupon absolutely correctly and although at present your employment may be of the humble order, there is no reason why before long you cannot even excel the type of gentleman we portrayed in our picture No. 2. It is a pleasure to know that these two pictures impressed you, and it was particularly noteworthy that the individual in picture No. 1, looked somewhat like yourself. This point alone proves that you are the very person who should take up our course, as our pictures were drawn from life, and from an actual example of phenomenal rise in life.

Regarding your question if our lessons are difficult. This is only a natural question, and one which we feel sure we can answer satisfactorily. Your lessons will be far from difficult, for we have simplified each lesson until it has become mere routine.

I enclose a form which you can fill out and send to me by return mail. Kindly see that you send this form properly filled out by the very next mail, as I am arranging to have your first lesson sent to you as soon as I receive the form.

Now, Mr. Blithers, regarding the price of our course, does not this seem to y u a trivial matter, when your future is at stake? We do not as a rule talk price, for one is apt to think the amount a trifle high at first glance, but we find that by allowing the student to first fill out the form and sending along his first fee of $5.00 we have, unknown to him, started him on the road to success. However, since you have asked the question I might say that you place a $5.00 bill with the enclosed form and receive your first lesson at once. Then once a month let us have another $5.00 until the course has been paid. These payments will onl go on for a matter of 10 months, which you must admit is not long.

Awaiting your form, and the $5.00,
I am,

Your well-wisher,
I WANT YOUR MONEY.

P. S. Do not forget to mail the $5.00 with the form, for otherwise I could not hurry through your first lesson.

P. O. Box 23,
Ruebenville.

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.

Mr. Want Your Money,

I beg to inform you that I received your letter, and I am sorry but will not be abel to join your school.

Yours regretfully,
BILL BLITHERS.

Educativetown.

WILLIAM BLITHERS, ESQ.,
Ruebenville, Ill.

Dear Sir:

I cannot understand your recent letter. Do you think the prices too high? I believe that you were backward at telling me this, so I have tried hard to get you some personal and special consideration, and have at last succeeded in so doing.

Instead of $50.00 the regular price of our course we will offer you for 5 days only, a special reduction for cash, and believe me, Mr. Blithers, this is a wonderful opportunity.

Whatever you do, don't delay, but accept this splendid offer. In place of $50.00 we offer you this complete course in its entirety for not $40—not $30, but for half the real price, namely $25.00.

Act quickly before it is too late. Send in your money at once.

I am,
Sincerely yours,
I WANT YOUR MONEY

Educativetown.

WILLIAM BLITHERS, ESQ.
Ruebenville, Ill.

Dear Sir,

I am surprised at your silence, and your not accepting our generous offer.

Surely you were serious in your ambitions. If I didn't believe so I wouldn't bother writing further, but as I have good news for you I felt that I should write at once. After considerable trouble I have arranged for a space of 2 days only to let you have our course for $10.00. Imagine, $10.00 in place of $50.00. You can hardly fail to see the wonderful offer this is, so I expect to see your enrollment in the next mail.

Very truly yours,
I WANT YOUR MONEY.

P. O. Box 23,
Ruebenville.

To the
VERYBEST CORRESPONDENCE SCHOOL,
Educativetown, Add.

Dear Sir:

This isn't Bill Blithers speaking, but a better person than he—this is his wife.

Keep your course, and its special offers. My Bill started work on sewers, and knows sewers off by heart. Why—he couldn't live without the smell of a sewer, so why tempt him away from it.

Besides, I don't think your blamed school is any good no how, $50.00 to $10.00. Bah.

Can I sell eggs that cost me 50c a dozen for 25c. No, I sell them for $1.00, so I guess according to these figures your course is worth about 25c. Even at that figure I wouldn't let Bill start it. He should by rights be a toolmaker or something like that, although in a way I still think he should still stick to sewers.

Believing this letter will be the last one,

I am,
BILL'S WIFE.

Editor's Note—It was the last one on the above subject so she got her wish, to a certain extent, but Bill is not done for yet, by any means, and will be heard from at a later date in an entirely new role.

Grinding Wheels and their Various Duties*

By JOSEPH HORNER

MACHINISTS have travelled far since the early precision grinding machines were designed. At that time, and for a long subsequent period, there was only one material used for grinding wheels—the natural emery, and the term "emery wheel" exactly denoted its composition. Variations could be made in grain, and in grade, but no difference in the hardness of the grains. Further, the natural product was always impure, being contaminated with earthy matters that do not cut—oxide of iron and other substances. Naxos emery contains only about 63 per cent. of crystalline alumina. Corundum is a natural abrasive of which emery is a less pure variety. It occurs in two other forms of which the commercial kind is translucent. It is, next to the diamond, the hardest known mineral. It is also contaminated, but not to the same extent as emery. These are the only two substances which were used for grinding wheels before the possibilities of the electric furnace became realized. Since that era, the natural products have almost ceased to be employed for any work of high precision, having been displaced by the numerous artificial products of some form of furnace in which the work is either of a purifying, or of a synthetic—a building-up character. The story is almost like one of the romances of manufacture, since some very unpromising substances, coke and sand, are transmuted at temperatures far above that of molten steel, into abrasives only second to the diamond in hardness. These products are denoted by various trade names which alone reveal nothing. The result is that grinding wheels are now standardized, not alone in grain and grade, but also in regard to their cutting properties, which was never the case with the old emery wheels. The characteristics of a wheel are repeated precisely in all others of the same name and description. The value of this certainty in highly repetitive grinding practice need not be emphasized. No single firm now has a monopoly of grinding wheel manufacture. There are many in the market, some of whom have specialties of value prepared under their own methods.

What is Corundum?

Corundum—the purer emery—is a product of the electric furnace, but not in the same sense that the artificial abrasives are. The aluminum oxide is simply crystallized by the intense heat instead of naturally, and the product is not contaminated by foreign matters as the natural corundum is. The trade name of this is "oxaluma." With this exception all the products of the electric furnaces are prepared artificially by synthesis.

The first of these was carborundum, prepared at Niagara by power obtained from the falls. Coke and sand are the ingredients used. The first supplies the carbon, the second silicon, so that the product is a carbide of silicon. The diamond alone exceeds it in hardness. Sawdust is added in the furnace, but only to render the mixture porous enough to permit of the escape of the gases. A resistance core of carbon rods is inserted in the furnace, connected with the power cables, and a temperature of about 7,000 deg. Fahr. is maintained for something like thirty-six hours, after which the crystals produced are removed. Crushing, washing, and sorting the grains into the different sizes required follows.

Another carbide of silicon is that termed "Crystolin," prepared from coke, sand, sawdust, and salt. The method of production is different from the other. A core of small coke is raised to a tem-

* From Hardware Trade Journal

perature of 3,500 deg. to 4,500 deg. Fahr. by a current of 12,000 volts, which produces a chemical reaction without fusion. This material also is only second to the diamond in hardness.

Alundum is an artificial abrasive of a different class, being an oxide of alumina, resembling therefore in that respect the natural emery. It is prepared from the soft mineral earth, bauxite, which is the purest form of alumium oxide found in nature. It is first calcined at a red heat to drive off moisture, and is then fused between electrodes until a mass of alundum of several tons weight is produced. This is broken up, pulverized, and sorted for grain.

Aloxite is also prepared from bauxite, and is hard and sharp, and suitable for grinding materials of high tensile strength. The bauxite is calcined to remove moisture, is then mixed with coke and placed in the electric furnace. The proportion of coke is adjusted to remove the oxides of silicon and of iron present, but to leave the alumina unreduced. The charge is fused between vertical carbon electrodes at about 4,000 deg. Fah. A mass of several tons weight is produced, which is broken, crushed, and graded for size.

These are the best known of the artificial abrasives, but there are others, and the number grows. The aspect which interests us is that materials are now exactly correlated to the work that they have to perform, which is not the case when emery alone is available. The point is that wheels are prepared suitably for the materials on which they have to operate. Materials of high tensile strength, as the steels, require wheels of a different character from the softer brasses, the bronzes, and the cast iron. That is the first fact. The second is that apart from the materials used, the size of the grains, and the character of the bond or matrix which unites them has to be selected to suit the harder or softer nature of the materials operated on. Broadly, hard materials require wheels from which the grains are torn away quickly, more than the softer materials do. But only broadly, since the question of clogging arises in some soft materials, as brass, for which soft wheels are required. In general, materials of high tensile strength—the steels—require abrasive wheels of an alumina oxide abrasive, those of low tensile strength—cast iron, the brasses and bronzes—wheels made of carbide of silicon.

An Important Point

The point to bear in mind always is that a grinding wheel is in effect an assemblage of millions of cutting points which, as they become dulled, must be torn away from the matrix, exposing fresh sharp grains for the work. The sparks thrown off from work that is being truly cut, and not rubbed, show under the microscope as veritable chips. not easily, unless care be taken to select a proper wheel, and to run it and the work at a speed suitable.

It has been stated that a wheel 24 inches in diameter, with 4-inch face, presents approximately 1,086,171,000 cutting points per minute to the work. The laws which govern the action of these multiple tools are as precise and inexorable as those which concern the more obvious cutting tools in the lathes, planers, milling machines. The great difference is that the first are thrown out and discarded after brief service, the second are resharpened.

This is the explanation of the bonds used, denoted by the term "grade"—that is, the materials employed to hold the grains securely just as long as they retain their cutting efficiency — their keenness of points—but not a moment longer. It is a nice problem, not easy of solution apart from experience, but information on which manufacturers are ready to supply. From this aspect wheels are hard, soft, or medium. A hard wheel does not signify anything concerning the character of the abrasive itself, but denotes the tenacity, the holding power, of the bond. The soft wheel may contain the same abrasive, but the bond does not hold so tightly, but permits the grains to become torn out more quickly than the hard wheel does.

This is entirely distinct from the question of the size of grains, which vary in degrees of coarseness, determined by the passing of the grains through sieves of various meshes, ranging generally from 24 to 60 per lineal inch. In the majority of instances the grains in a wheel are uniform in size. But combination wheels contain grains of different sizes, the object sought being to avoid changing wheels for roughing and finishing, the combination of grains of different sizes in one wheel permitting of employing the same wheel for roughing and finishing.

The Classes of Bonds Used

Different classes of bonds are used for groups of wheels employed for different classes of operations. There are the vitrified, that most widely used, the silicate, and the elastic, and vulcanite wheels for special work only, for which the wheels must be very thin.

The process in widest use is the vitrified, in which the wheels are burned in order to partly melt the bond that holds the grains. These wheels are porous and free cutting, and the bond is nearly as hard as the abrasive. But large wheels made thus are liable to crack, and the control of the burning process is difficult. They are of a reddish color, and ring when they are tapped. The bond used is a clay—generally a pure grade of kaolin. It is mixed with the abrasive to the consistency of thick paint, and poured into moulds. When very hard wheels are required, they are made in moulds under hydraulic pressure. Moulds are larger than finished wheels to allow for shrinkage in drying. They are burned in a kiln when packed in fireclay saggers, the kiln being luted during the burning, which is continued during from three to five days, followed by slow cooling for a week. Silicate of soda is the bond used in the silicate process. The mixture, with the abrasive, is tamped in moulds by hand, and baked in ovens at a temperature very much lower than that required for the vitrified process. These wheels are excellent for wet grinding, but are not so free cutting as the harder grades of vitrified wheels of the same grades are. They are of a light gray color.

The very thin wheels are bonded with shellac—elastic wheels, or with vulcanized rubber—vulcanite wheels, both being baked at a low temperature. They are very hard and tough, but do not permit of so fast grinding as the others do. They are used for saw gumming, for sharpening milling cutters and severing stock. They will run in water, but oil or caustic soda damage them. They are porous.

The grain of wheels—the degree of fineness or coarseness of the grains to linear inch—is indicated by numbers. The grades—the degree of hardness or softness of the bond—are indicated by letters. The lists of different manufacturers differ here, so that those of one maker do not afford exact comparison with those of another.

Since there are so many differences in materials, not only taking note of that which divides materials of high tensile strength from those which are of low strength, but also in alloys and mixtures of the same designation, the necessity for a wide selection of wheels is apparent. The steels include scores of combinations of a few elements in varied proportions. The brasses, the bronzes, the aluminium alloys, each include many differences.

And when the wheels most suitable for any single group or specimen are selected the ultimate end is not achieved. The relations of the wheels and the work, the speeds and the question of lubrication, entail variations in the wheels selected.

Contact Between Wheel and Work

The principal problem here is that concerned with the area of contact between the wheel and the work. Obviously there is little in common between grinding cylindrical pieces of small diameter with the edge of a wheel and grinding plane surfaces with the face of a large disc wheel. In the first case the arc of contact is little more than a mere line, in the second the area of contact will often amount to several superficial inches. In the first the grains will fall away directly they are released from their bond. In the second they will remain entangled between the wheel and the face of the work. The result is that the work will become heated up and will warp. In general, therefore, the larger the area in contact, the softer should be the grade of the wheel, and the larger the volume of lubrication to drive out the grains released. Strictly the term lubricant is not correct. The liquid is used solely for cooling, and for washing away the swarf. Enormous volumes are used in present-day practice in order to prevent risk of distortion of the work.

It follows that with small and moderate increases in the areas of contact, wheels of softer grades must be used. Since a cylindrical piece of work of large diameter offers a large arc of contact to

the wheel than one of small diameter does, a wheel a grade of two softer is desirable. So, in grinding bored holes, the arc of contact is much larger than when doing outside work, and again a softer wheel is wanted, and generally a larger volume of cooling liquid. Again, surface grinding with the edge of a wheel presents a larger area than cylindrical work does. And so we come to the most severe work of all, that of plane surfaces with the face of a disc wheel. And the wider the work the softer should be the wheel.

The man who aspires to operate precision grinders has much to learn, and he is always learning and gathering rich stores of experience.

Three Clamp Devices of Uncommon Design

By F. SCRIBER

TO hold a forked lever while drilling holes from both sides without springing the same is often something of a problem, and it is thought that the devices illustrated with this article will be of more than ordinary interest to anyone who has ever been up against this proposition.

The drawings show sections of jigs with reference to the forked end method of locating without regard to the shape of the other end of the work and referring to Fig. 1 this shows an arrangement by means of which the lever is located and the thrust of drilling from both directions is taken. To accomplish this the plate A made part of the stud B has two eccentric radius cut on it at R, thus, as the portion B is a snug running fit in the body of the jig C, turning this in the direction of the arrow, causes the inner bosses of the forked lever to be gripped equal distance from the centre and with the other end suitably located in both directions this device, in addition to locating the forked end of the work, takes the thrust of drilling, which is done from both sides of the jig, using bushings D and E for guiding the drills. The nut F, with washer, is used to clamp this eccentric arrangement when tight between the fork, while pin G acts as a handle to turn the same.

Fig. 2 shows a device somewhat similar to the foregoing, except that it is used only to take the thrust of drilling from both sides through the bushings A and B, other means at the opposite end doing all of the locating, and for this purpose the eccentric plate C has an elongated slot cut lengthwise of it, the method of operation being as follows:

The plate C is turned until it grips the fork, the plate being free to slide, it is then clamped by bolt D, using nut and washer E, while the pin F, working in an elongated slot, prevents the bolt from turning while nut is tightened.

A plug method of locating and clamping is shown by Fig. 3, the function at this time being to locate from a finished hole and clamp with the same motion of a stud. Referring to the drawing, the work rests on the pin A in the body of the fixture. The stud B has the end turned down to fit the hole of the work, while a plate C and pin D for turning the stud completes this arrangement.

The stud B is put in place in the manner shown, the flat X being made to slip by the plate C; this plate is bevelled on the side to conform to the cam surface on the plug and by turning the plug under the plate in the manner shown the work is clamped and located at the same time.

These clamping methods are quick acting, sure in operation and very efficient for the purpose illustrated.

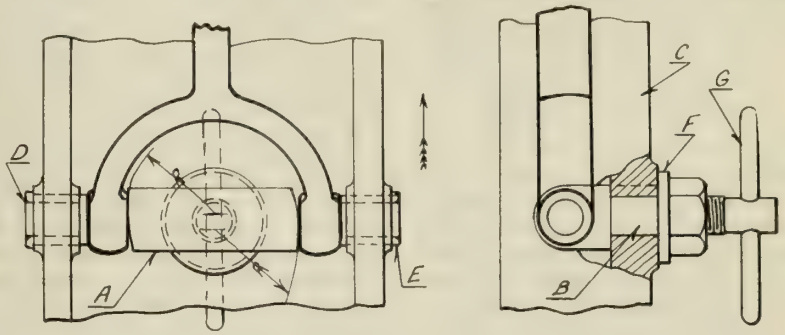


FIG. 1

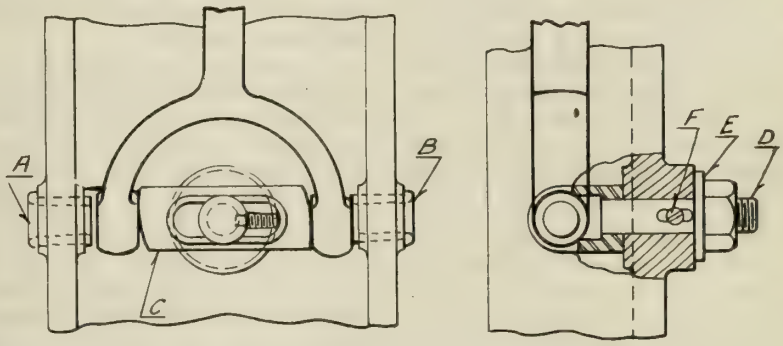


FIG 2

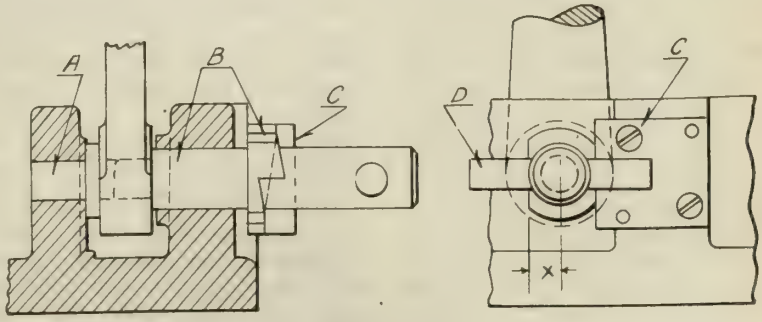


FIG. 3

The reason for limiting the voltage for which alternators are built is that after about 20,000 volts, the weight of the generator increases rapidly and the cost soon becomes greater than the combined cost of an equivalent lower voltage generator and transformer. Furthermore, in the absence of a transformer the generator windings are exposed to the direct action of surges originating in the line.

The extending use of arc welding makes it desirable that the constituents of a weld should be better controlled. Refractory tubes and asbestos coatings have been suggested, but the author of an article in the "Electric Journal" is of opinion that better possibilities are offered by the development of an electrode which generates during operation, an atmosphere of inert, permanent gases enveloping the arc.



WHAT OUR READERS THINK AND DO



STILL ANOTHER ANSWER TO H. H. J.

By D. A. H.

THERE are two sides to every problem, even to H. H. J.'s, and those who had commented on his viewpoint have most certainly not taken the trouble to inform themselves of the other side, or whether one existed. Without having had experience with the great industries, whose earnings are large through systematic production, and who are in a position to enlist the necessary capital to make that kind of production possible, the writer will touch upon the other side of the problem from the standpoint of the smaller employer and his executives—plants that employ anywhere from five to two hundred men.

Let it be said first that a majority of men—workmen and employers alike—are fair and reasonable when problems are taken up separately. I say separately because that is the only fair way to treat problems of this nature; the union idea is all right up to a certain point but when it compels an employer to pay as much for a poor man's work as for a smart man's, this is where the unfairness begins, and every intelligent man in every union will concede this.

"Little George," as we called him, was a bright lad and quick, but he was careless, and so, naturally, he spoiled many a job just when that job was needed worst. He wanted to be moved to the big universal miller, and the foreman had promised that he would do so if he, George, would apply himself more diligently to his work. The man on the universal left and the foreman put Jim on the job simply because the work from that miller was pivot work for the room, and Jim, though comparatively young, was of the faithful plodder class. Little George had no real kick and he knew it, but instead of taking it up directly he agitated the matter at noon hours, working up sympathy, and a delegation headed by a rather mouthy fellow, also of the careless kind, took the matter over the foreman's head to the boss. The latter, knowing how matters stood, fired the mouthy one, and the rest of the boys, feeling very sheepish, slipped back to their machines muttering something about "George can do his own dirty work another time."

As has been said, most men are fair, even employers. The writer went to work one time for "Old Man Fellows," who, during his years of experience, has had hundreds of employees working for him. Many and many a time I have heard him called "the meanest man in Gorhem," and it was with a little feeling of uneasiness that I went to work. But our relations were always of the pleasantest, probably because I had made up my mind to do things his way to the best of my ability, and he never exhibited anything meaner than a sharpness of speech when an especially poor meal affected his stomach.

When I went to work at the trade, apprentices were paid $3 a week for the first year. That was in 1899. Machinists received $2 a day (I really think wages have kept pace with prices since then). Most shops were dark and dirty, all worked from 7 until 6. One of the recruits came from the country; he paid his $3 for his board and did his washing himself Sundays; when he got a dollar more a week he took a correspondence course, and to-day he is a successful, prosperous engineer.

At that time apprentices in the railroad shop were put upon the bolt cutter job for a whole year, and in other shops they swept floors and did odd jobs. The second year was lathe work, and the third planer and vise. Sometimes a bright boy would get a chance to do drafting or to help one of the machinists on an engine job. Men trained in such a school do not have an excess of patience with present-day workmen, who are so touchy you cannot correct them or they leave, who work amid pleasant surroundings, get big money for short hours, and have so many things done for them in the way of better conditions and chances for learning and advancement. Apparently the modern man lacks stamina.

But put the same man in an employer's position or that of an executive and note the change. If he has been a draftsman and had a few hours each week when he merely had to "be there" and could roam the shop and office at will, you will find him checking each man with a stop-watch. If he has been a machinist and has started a little business of his own, he buys his tools from a Jewish vendor, even though he used to complain loudly about the "junk heaps they call machines" that he ran in his ex-employer's shop.

All similar businesses are in the same position regarding high prices that the individual is. There is a limit to what a concern can pay its men. Shops are forced at times to cut prices to get certain business because the customer may be one that cannot be lost by holding out. Competition is just as keen to-day as it ever was in numerous lines. In order to get a customer's work a firm must often take jobs that prove unprofitable as well as those that do pay.

It is for these reasons that men have to be kept on certain jobs longer than they themselves think is just. Often they hold themselves back; Jimmy wanted to get on the planers, and his superior told him he would give him "a show" as often as the opportunity came, which he thought should be two days a week if the lathe work came out all right, but Jimmy didn't like this and so he sulked and rubbered, and his net result was four days' work in six days, and he didn't get any chance at all, besides forming a habit that is always hard to break.

Then there is the case of Bob Wilbur, who was assistant to the foreman, and whose case was typical. He developed a lazy streak, took to dropping to a seat on the slightest pretext, and engaging one of the others in a conversation—result, two men's time lost. Like many others, when the shoe pinched he resented being corrected and would tell on the street of how a man was hounded at Coleman's shop, and being an intelligent, attractive fellow, his listeners believed it all. But when the plumber came to fix the pipe in the cellar, and Bob's wife sat on the step exchanging bits of gossip, which she afterwards served with the evening meal, did Bob take kindly to that sort of conversation? No, he hiked to the plumber's establishment and gave the owner a dressing down for charging him 90 cents for an hour spent in conversation.

And I recall Charlie and Ben who worked for me at the same time. Both wanted more money as their labors turned out less work, and both were strong around town on that line of talk about the low wages the shop paid. Charlie always quarrelled at home; he married to escape that and lived a cat-and-dog life with his wife; his domestic troubles were ever with him, his lips would pantomime evening blessings for his wife, and his arms would raise in threat—all this while his lathe was merrily running with a cut a thirty-second deep. We really felt sorry for him and retained him, though we didn't get more than actual wages out of his labors.

And Ben, he was building a house, working so hard wheeling dirt night and morning that he could hardly stand up during the day; naturally his production dropped way down, and the influence of a lagging man did not spur the men near him.

We hear a great deal about a plant not paying its own trained men as much after they have served an apprenticeship as they pay to open market labor. There is one good reason. It costs a substantial sum to teach a trade, and certainly every one is entitled to a return on an investment. The General Electric Co. has as modern a system of cost finding as could be devised, and they place the cost of training a machinist at $1,200. The Philadelphia Street Railway system is the best managed in the U. S., and they have computed the expense of breaking in a motorman as $250! Included in training costs are such items as spoiled work, instruction expenses, accidents, abnormal wear and tear on machinery, insurance, delayed work, loss of earnings from machinery used in instruction.

A young man dropped in the office one day and asked for a job as apprentice. He was working in the shop of a large corporation in another part of the city, and while he waited we called up that shop and asked about him; they said he had worked four years as a drill press hand and that they liked him, but they would not consider it an unfriendly act if we took him. We needed help and put him to work; frank, intelligent, good-natured, he had all the qualities that go to make one popular, and he seemed able to do plenty of good work of whatever kind was put on. But after a while we found that he was too good-natured, too ready to "Hello Bill" every workman that passed, too anxious to watch the cut on a neighboring machine to the detriment of his own. We found that after four years on a drill press he could not drill and hole to a layout (or rather would not force himself to do it), and we comprehended why the other shop had never advanced him. Eventually he was discharged, and most of the boys in our shop were sure an injustice had been done.

Turn an employee—even the most turbulent one—into an employer, and he immediately sees the other side of these questions for the first time. Employers are partly to blame for this condition for they rarely think it worth while to explain or to present any of the business end to workers.

One of our men had an opportunity to buy a one-man repair shop that had been offered as a good investment. He came to me for an opinion, said there was steady work at 75 cents an hour the year around, and he was only getting 38 cents where he was, making the proposition look very good, besides enabling him to be his own boss. He knew his trade well and I told him that he ought to succeed but that he must consider certain items of expense that would cut down his profits. These I jotted down offhand as: Insurance, waste and oils, factory requirements, rent, light, heat, power, repairs, bad debts, small tools and belting. And I mentioned the certain amount of bookkeeping, the capital and interest tied up, and the necessity for setting aside a fixed sum for replacements. A week later he came in and said he had given up the idea of "being his own boss" and sharing in the losses.

There are not the chances for advancement in some plants that there are in others, and the same is true of wages. But money alone is not everything. Good treatment and opportunities to learn something besides routine operations count for a great deal, and in the end a man may be just as well off.

The nursed grievance may disappear with an exchange of ideas. Before harboring a grievance every one should make a fair and impartial analysis to see if the grievance is not a weakness or a fault with one's own self. No matter how low the wage, the employer always pays it and pays it in genuine money, not counterfeit—but is the time always genuine; is there not a forty-minute hour passed off for a sixty? Will the promised quality of work be turned out a month after the advance has been granted, or will we drop back to the old, easy rate? Yes, there are two sides to every question, and each will bear presentation.

SWINGING TOOL FOR RECESSING AND SIMILAR OPERATION

By F. Scriber

A swinging tool that is a convenient auxiliary for a hand turret lathe is shown by Fig. 1 of the accompanying illustrations, while a group of cutters used in this tool are shown by Fig. 2.

Its construction can best be explained by referring to a practical working example, and Fig. 1 shows at the left of the tool proper a section of a part which has a double recess cut into it, this being indicated at X. The shank A is gripped in the turret of the lathe in the usual manner, it having a flange B forged on it to which is attached the swinging block C. This block is mounted on a stud D, a bushing being used in the swinging part, also nut and washer to keep it in place. At E a pin is located and an elongated clearance slot is cut into the swing part to clear this stud, while two screws F with check nuts on them limit the movements of this part, which is operated radially by the operator pushing over handle H, a spring attached to pins G being used to pull the tool back into central position. A split bushing J with binding screw K for clamping the cutters in position completes this tool, it being obvious that split bushings having different sizes of holes can be used for gripping different cutters.

In operation the turret with tool is fed till the cutter is the correct depth in the work and the recessing is done by pushing handle H, thus forcing the cutter L into the work the required depth, which is governed by screw F, thereby the work is machined to the shape of the cutter.

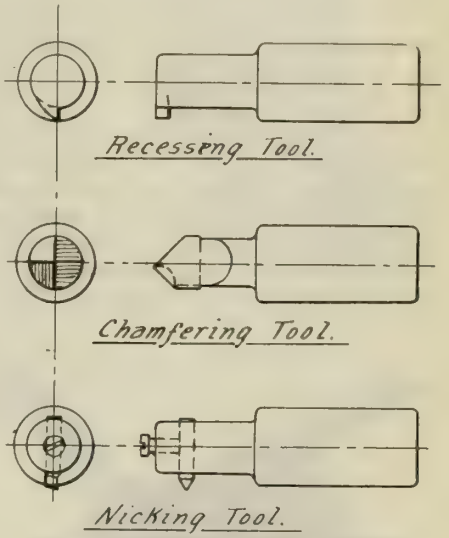
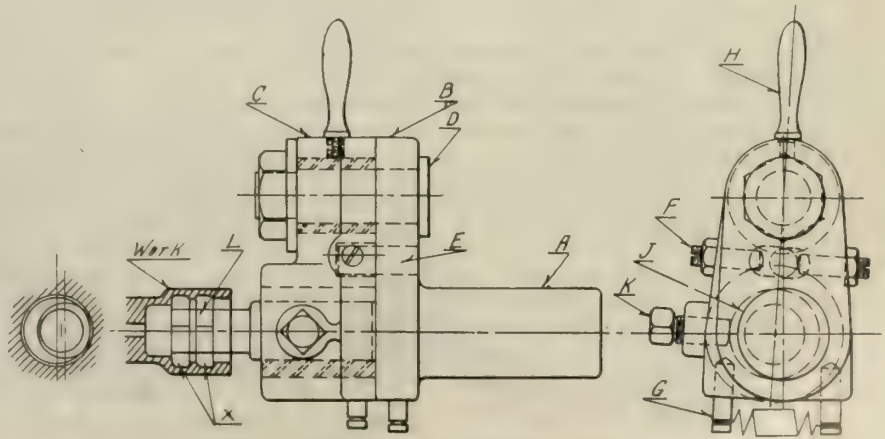


FIG. 2. DIFFERENT TYPES OF TOOLS

Referring to Fig. 2, the upper views show a plain necking tool or cutter such as is used for recessing back of a thread. The views at the centre show a type of chamfering tool for breaking corners, centering, etc., while the lower views show a pin cutter and bar used for cutting internal oil rings by the same method.

When it is desired to use this holder for boring, screws F are adjusted until the whole arrangement is prevented from swinging by having both screws come in contact with pin E.



GENERAL VIEW OF THE RECESSING TOOL



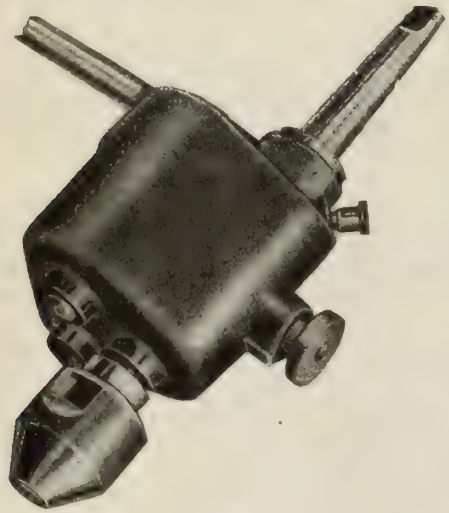
DEVELOPMENTS IN SHOP EQUIPMENT



WAHLSTROM TAPPING ATTACHMENT

The Wahlstrom Tool Co., 5520 Second Ave., Brooklyn, New York, have placed on the market their automatic tapping attachment as illustrated.

This attachment imitates hand tapping but is at least ten times faster, and handles all sizes of taps up to ½ in. The hand-tapping movement is obtained by means of steel gears so arranged as to provide an oscillating movement, the backward movement clearing the chips, thus saving the taps.



GENERAL VIEW OF THE TAPPING ATTACHMENT

The forward movement being greater than the backward movement advances the tap, while the return movement is continuous and works at an increased speed. With this attachment there is no danger of stripping the thread.

No springs are used, the movement being absolutely mechanical. The taps from the smallest to largest size are driven positively, without any adjustment being necessary.

If tapping cast iron or soft material, you can, by turning a knob on the attachment, make the movement continuous in place of oscillating.

All parts are of steel, hardened and ground throughout. There is nothing to get out of order, and every part is carefully machined to place. This device is handled by the Aikenhead Hardware Ltd., 17, 21 Temperance Street, Toronto, Canada.

MORRIS RADIAL DRILL

The Morris Machine Tool Co., Cincinnati, Ohio, have placed on the market what is known as their line of Morris 2½ ft., 3 ft., and 3½ ft. radial drills. These machines have certain distinctive features as follows:

At Fig. 1 and 2 is illustrated the front and rear view of head, which is heavily constructed and, at the same time, exactly balanced on the ways of the arm, permitting it to travel freely. An extra wide tapered gib is provided to take up wear. The head is moved along the arm by means of a rack and pinion, reduction gears and a handwheel on the left-hand side at the lower part of the head. This places it in reach of the operator when the arm is in its highest position. The head is clamped by two screws operated by one handle against the gib. One of the principal features is the helical spindle gears.

The angle of the teeth is enough to have more than one tooth meshing at one time and to avoid end thrust. The result is a constant power factor at the cutting point of the tool, eliminating the slight chatter effect usual with spur gears. It also means a more quiet drive and a stronger gear. Other features are, the enclosed spindle and sleeve, enclosed gears, tapping attachment gears and reversing clutch running continually in a bath of oil, and the graduated depth gauge, which trips the spindle feed at the desired depth. The column is made of semi-steel and is ground true to size. It is supported by both a large ball-bearing and roller-bearing in the stump, where it is rigidly clamped. This construction permits the arm to swing with exceptional ease, and when clamped is as rigid as a radial column and stump can be constructed. Both column and stump are extra heavy, insuring this rigidity. The base on these machines is so constructed that the speed box, cone pulley or variable speed motor drives are interchangeable.

The arm is designed to properly resist torsional and lifting strains. It slides on the column, having a long bearing, and can be clamped in any position by one lever convenient to the operator. The ways are wide, giving the head a generous bearing to slide on. The arm is raised and lowered by power through the lever at the top of the column.

The back gears are mounted in a fully-enclosed bracket directly in back of the head. All gears are of steel and the sliding engaging gears and clutches are of three and one-half per cent. nickel steel, heat-treated and hardened. Through these gears two speeds are obtained by a lever on the left-hand side of the head, convenient to the operator. Reversing gears and friction clutches are mounted in the same bracket, fully enclosed and run in oil. Lever controlling the reversing or tapping attachment is at the lower right-hand side of head, within easy reach of the operator.

The spindle is a hammered forging of high carbon steel ground true to size. Thrust is taken care of by a ball thrust bearing.

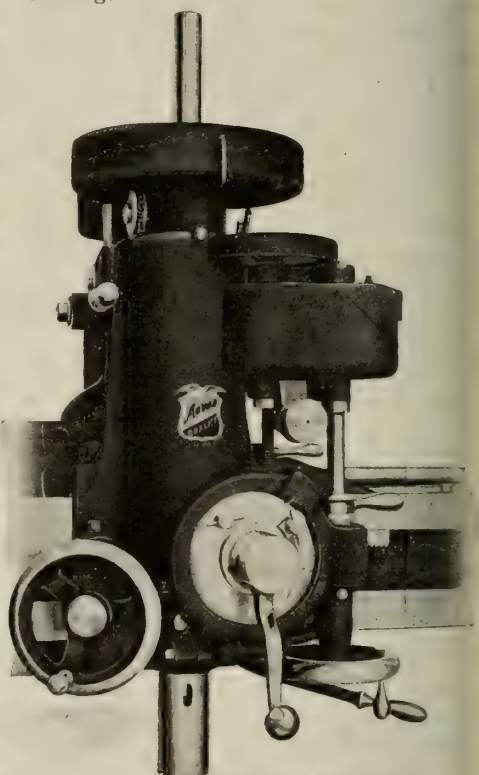


FIG. 1. FRONT VIEW OF HEAD

The feed box is a unit mounted on the head. Feed gears are fully enclosed and run in heavy oil. Four feeds are obtained and are marked on a dial in thousandths advance per revolution of spindle. Feed can be automatically tripped at any depth within the traverse of the spindle.

The gears are made of steel, except the large spindle gear which is made of semi-steel. Spur gears are hobbed and bevel gears are generated theoretically correct on a gear shaper.

The speed box is mounted on the base. Gears are fully enclosed and run in a

light grease or heavy oil. Six speeds are secured, three through the vertical lever on the top of the box. This lever controls the double friction clutch on the

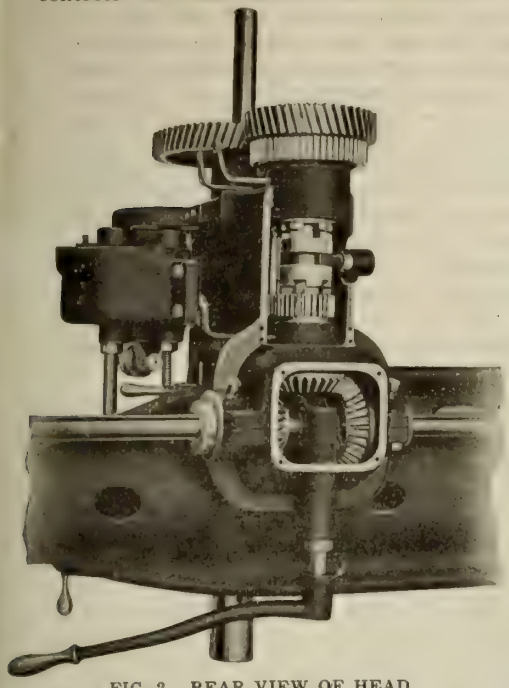


FIG. 2. REAR VIEW OF HEAD

pulley shaft, and when in neutral position stops every revolving part except the pulley shaft.

Friction clutches in speed box and tapping attachment are of the expanding ring type. Rings are ground in an expanded position insuring true contact when thrown in. They are of large diameter and wide face and capable of a pulling power considerably greater than the capacity of the machine.

The bearings throughout are of bronze, arranged with oil chamber, the oil being drawn into the bearing by a felt wiper.

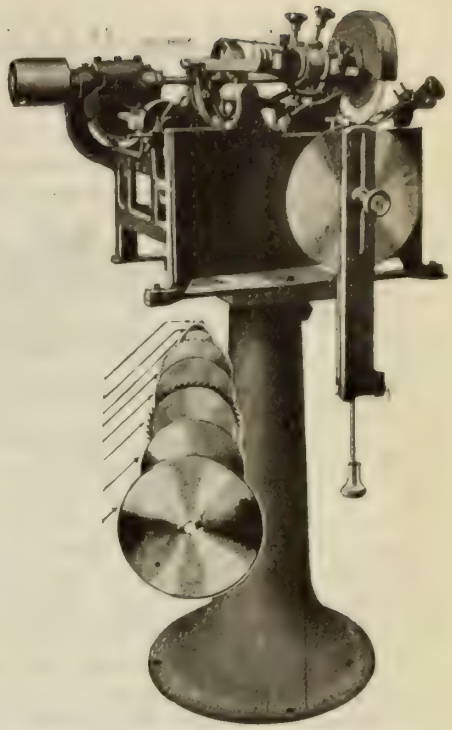
Motor drive can be arranged if desired.

AUTOMATIC SAW GRINDER

The Wardell Manufacturing Co., of Cleveland, Ohio, have now placed on the market their model E automatic metal cutting circular saw grinder. This machine is claimed to be the only one that will resharpen all screw-slotting, slitting, and cold saws from 1½ in. to 18 in. diameter, with teeth from 36 to the inch up to 2 inches from point to point.

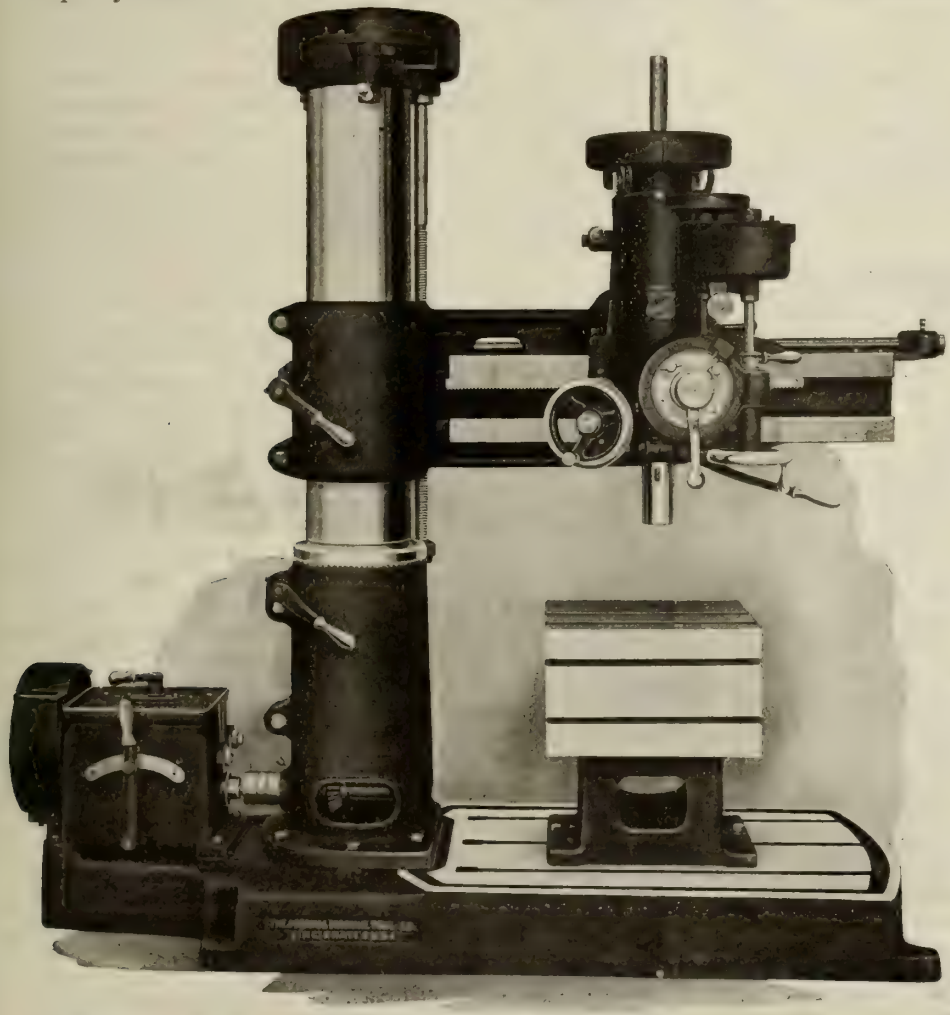
It seems a general rule that saws are carelessly thrown away when dull, but with the machine shown the saws can be sharpened indefinitely.

Saws are resharpened at a speed of 45 teeth per minute. The machine is full automatic, and once started needs no further attention. A scaled slotted eccentric permits of quick adjustment



GENERAL VIEW OF THE SAW GRINDER

of the feed, and a double pawl positive feed movement gives a continuous feed of the saw, even where teeth are broken out.



GENERAL VIEW OF THE DRILL

TRADE OPPORTUNITY IN CUBA

The old-established British firm of Albert Moloney and Co., 12 Amargura St., Havana, Cuba, is anxious to obtain sole agencies in Cuba for the following heavy machinery manufactured in Canada: Return tubular boilers, water-tube boilers, condensers, surface, jet, and barometric, power pumps of all types, steam driven, motor and belted, vacuum pumps, steam engines, valves and fittings, electrical generators and motors.

Canadian manufacturers might bear in mind that Americans enjoy a preferential tariff in Cuba, but that this is more than offset at the present time by the discount on the Canadian dollar. Another substantial assistance to Canadian trade with Cuba is the recent establishment of a direct line of the Canadian Government Merchant Marine between Canadian ports and Havana.

According to an article by Dr. Henry T. Eddy in the "Journal" of the Franklin Institute, uniformly reinforced concrete beams loaded at the one-third points store some 60 per cent. or more of the total energy of flexure in the steel reinforcement alone, and only about half as much in longitudinal compression in the concrete. Uniformly loaded flat slab floors with four-way reinforcement store only about 12.5 per cent. of the total energy of flexure in the slab steel. Since this is only about one-fifth of the amount stored in beams, the author states that it evidently is impossible to compute slabs by beam theory.

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The Exchange Situation

IT may be that some United States firms doing business in Canada do not appreciate the feeling that exists here in regard to the peculiar situation that has been created following the war.

Let us get back to first principles. During the war Britain and Canada did the same thing, namely, they bought right and left, wherever they could secure the supplies and the materials they needed to carry on the conflict. It was a matter of life and death at that time. There was no chance whatever to sit back and reckon on the finer points of trade balances. It was a case of go on or go under, and Britain and Canada chose to go on, and they have been doing so ever since. Right there and right under those conditions Britain and Canada got a bad start in the adverse balance of trade.

Now we are not putting this forward so that United States sympathy should be appealed to on behalf of Canadian trade. Far from it. Canada can shake out with natural resources, with available acreage, and with undeveloped wealth and pay dollar for dollar with United States. We simply wish to state that this is the point from which many a Canadian business man views the exchange situation in its exaggerated and lop-sided condition to-day.

In order that we may give our American friends the benefit of what is being said in the machine tool trade in this country we are giving here the views of two prominent Canadian dealers. Both of them do a large amount of business with American houses. The first one:

"United States houses that are looking to this country to furnish them with business in the days to come should realize that the measure of their future business here is going to be largely the measure of co-operation they give to us at the present moment in trying to meet the exchange situation. There are firms that seem to think it is a matter over which we should worry, and we are doing all the worrying, and paying all the losses. On the other hand we have principals in United States that are showing the keenest desire in our welfare at this time. They realize what we are up against, and they have in several cases opened accounts here where our customers can pay their accounts at 100 cents on the dollar. I tell you, we are out for business for these firms, and in future we are going to give them selling service that will repay them for their decency at this time. I am sorry to say that, opposed to this class, we have some American principals whose chief interest in the exchange situation seems to be that they should be careful to carve off the last half per cent. exchange at whatever figure the fluctuating price for the day may be. I am not making any threats, but it is easy to see to which class we are going to turn for dealings in the future."

Here is the second case. These are both concerns that have large, active selling organizations:

"Exchange is hurting us now, in fact it is losing money for us. Some months ago we quoted on enquiries that were in the Canadian market and we allowed what appeared to be ample for exchange. Now, these shipments are arriving. What happens? The increase in exchange amounts to more than our profit on the deal, and we are losing the difference out of our own pockets."

Of course, it is very easy to sit back and say that the latter case should not have given a definite price. That does not alter the case at all. The price was given, and it was right and reasonable to give it, and what appeared at that time to be reasonable protection against exchange was put in. Events that no one foresaw have obliterated that apparent margin of safety, and we find the Canadian firm that got out and sold the American goods delivering the same at a loss because it is considered good business by the firm to reaffirm its belief in the fact that a contract is a contract.

CANADIAN MACHINERY, in all seriousness, would ask its American friends to think seriously and carefully over these matters. Conditions are being built in these trying times that are going to direct the course and current of business in years to come. The far-sighted firm is going to see that this rich market is worth something more than the monetary consideration of an added percentage that can be secured under passing and temporary conditions.

An Error in Topography

A WRITER in an American contemporary, speaking of a new 15,000-ton steamer now building for the White Star-Dominion Line, says that she is to be named the "Calgary," after the Canadian province in which the Prince of Wales owns a ranch. This reminds us of an old lady, who, after listening all evening to a traveller's tales of the Orient, remarked, "Yes, China must be a wonderful city."

"CAN any of you tell me what the late ruler of Russia was called?" asked the teacher. "The Czar!" roared the class. "And what was the Czar's wife known as?" Only two voices answered this time: "The Czarina." "Ah!" said the teacher eyeing his flock fondly. "That is very good. Now, who will tell me what the Czar's children were called?" "Czardines!" yelled one little boy.

PASSING a hand over his forehead, the worried drill-sergeant paused for breath as he surveyed the knock-kneed recruit. Then he pointed a scornful finger. "No," he declared, "you're hopeless. You'll never make a soldier. Look at you now. The top 'alf of your legs is standin' to attention, an' the bottom 'alf is standin' at ease!"

"CLOSING the saloons has brought great changes."

"You bet," said the other dry-town inhabitant. "Nowadays a woman doesn't know where to find her husband."

A Giant in Chains

A CANADIAN who happened to be in New York during the past two weeks must have wondered at the acute paralysis developed by that city when attacked by a snowstorm. Granted that it was a fairly heavy snowstorm, its proportions were such that cities like Toronto or Montreal would have passed by without remark. The giant city of New York, which our neighbors are fond of calling the wonder city of the world, threw up its hands and murmured "Kismet," while its thousands of city dwellers and commuters spent hours in endeavoring to reach their homes, or else gave up the attempt, and spent the night as best they could in the city. Those who succeeded in reaching home remained there for several days in many cases before finding means to reach the city. The first means of conveyance to go out of business were the surface electric cars, they being handicapped by the fact that the current-bearing rail is under ground, a narrow slot in the centre of the tracks being left for the conductor to the car. This slot promptly filled up when the snow began to fall, and the cars just died on the tracks. For seven days not a street car ran. The elevated also was tied up considerably, and the power plants were short of coal due to the fact that communication with New Jersey by river became almost impossible due to masses of drifting ice coming down the Hudson. The subway was the only means of communication that kept up any kind of regular service. Motor vehicle traffic on all but the widest streets was suspended for days, and those cars and trucks that could run, received such abuse that they soon had to make for the garage for repairs. The scene in the down-town streets, in that congested section from the Battery up to Canal Street, was remarkable. The narrow streets with their high buildings, made admirable ravines for the snow to pack in, and broken-down and abandoned trucks and cars littered them as in the track of a hurriedly retreating army. For the first three days following the storm there seemed to be no definite and co-ordinated attempt to tackle the problem. Groups of men widely scattered could be seen making dispirited attempts to form a passage for vehicles. Hanging round every group was a sneaky individual who whispered to the men that they should not dream of working for less than $1 per hour, advice which seemed to be good to the men engaged. As late as last Saturday, ten days after the storm, the city was frantically calling for men to come and dig it out of the snow. The remarkable part of the whole thing seems to be that although snow is by no means unknown in New York, there does not seem to be any organization or equipment in the big town to tackle it when it does come. It was estimated by the merchants that they were losing $5,000,000 per day due to the tie-up, to say nothing of the damage done to rolling stock. Several fatal and near fatal fires occurred owing to the inability of the fire brigade to reach the scene over the blocked streets. The most amusing sight of the many to a Canadian was that of an old Jehu who had from some unknown old stable resurrected a two-seated sleigh, and a broken-down horse, and was offering sleigh rides to the populace for the small price of 50 cents for a five minutes' ride. The residents of Gotham congregated around this unusual sight and stared with great interest, and some of the more venturesome took 50 cents' worth. Truly New York is the wonder city, but they should send their Commissioner of works to Montreal or Toronto and see what we do with our snow.

Fuel Alcohol

IT has been said that the fuel resources of the world both as regards coal and oil are sufficient unto the present day and that regard for the comfort and convenience of future generations is a bit too altruistic. In other words we should trust to a kind Providence or to man's ingenuity and inventiveness for the circumventing of a future shortage of coal. While this is true and while it is also true that the present known resources in the way of coal and oil will last for some little time to come it is also true that long before exhaustion takes place, prices will have advanced to such a point as to render conservation in the strictest sense advisable.

To-day even coal and oil are far more expensive than anyone thought possible a few years ago and increasing attention is being given to other forms of fuel.

Low grade lignites and other material formerly of little value are now being used and industrial alcohol is being recognized as a cheap and valuable fuel for the internal combustion engine. The Advisory Research Council in Canada published a report on the use of industrial alcohol some little time ago and a recent report states that the Dominion Government is contemplating the removal of restrictions on its manufacture and will free it from excise duties.

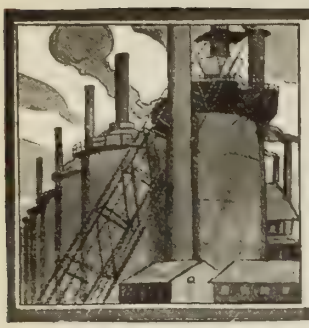
The importance of this step can scarcely be overestimated, for the production of alcohol may be likened to the use of our waterpowers—water over the dam is lost forever and undeveloped waterpowers have to be paid for in the use of fuels which when once mined can never be replaced. In like manner the raw materials from which the alcohol can be obtained are now wasted, wood waste is allowed to rot or is burned, vegetable waste of the farm or city garbage is treated similarly and the sulphite liquor of the pulp mill is turned into the nearest stream to the pollution of the waters and the injury of all aqueous life. This latter source of alcohol, in passing, would provide an enormous quantity of alcohol for industrial purposes at a very reasonable price.

Probably the greatest immediate use for alcohol would be in the form of motor spirit and in this alone its use would render Canada more self contained, rendering her independent of foreign sources of supply, incidentally to the material benefit of the exchange situation. Tests have shown that alcohol is an admirable source of heat energy and any engine at present using gasoline may be run equally well on alcohol, although an increase in power of about 20 per cent. can be obtained by redesigning.

An interesting feature in connection with the world-wide shortage of fuel is the appointment in England of Sir Frederic Nathan as power alcohol investigation officer under the Fuel Research Board.



THE QUESTION IS—"WHEN WILL THEY GET DIZZY?"



MARKET DEVELOPMENTS



Flu and Exchange Are in the Limelight

Bothering Business This Week in a Good Many Ways—Prices Again Are Increased and Material Is Very Scarce—Steel Mills Are Short of Their Coal and Coke Supplies

THERE is no doubt a feeling of "we don't know" in the market this week, and it finds its echo in steel, iron, machine tools or small tools. The exchange question is a hackneyed affair, but it is a real circumstance just now. It means a loss of business in the way of booking, and a loss of money on orders that have been quoted by dealers at a definite figure.

Influenza is hitting the industrial world hard this week. There are plants with from two to three hundred workers out, and, of course, production is suffering accordingly. In spite of all these conditions, dealers report a good inquiry and a satisfactory volume of sales as a result.

The steel situation is serious, and it grows more so. There is nothing in sight to show any improvement. Steel mills in Canada are having a hard session trying to find the necessary coke or coal to keep their plants going. As sheets from Canadian mills are about all the relief that is coming in this much-wanted line, a shutdown would be a serious affair.

Several warehouse men from Toronto district have been in the steel mill belt of United States during the past few days. They went to see if they could not get their business on the mill books, and also in the hope of picking up any stray tonnage. In both quests they were disappointed.

Many of the consumers of steel in its various points are being hard pressed to find the supplies necessary to keep their plants going. In common with dealers and warehousing interests, they complain that under present conditions it is impossible to lay out a programme for the year's operations, as they know from past experience that they cannot adhere to it.

The scrap metal trade is very quiet. Mills and foundries seem to have dropped out of the market entirely. There is a very keen demand, though, for cast iron scrap, and lots of this will always bring plenty of buyers, regardless of other market conditions.

MONTREAL SAYS EXCHANGE RATE IS PUTTING BRAKES ON BUSINESS

Special to CANADIAN MACHINERY.

MONTREAL, Feb. 19.—The all-absorbing question of the moment is the slowing up of normal business, as a result of the exchange situation. While the effect in some quarters is not very pronounced, the consequence has been more or less serious, and is particularly emphasized in industrial circles, where it is virtually imperative to bring needed material in from the States. An example of what is taking place might be cited in the experience of a dealer here who quoted on a large machine list for a Canadian railroad. The equipment involved an expenditure of upwards of $300,000, but when it was learned that nearly $25,000 of this would be required to cover the exchange charges, the reply was "nothing doing." If no better arrangements could be made, the purchase of the machinery would be diverted to Canadian manufacturers, where possible, and such machines as required to come in from the States would be held in abeyance until trading conditions became more normal. This appears to be the general situation and while considerable business is still carried on, the bulk of it is of essential character. Some dealers here have been negotiating with their American principals in an effort to induce them to co-operate in carrying the burden of the high exchange. In this they have been partly successful, particularly with those lines that are open to the trade, many of the makers of these lines agreeing to absorb the full amount of the exchange. In the case of exclusive agencies, the assistance is varied, the majority deciding to take care of all exchange over 4 per cent.

Plates and Sheets Advance

Despite the announcement a few weeks ago that the steel strike was declared over, the resultant relief has not been one that would indicate that mill production has shown any material increase. Many reasons are advanced for the shortage of material, such as car shortage, scarcity of raw materials, inefficient help, etc., but it is still a glaring fact that delivery of material is a disturbing factor in industrial activity, and the consumer is far from satisfied. No assurance will be given as to the expected date of delivery and normal acceptance of business is the placing of the orders on the books, with no definite promise as to time of shipment. Even premium business is less pronounced, owing to the inability to get producers to handle the same.

The plate and sheet situation is now beyond the knowledge of the average dealer and obtainable information is of a very indefinite character. Warehouse supplies on ordinary sizes are now a matter of history and little relief is looked for in the early future. Montreal quotations on plates have been marked up, but more as a result of habit than a definite message to the trade, as present circumstances allow of normal prices only, each individual sale determining the actual trading figure. Asked as to what was being quoted on sheets, one dealer replied, "Anything we can get," but for the sake of relative guidance, they are quoting $8.25 on black 28, and $7.75 on black 10 gauge; these prices represent an advance of 1¼ cents per lb.

Nervousness Pronounced

Dealers are loath to commit themselves on the actual scrap situation, for the specific reason that it is very difficult to make a definite statement of conditions as they exist to-day. The question of price on some essential lines is

now secondary to supply and dealers are open to consider offers when material is available. This is particularly true respecting machinery scrap, and the figure of $26 is only nominal, as dealers intimate that a price will only be considered when a sale is negotiated. The entire old material market is pregnant with nervousness and uncertainty.

SHORTAGE HAS BECOME MARKED

Conditions Grow Serious in Some Lines With No Relief in Sight

TORONTO.—Several influences are at work just now with the apparent intention of stopping business in this district. One of them has been here for some time, viz., shortage of supplies, and the other, although only here a short time, has been making its presence felt—the "flu."

There are a number of plants in this district that are badly handicapped because they cannot get their supplies of raw material. This refers especially to those that use large quantities of steel in any of its various forms. There is a serious situation right here, and it is only by very careful handling and apportioning of the available stock that plants are keeping in operation at all.

The "flu" epidemic is playing havoc with the available labor power in a good many places. Large plants report from two to three hundred hands off this week. This tends to curtail operations, but dealers in small tools report that they do not notice any falling off in the amount of business they are doing, which might be expected from a letting-up in the shop operations in the district.

"There is a good inquiry list coming in now," stated one dealer to CANADIAN MACHINERY this morning, "and what is better, some of our principals in the United States are showing a little betterment in their delivery schedules, and an increasing desire to do all in their power to make it as easy as possible for their Canadian customers to deal effectively with the exchange situation. They realize—some of them do at least—that if they intend to carry on here in years to come they will have to show a very marked desire to act in the utmost good faith in the present unsettling times."

Report Business Brisk

Three dealers in small tools reported this morning that they were doing a nice volume of trade. The order for many of the supplies for the St. Malo shops of the National Railways is being placed this week. The last list is largely carbon drills. It is understood that the business is being pretty well split up as it seems to be the policy of the railroads in their buying to do this. The limit price for large quantities is generally given to the railways, so here is one case, at least, where the Government does its buying at rock-bottom figures. The only complaint some of the dealers have about the Government railway business in tools and supplies is that the money for the goods comes slowly, and very often they are required to tie up their own money on a sale where they have given the very lowest possible figure.

POINTS IN WEEK'S MARKETING NOTES

Bars are up again, iron and steel base now being $5 per hundred Toronto, with $5.50 for 3-16 and thinner.

Shortage of coal is keeping Canadian steel mills on the keen edge.

Automobile makers find it hard to secure springs for upholstering seats.

"Flu" is invading Toronto industries now, many of the larger places reporting from 200 to 300 off.

Buyers from Ontario have made several trips to the steel district of the States in search of material, but without success.

Thousands of tons of finished steel are at the plants of the U. S. Steel Corporation, awaiting removal.

Scrap metal markets are dull, but there is a great scarcity in cast iron, and a good price can be secured for this.

The Steel Market

Little good can be done in trying to make it appear that conditions are improving in the steel market. Manufacturers and consumers of steel in any form know that such is not the case. Several Toronto warehousemen have been down in the steel mill belt of the United States, seeing what they could pick up in the way of ready shipments, or using what influence they had to try and get some of their bookings on the go. They all come back with the same opinion of the situation. They are not at all enthusiastic over the outlook. The shipping is slow. In fact the Canadian office of the Steel Corporation states that they have in all some 150,000 tons in the Corporation's various yards that cannot be moved to the consumers. Some of the smaller mills of the Corporation have been forced to close during the last few days on account of shortage of material, principally coal and coke. Canadian mills are suffering from the same cause. The situation in the Dominion steel industry is one that is causing no small concern. Supplies of coal that must be forthcoming daily to keep the coking plants in operation are being confiscated before they ever reach the border. Close off the coking plants and the blast furnaces, open hearths and the finishing mills will not run very long. This is especially true at present as there is very little steel in the semi-finished stage in any of the yards, as the entire hearth capacity has been drawn on by the capacity operations of all the finishing departments.

The situation just now is confusing to warehousing interests and to manufacturers alike. They are finding it particularly hard to lay out any concerted programme for the year's operations, because they cannot count on supplies coming through. The automobile industry in this district is finding it hard to secure several things, perhaps nothing so much so as springs for the making of upholstered seats. Steel for running boards, bodies, etc., is also very scarce, and operations are curtailed as a result.

Canadian mills have announced to the trade an increase in bars, the resale price in the warehouses now being $5 per hundred base, and $5.50 for 3-16 and thinner.

"Flu" Bothers Scrap Trade

Reports to CANADIAN MACHINERY indicate that the "flu" has hit the scrap yards. Business has fallen away off this week, was the report of the largest yard in this district. Not only in this immediate territory, but all over, the buying is away off, and the only demand is for export.

Prices remain the same. There is very little moving at present in reds and yellows. Cast iron is just as scarce as ever, and the man who happens to be holding any just now is in the rather enviable position of being able to dictate his own terms and conditions and price. The fact that under these favorable selling conditions very little of it is being unearthed goes to show that the shortage is bona fide, and not due to manipulation or withdrawing from trade.

Dominion Oxygen Company Will Have a Plant in Toronto

Toronto.—The growth of the oxy-acetylene industry in Canada is evidenced by the recent organization in the city of the Dominion Oxygen Company, Ltd., which aims to meet the greatly increased demand for oxygen, and other gases used in industrial plants. This company is a subsidiary of the Union Carbide and Carbon Corporation which controls 36 distinct companies throughout Canada and the United States. The officers of the company are: President, B. O'Shea; vice-presidents, Leighton McCarthy and E. S. Whitney; treasurer, Silas Wiley; secretary, J. R. Knapp. The building programme provides for the immediate erection of five large oxygen plants, one of which will be at Toronto, with others in leading industrial centres. In addition, service stations and warehouses will be established throughout Canada to supply the smaller industrial centres. The formation of this company is an added proof of the great growth of the iron and steel industries in Canada, as the demand for the oxy-acetylene process is but an outgrowth of the other industry.

MACHINE TOOL ENQUIRIES SLACKEN BUT SOME FIRMS STILL IN MARKET

Special to CANADIAN MACHINERY.

NEW YORK, Feb. 18.—It is somewhat difficult to analyze the machine-tool situation at the present writing. Evidence of a lull in buying and in inquiries has been noticed in the past week, and following the disturbance in the financial markets this naturally leads to the assumption that manufacturers are pursuing a more cautious policy. However, the epidemic of influenza and the tie-up of transportation due to recent heavy snowstorms, may have had something to do with bringing about a lull. It will take more than one or two weeks of quiet to determine whether most of the buying of equipment for the country's amazing industrial expansion has been done. Most of those in the trade believe that the lull is but a temporary condition, and that as soon as spring comes business will go forward with a rush. There is much to support this view, so far as the metal-working industries are concerned, in the large number of new manufacturing projects which are every day coming to light. New steel plants and rolling mills are a conspicuous feature of recent industrial planning.

Prices on many commodities have gotten so high that a break is bound to come sooner or later, and in the past few weeks there have been slight declines in food products and in some textiles. Any pronounced break in prices in any line of commodities would be reflected eventually in the metal-working industries, and this possibility is, of course, being watched for very closely.

The Columbia Graphophone Co., Bridgeport, Conn., continues to buy for its Toronto and Baltimore plants. The Willys Corporation, Elizabeth, N.J., is still adding to its equipment. There is considerable activity also in New England, one of the most important inquiries coming from the Saco-Lowell shops, Boston, for several hundred thousand dollars' worth of equipment. The Eisemann Magneto Co., Brooklyn, N.Y., is buying on a fair-sized list. Business is made up largely, however, of small orders, and of these one dealer has received a sufficient number thus far to indicate that February will be an exceptionally good month. Other sellers report a very material falling off in business this month. So at best it may be said that conditions are spotty, as is to be expected during a period of uncertainty, such as has been brought about by the foreign exchange situation, the tightness of money and other related developments.

PIG IRON PRODUCTION INCREASES; SCRAP MARKET QUIET

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 18.—The situation in the steel market as a whole remains as it was. There are some stabilizing influences, but there is in substance a runaway, as was apparent in the reports of a week ago. The United States Steel Corporation has no direct following in its adherence to March 21 steel prices, but two large independents are with it in theory to the extent that they are holding their products at prices substantially equal to the prices ruling before the March 21 reductions. All other sellers seem anxious to secure the highest steel prices obtainable.

Steel Ingot Production

According to the monthly report of the American Iron and Steel Institute, the production of steel ingots in January, 1920, by thirty companies which made about 84.03 per cent. of the total steel ingot production in 1918 amounted to 2,966,662 gross tons, as compared with 3,107,778 tons in January, 1919, a decrease of 141,116 tons. By processes the output in the two months was as follows: Open-hearth, 2,351,153 gross tons in January, 1919, and 2,241,318 gross tons in January, 1920; Bessemer, 749,346 gross tons in January, 1919, and 714,657 gross tons in January, 1920; all other, 7,279 gross tons in January, 1919, and 10,687 gross tons in January, 1920.

Surprise in Pig Iron Production

Much surprise has been expressed by the reports showing that pig iron production increased nearly 15 per cent. from December to January. Coke shortage and disorganized traffic conditions on the railroads had been the source of much complaint, so that the belief of a loss in production seemed to be well established. While the 15 per cent. increase was not expected, nevertheless it wasn't satisfactory, and much more than that is needed. Accumulations of finished steel are seen at many of the steel plants awaiting shipment and held back by reason of insufficient car supply. Some of these plants report accumulations of 50,000 to 75,000 tons, and it is safe to say that in the Central West there is more than half a million tons of material at plants awaiting shipment. This does not mean that the railroads are functioning less than formerly, but it looks as if they are unable to increase their service with anything like the rapidity desired by the iron and steel industry.

U. S. Steel Unfilled Obligations

This week the report of the United States Steel Corporation showed that its unfilled obligations had increased during January by 1,020,075 tons, this increase being about 10 per cent. less than the December increase, but on account of shipments having been heavier in January, say 84 per cent. of capacity against about 73 per cent. in December, the actual bookings were somewhat larger in the latter month. The actual bookings in January involved, in many cases, orders that were doubtless booked in November or December, but were held back pending a careful scrutiny of the customer's record, for much more tonnage is offered the corporation than it can accept.

Export Tin Plate Business

It is stated here that about $9.50 is the highest that has been done on any regular overseas export tin plate business, and if that is really the case it would indicate that sellers have not exacted the very highest prices possible, as with the Welsh market up to 70 shillings there is little doubt that somewhat higher prices could be obtained. One sale to Canada, however, has been made on a $10 basis. That is exceptional, since, as a rule the tin plate producers regard Canada as more or less a part of the domestic market. The last-named has been well held at the $7 level. The tin plate plants are operating on an average at from 75 to 85 per cent., there still being a shortage of sheet bars. There is a very serious shortage of box cars for shipping the product, but thus far the warehouse capacity of the mills has been ample to take care of the difference between production and shipments.

The Scrap Market

The iron and steel scrap market is very quiet, and prices have softened somewhat, a temporary condition due to the congestion at the different consuming plants. Prices are not varying much, although it is believed that in a few cases concessions have been made. There was little buying by the mills this week as they were heavy buyers two weeks ago, and this eased up the activity in the market. Dealers who last week were disposed to encourage the softening in the market were in the same mood this week, and held back from making bids for heavy melting steel, a policy that generally brings out odd lots at lower prices than the $28 possible in Pittsburgh some time ago. The several descriptions of re-rolling scrap that advanced last week have kept up, although very few actual transactions have been recorded.

Pig Iron Market

Bessemer and basic pig iron have both advanced in the week just ended, and the irregular nature of the advancing tendency is well illustrated by the fact that basic pig iron has passed Bessemer, although the last-named is the most expensive grade to make, and is always considered the most valuable. A week ago basic stood at $40 Valley, and Bessemer at $41. There was a larger tonnage demand for basic than for Bessemer, and when all the $40 iron was cleaned up there was still some buying, which

promptly developed a jump in the quotation to $43. Bessemer remained at $41 until the middle of this week, when a sale of 3,000 tons was made, delivery over the next five months, at $42 valley, thus establishing the market at that figure. Demand for foundry iron seems to have quieted down, after furnaces had sold about one-third of their second half output at the regular market, recently developed at $40 valley. The furnaces now state, however, that they are out of the market and would not sell any more at the recent prices. A fresh movement may come in foundry iron, but basic now seems to be the more interesting commodity. The market is quotable as follows: Bessemer, $42; basic, $43; foundry, $40; malleable, $41.25.

While the total supply of coke has not increased to any great extent, it is not altogether as difficult as it was formerly to effect purchases. Some of the dealers state that while they have not been able to secure all the coke for their friends that was wanted they were able to pick up a fair quantity. The coke market remains quotable as follows: Furnace, $6; foundry, $7; crushed, over ¾ inch, $7.30. There has been a falling off in production in the Connellsville region, the loss this week showing 1,991 tons. Car shortage is given as the greatest reason for this.

MEETING AND SOLVING THE EXCHANGE SITUATION

THE subject of exchange has become a vital question among the big majority of business men here, who, through necessity, have to deal with manufacturers or other business interests in the States. Customers are very reluctant to purchase new equipment from American concerns on the understanding that they will be called upon to pay, in addition to the list price of the material, the exorbitant high rate of exchange existing at the present time. It will readily be seen that this condition is a very severe handicap to the handling and selling of the merchandise of American manufacture.

The situation is one that tends to prevent early expansion in many directions, and the American business house is in danger of losing his hold upon the Canadian market unless he takes prompt steps to remove the obstacle of high exchange that is now preventing the onward march of progress.

One of the industries that has received a full share of the resultant decline of business, as a direct consequence to the exchange problem, is the machine tool interests, and several of the larger Canadian houses have been in correspondence with their principals with the purpose of negotiating some practical method of bridging this widening chasm. In some instances, and the one generally accepted as the most effective, American tool manufacturers have opened accounts in Canadian banks to allow the purchase of equipment to obtain the full value of the money expended without being called upon to have it discounted at the prevailing rate. In this way the American manufacturer could conduct his sales in the ordinary manner, at the same time retaining the full confidence of the buyer. When the rate of exchange again becomes normal the funds could be withdrawn and transferred to the home office without loss.

Another suggested alternative is the investment by the American distributor in gilt-edged Canadian securities, bearing a good rate of interest such as the late issue of Canadian Victory bonds bearing interest at 5½ per cent. per annum and issued at par.

This appeal has been made in the interests of the American manufacturers as well as those of the Canadian buyer. It will enable the former to retain a hold on this market and will likewise facilitate the expansion and reconstruction of Canadian enterprise.

The response, it is learned, has become very favorable, as many Canadian interests, either by the methods above suggested, or others arranged by themselves, have agreed to co-operate in meeting the burden of the high exchange. Some are willing to absorb the full amount, and many others are offering to absorb all over what might be considered as a normal rate of exchange.

U.S. SCRAP METAL

The scrap iron market is not as firm as it has been of late. Prices have eased from their high position and buying has slackened. Following are reports from various U. S. points:

Chicago.—Heavy melting steel has gone back about 50 cents per ton. Pig iron is still short, and cast scrap is in consequence retaining its strength. Rolling mill grades are strong.

Boston.—There has been a general shading on all grades, but it does not amount to very much. Cast grades are keeping firm, while railroad wrought has brought $32. Turnings and borings are firm.

New York.—A quiet week has been experienced, largely due to climatic conditions tying up yards and railways. The market has remained firm with the exception of heavy melting steel.

Philadelphia.—There has been little business done during the week, the weather acting as a brake on most activities. Quotations remain as they were but the market is thought to be weaker.

Pittsburgh.—The market is still firm for foundry grades, especially cast scrap and special purpose material, but the steel grades have receded somewhat. Heavy melting has been quoted at $28.50 but no sales have been made.

Cleveland.—There is little doing in the scrap iron market here. Purchasers are stocked up for some little time ahead and are keeping out of the market. Heavy melting quoted at $26.50 to $27 is not selling. Cast iron borings are quoted at $20.

Buffalo.—There has been little business done during the week, a general tie-up resulting from shortage of cars and labor. The market has weakened a little but resumed business will no doubt bring prices back to their former level.

St. Louis.—The scrap iron and steel market has suddenly taken fright at the recent slump in foreign exchange, and seem to be doing nothing but sit tight. There is a good demand for scrap, and the foundries and mills are big consumers. Heavy melting is being held for $30 by dealers.

Birmingham.—There is a firm market here, though the withdrawing from the market for a couple of days of the steel consumers caused some anxiety. Some heavy melting was sold towards the end of the week at a slight price concession.

PIG IRON TRADE

With an active demand and supply scarce, both basic and foundry iron have made advances. Following are reports from various U. S. centres:

Pittsburgh.—About 20,000 tons basic has been sold recently at $43 valley furnace; an advance of $3 over previous sales. Delivery is mostly to start immediately. There is an active demand for basic, while foundry grades are around $43.75 for the basic grade. Malleable is not in as much demand as it has been, and a quotation of $42 met with no buyers.

New York.—Prices of pig iron are again on the rise, but the amount of buying is not so heavy as has been the case recently; 1.75 to 2.25 silicon for second half Buffalo was sold at $45. First half Virginia iron sold at $42 furnace for the basic grade. Some foundries have had to shut down recently through the storms tying up traffic.

Cleveland.—Basic is hard to obtain, and sales have been made as high as $44 valley furnace. Sales for the week in this district total around 250,000 tons, the average price being $41 furnace. Foundry iron is also feeling the effects of the high prices, and is now quoted from $41 to $43 for No. 2 foundry. The higher figure is for second quarter delivery.

Cincinnati.—The market is firm here, but the feeling is not quite so buoyant as it was. Furnaces are pretty well sold up. There is a wide spread in prices quoted, some having been offered at $40 Birmingham while as high as $45 has been asked. The car situation is serious.

Philadelphia.—There is an active enquiry for second quarter iron and also for second half. No. 2 iron is quoted $44 furnace for first half and $43 for second half. Basic has been quoted at $45 furnace, an advance of $5.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 75
Steel bars, base, Toronto	4 75
Iron bars, base, Montreal	4 75
Steel bars, base, Montreal	4 75
Reinforcing bars, base	4 75
Steel hoops	6 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	71 00	60 00
Spelter	12 50	10 75
Lead	10 25	8 75
Antimony	14 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in	6 50	7 00
Plates, ¼ up	$ 6 00	$ 6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

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WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	26 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing; No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

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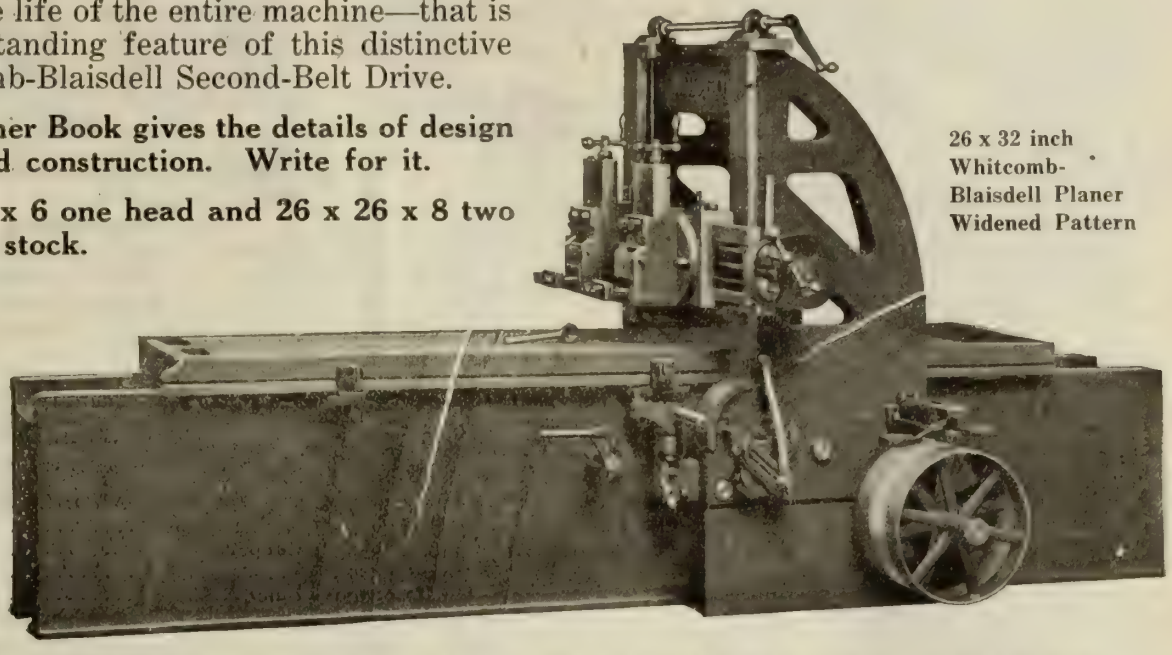
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24 x 24 x 6 one head and 26 x 26 x 8 two heads in stock.



26 x 32 inch Whitcomb-Blaisdell Planer Widened Pattern

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Railroad and Other High Grade Castings

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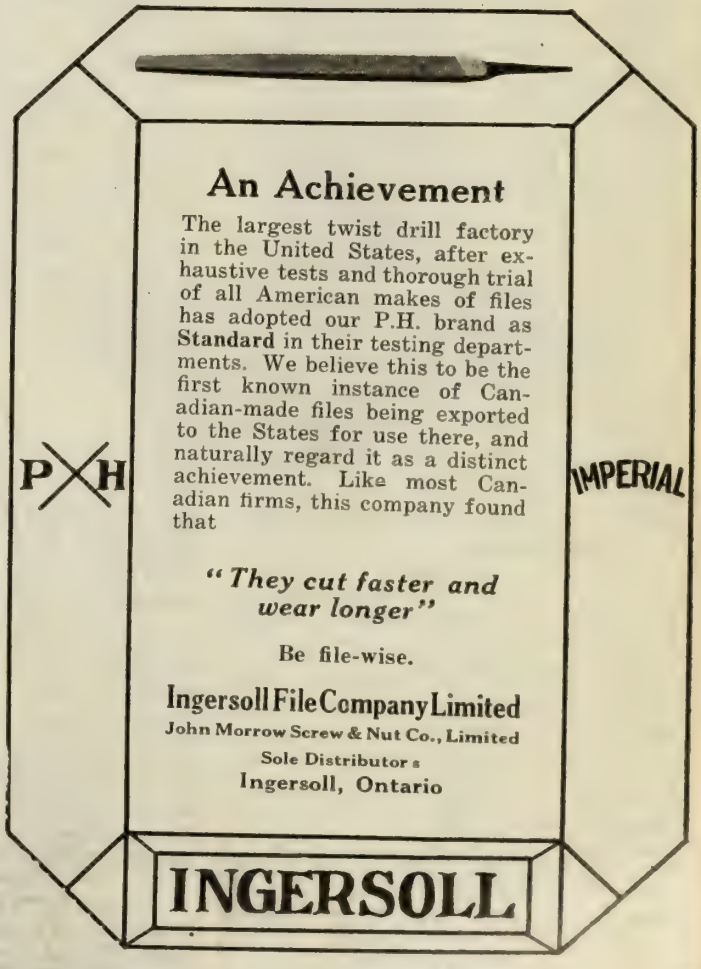
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Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 25	$ 8 00
Sheets, black, No. 10	7 75	7 50
Canada plates, dull, 52 sheets	8 50	8 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 50
Premier, 10¾ oz.	....	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

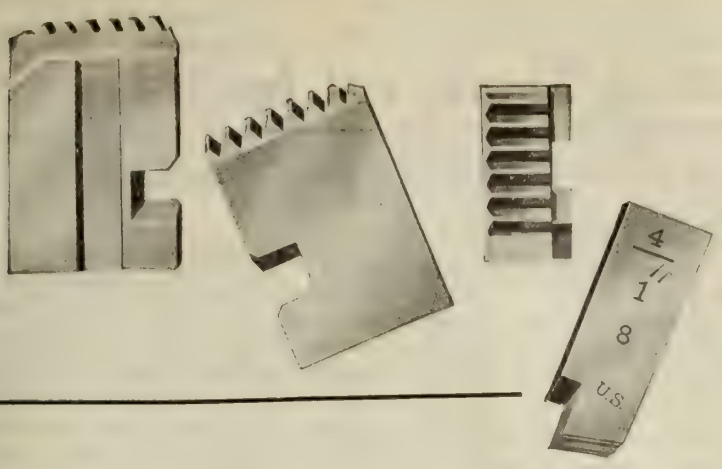
Cut sheets, ½c per lb. extra.

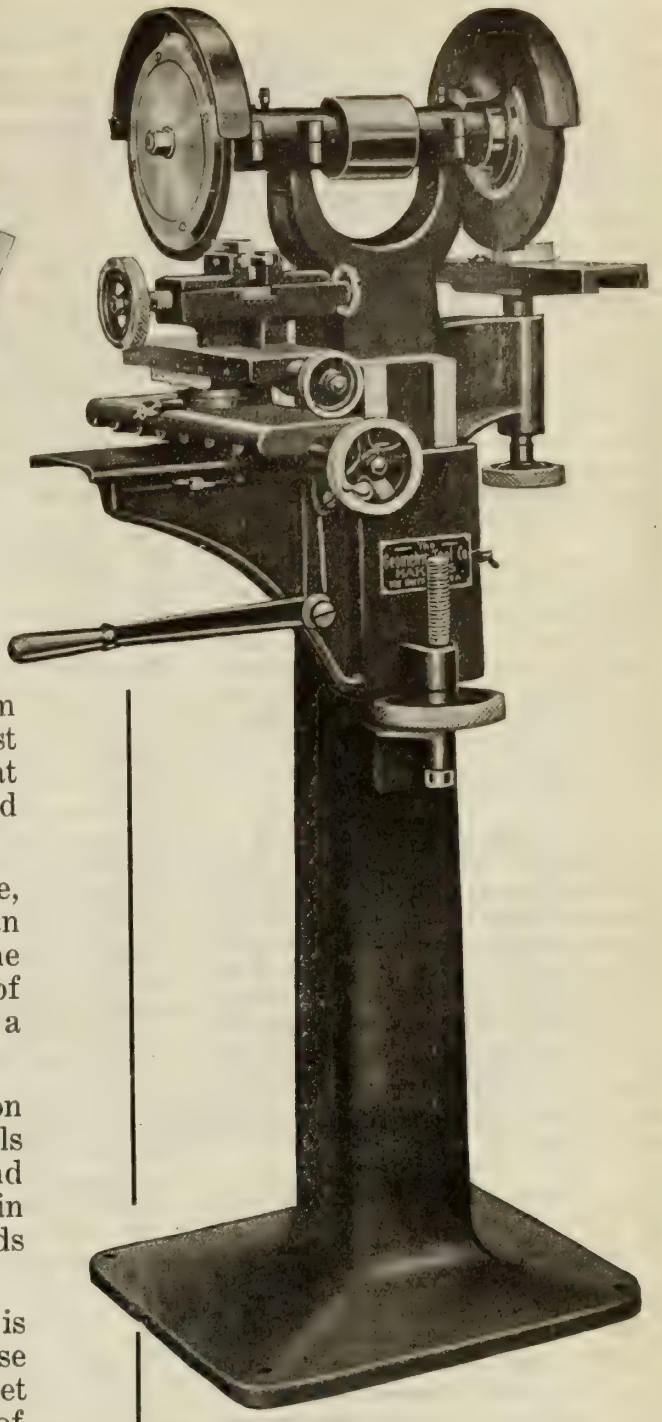
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated





Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine — the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Various makes of chasers can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalogue describing this machine is a mine of information on chaser grinding. Write for it

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, Winnipeg, St. John, N.B.

The Week's Events in Montreal Industry

Chas. P. Archibald and Co., machinery dealers, Montreal, have removed their offices from 164 St. James St. to 285 Beaver Hall Hill.

The new form of Government proposed for the City of Montreal will be decided at an early sitting of the Quebec Legislative Council, and it is anticipated that the commission appointed for the study of the question will be composed of twenty members, including two from the Canadian Maanufacturers' Association, representatives of which body was omitted from the number first proposed.

According to an estimate by Obadiah Gardner, chairman of the American section of the commission investigating the possibilities of deepening the St. Lawrence for ocean ship traffic, the amount required for such a purpose would exceed $50,000,000, and the total cost of developing the water powers of the river in connection with the undertaking would be over $250,000,000.

The discovery of what promises to be of inestimable value to the development of Eastern Ontario was made recently on the property of the Prescott Quarry Company at Prescott, when engineers struck a vein of coal at a depth of 40 feet. The samples produced were passed on by efficient engineers and pronounced to be of good quality of coal. This find has opened up an opportunity of development that has lain dormant for some time in the adjoining counties where iron ore is in deposit.

Vice-President Grant Hall, of the C.P.R., has announced a new departure in connection with the education of their apprentices and other youths in their employ, or sons of older employees of the company. The competitive examinations that will determine the qualifications of the student will be the regular entrance matriculation of McGill for June of this year. The candidate making the highest average will receive the scholarship, which will be renewed from year to year for a four-year period, if at the close of each term the holder is entitled, under the rules, to full standing in the next higher year.

The efforts put forth by the Canadian Manufacturers' Association and other business interests to have the business profits tax rescinded, is likely to bear fruit, as there is a growing impression in local circles that it will not be renewed.

There is a belief that many outside firms would be ready to establish plants here provided they were exempt from this form of taxation. Nothing definite is yet known as to what the attitude of the Government will be in the matter, but it is more than likely that the present tax will be replaced by a heavier one on industrial and corporate incomes.

Montreal shipping men were subjected to a slight shock this week by the announcement from Ottawa to the effect that wharfage charges for the port would be increased 20 per cent. over those ruling last season. While the matter of raising the rates has been under consideration for a long time, the shippers were hoping to be freed from any further charges, so that the 20 per cent. advance has been a staggering blow to many interests. The new regulations go into effect at once, but will not be actually felt until the port resumes active operations at the beginning of navigation.

Following a fire recently, which resulted in some little damage to the plant of the St. Lawrence Welding Company, this firm has decided to dismantle the present plate shop and construct a modern steel and reinforced concrete and brick building 148 feet by 60 feet, with a height of 25 feet, fitted with an electric travelling crane, to handle various classes of boiler and plate work in which the company is now engaged. They have secured orders for a number of contractors' steel dump cars, and this work will be commenced as soon as the new plant is ready. Ordinary work will be carried on as usual in the temporary building, the steel work will start immediately, and the plant will probably be completed about the first of April.

At a recent meeting of the Montreal branch of the Engineering Institute of Canada, an address, illustrated by motion pictures, was given by John Murphy, M.E.I.C., electrical engineer of the Department of Railways and Canals, Ottawa. The subject, "Ice Formation," was ably dealt with by the speaker, and the pictures showed the audience the actual formation of frazil and anchor ice and the manner in which submerged machinery at temperatures below the freezing point attracted the spicules of ice and invited disaster to the equipment. The pictures were taken during experiments carried out at the refrigerating plant of the Chateau Laurier, Ottawa. The lecture was one of the most interesting and instructive that has been held by the Institute, and the large attendance taxed the capacity of the hall.

INTERESTING CIRCULAR

The Canadian Manufacturers' Association have issued a circular to manufacturers who have a special interest in exporting. It deals with the exchange situation, the figures used being based on conditions as they existed on January 14, since which they have become more pronounced. The circular follows:

On many sides the reduced exchange value of the Canadian dollar as compared with that of other countries, particularly the United States, is being deplored. The bright side of the question is that it offers distinct advantages in export trading provided Canadian manufacturers stipulate that their quotations to all customers are made in terms of Canadian dollar values and insist on payment in Canadian funds.

At the time of writing the Toronto quotation on New York funds is 8½ per cent. premium; demand sterling in Toronto, $4.11; sterling in New York, $3.79. The difference in sterling as between New York and Canada is 32 cents, or 8½ per cent. advance on $3.79. That is to say, sterling is worth more in Canada than in the United States, or in any other country whose currency is at or above mint par. Therefore, your customers in Great Britain do not need to use as much sterling to settle for Canadian commodities if payment is made direct from Great Britain to Canada on the basis of Canadian exchange. For instance, if you sell a bill of goods for which you are satisfied to take one thousand dollars in Canadian currency, on the basis of the above quotations your British customer would require to pay into a bank in Great Britain approximately £244 and 14 shillings, plus bank charges. If your quotation is made on the basis of New York funds, it would cost him approximately £265 and 9 shillings plus bank charges.

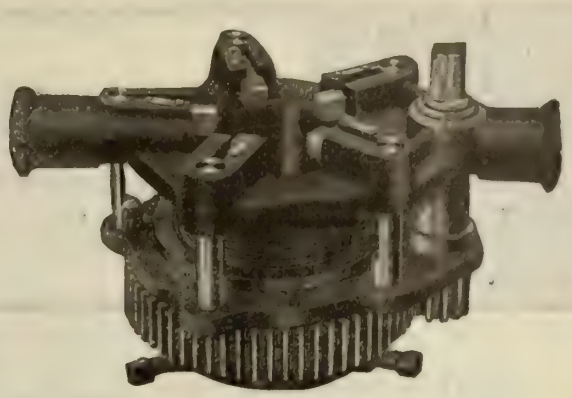
Similar calculations apply in dealing with many other countries, Great Britain simply being used as an example.

Ample facilities for the sale of foreign drafts to Canadian bankers and for the purchase of Canadian funds have been arranged for in practically all countries; thus Canadian manufacturers have all necessary facilities for securing a real preference both in the British Empire and in other Continental markets. It is not only to the advantage of Canadian manufaeturers themselves to quote in Canadian currency; it is sound national business to do this at the present time. No Canadian manufacturer under present conditions is justified in making his quotations abroad in New York funds.

Buffalo.—The furnaces in this district are sold up pretty well for third quarter, and in some cases into the fourth. It is therefore a difficult matter to get iron for third quarter. Prices for any future business are at $45 for the basic grade. Malleable has brought $46.25 and basic $41.

Aikenhead's

JARDINE and TOLEDO PIPE THREADING TOOLS



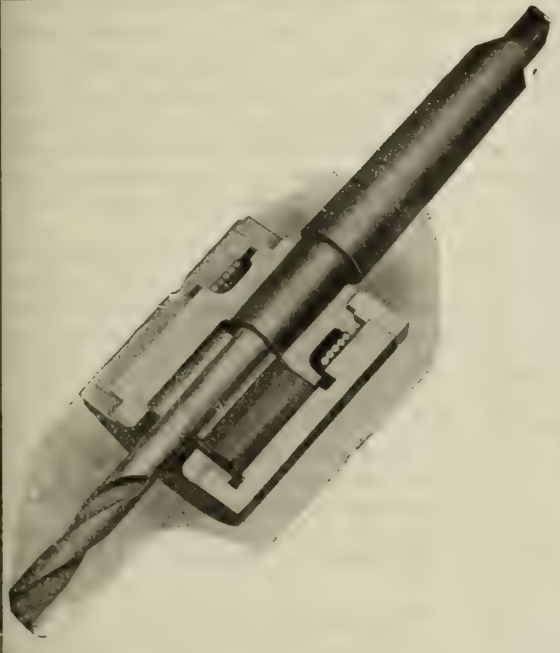
In "Jardine" and "Toledo" Pipe Threading Tools, the cutters recede from the pipe centre as the die advances in order to form a taper thread. This is a tremendous advance in pipe threading tools, since it eliminates friction, makes a thread of perfect taper equal to lathe cut, with less than half the exertion required by the tapered die.

The ratchet feature of these tools permits their being used to thread pipe already in place, no matter how awkward it may be to reach. There are no complications to get out of order, and every ounce of strength is used in making the cut, saving time and labor.

Let us tell you more about these tools. There are other exclusive features of equal value.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.



Aikenhead's

WAHLSTROM Automatic Drill Chucks

A strong, instantly gripping and releasing chuck that holds the entire shank in a grip that becomes firmer as the resistance to the tool increases. The clutch can't slip, and the jaws never mark a tool.

The operator can make any change of tools in two seconds, without stopping the spindle and simply by grasping the loose shell of the chuck.

Figure out the labor saving in your plant on drilling jobs.

Made in a number of sizes to take straight or taper shank tools.

Write for the Wahlstrom Booklet.

Aikenhead Hardware, Limited

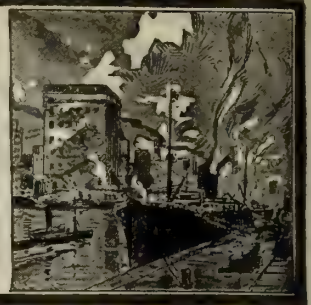
17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Engineers' Club Closes Year.—The Engineers' Club of Toronto has just completed its 20th year, which has been the most successful in its history. Owing to the fact that their premises are not capable of accommodating any large number of new members, it was decided to raise the entrance fee 100 per cent.

New Brantford Industry.—S. C. Johnson & Co., of Racine, Wis., have purchased a portion of the Waterworks property in the neighborhood of the Robbins & Myers plant. The firm are manufacturers of prepared wax and wood stains, and they will erect a factory early this spring and employ 100 hands before the end of the year.

British Exports Increase.—Exports for the month of January from Great Britain reached the record total of 105,879,000 pounds, which was an increase of 58,000,000 over January, 1919. The increase in manufactured articles exported was over 100 per cent., while the imports, while still large, were mostly essential products, such as food, raw cotton, etc.

Have to Refuse Orders.—A story comes from St. Catharines to the effect that a local factory, a branch of an American firm, was compelled to turn down an order for approximately $1,000. The reason given to the customer was that, owing to the shortage of labor the factory would be compelled to put in new equipment to carry out the order.

G. D. Robinson, who was for twenty-five years with the Canadian Pacific Ocean Service, and European freight agent when he severed his connection recently, has now opened offices in the Coristine building, Montreal, room 511, where he will carry on a business of steamship freight broker, shipping, forwarding and chartering agent.

The Oil Engine Works of Canada, operating for the past few months at 29 Prince Street, Montreal, will shortly move their plant to Iberville, Quebec, taking over a portion of the plant now occupied by the Rapid Tool and Machine Company. They are building the Hvid line of oil engine in 6 and 8 h.p., principally for the farm trade. M. L. G. Vincent is the managing director.

Contract Let For Bridge.—The new bridge over the Batiscan River, which will complete the Montreal-Quebec highway, will be built by the McKinnon Steel Co. of Sherbrooke and G. Gosselin, Ltd., of Levis. The Steel Co. will erect the superstructure and the Gosselin firm the substructure. The cost of the bridge will be $186,000, and it is to be completed in one year.

Canadian Nathan Co. for Hamilton.—The Canadian Nathan Co., which will be closely allied to the Nathan Manufacturing Co., of New York, will shortly be established in Hamilton. The new company has arranged to take over the plant of the Canadian Chadwick Metal Co., and the premises will be remodelled and fitted with the necessary machinery to manufacture the Nathan line of valves, injectors, lubricators, etc.

To Manufacture Oxygen.—The Dominion Oxygen Co., a subsidiary of the Union Carbide and Carbon Corporation has been organized and will build five plants in the Dominion. Toronto will have one of these plants, and there will be in addition service stations and warehouses for supplying the small cities. The headquarters of the new company will be in Toronto, and work will be started almost immediately.

N. B. Timber Transaction—The lumber lands and two mills on the Tobique river, owned by the Upham Lumber Co., Ltd., have been sold to the Fraser Companies, Ltd., for a sum reported to be $100,000. The purchasers will take this season's cut of six million feet. The principal stockholder in the Upham Company is George W. Upham, ex-M.L.A., of Woodstock, and the stock is held entirely in his family.

Dominion Foundries Extends.—The mills of the Dominion Foundries at Hamilton are undergoing large extensions, the cost of which will be in the neighborhood of $1,000,000. The plate mill is expected to be put in operation within the next two months. There are orders on hand for plates enough to keep the new mill busy for the rest of this year and well into next. All the other departments are booked up for some time.

Canada Steamships Extending.—The Canada Steamship Lines are going to enter the immigration service with the opening of navigation. Mr. Harry W. Cowan, director of operations for the company, has returned from a three months' trip to Europe, and reports that he has made arrangements for this service. The company will put on two 12,500 ton steamers between Montreal and French and Belgian ports, and will inaugurate services to the Mediterranean and South America.

Conditions at Preston.—An official of the Preston Woodworking Machinery Corp., speaking to CANADIAN MACHINERY this week, said: "We propose completing an addition to our plant in the spring of 100 feet square. If we can get anything within reason we will buy a 36-inch Bullard vertical type turret lathe, as already advertised for in your paper. We will also consider installing a heating system some time this year. Our export business is cut off at the present time on account of the low value of the British pound."

T. W. Rogers has joined the staff of the St. Lawrence Welding Company of Montreal, and will have the position of general sales manager of the company. Prior to his recent appointment Mr. Rogers was eight years with Darling Bros., four years as a travelling salesman and the last four as purchasing agent. He was formerly with the heating division of Taylor Forbes Co. The tank development of the St. Lawrence Welding Company will necessitate additional selling organization and Mr. Rogers will have full charge of this department.

Travel Cost Goes Up.—The excursion lines on the American side of the Great Lakes are planning to raise their fares for the coming season. One of the leading excursion lines in Detroit, through their traffic manager, made the following statement: "Detroit is the principal tourist town on the Lakes, an average of 15,000,000 passengers being carried from here each season. Last year very few lines paid dividends and some just came out even. Receipts were larger, but operating expenses were larger still."

High Exchange Hurts U. S.—The new American merchant marine is suffering through the high price of the dollar. While exchange was near the normal level, Britain and European countries were chartering American ships to bring over grain, etc., but with the lowering in value of the pound sterling the cost of American tonnage became prohibitive. For instance, with exchange at a rate that made one pound worth four dollars, a freight rate of $40 a ton from the U. S. to Europe represented a rate of 200 shillings per ton. With the pound only worth $3.40, the same rate required

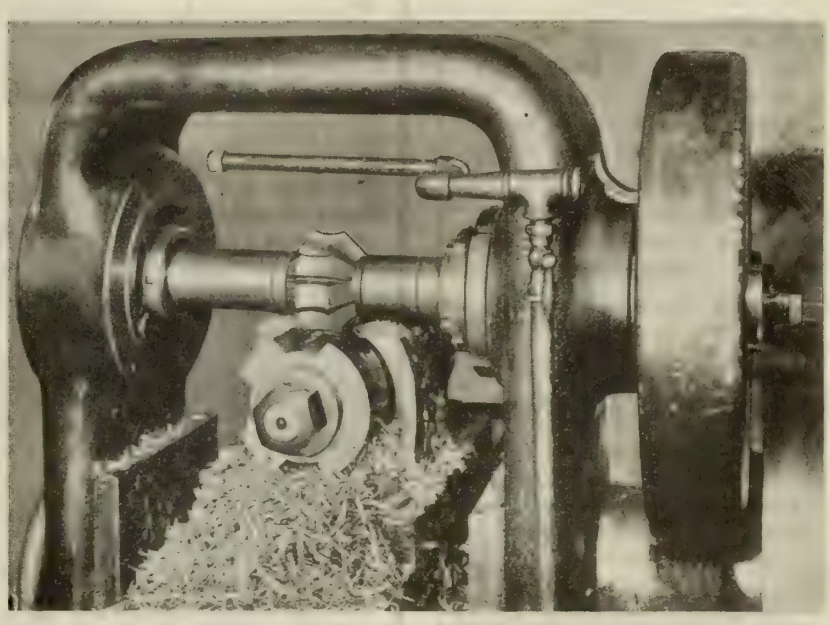
BRIGGS MILLERS

—the Solution of the Mechanical and Labor Problems of the Day

They are designed for accuracy, built to maintain accuracy and turn out any job in quick time and at low cost.

Many Canadian manufacturers are installing the Briggs Miller for operations requiring the closest limitations.

The Biggest Milling Machine in the Shop in Point of Output



The Briggs Miller is a hustler on any work. These photographs prove it. The work is heavy; but look at the chips in front of the machine—the size of them. Consider the size of this cut and the time it takes to complete it and you'll appreciate the power and strength there must be in a machine which handles work like this. The piece under operation is a special punch, 4¾ inches outside diameter. The cut is 2 inches long by ½ inch deep — and it takes just 10 minutes to complete the four of them in each punch, 6 pieces each hour, 54 every nine-hour day.

If you will send us a sample piece of work which has to be milled, we will recommend the correct size machine and can supply cutters and jigs as required.

It will pay you to investigate.

Garlock-Walker Machinery Limited

567 Banning Street
Winnipeg

32 Front Street West
TORONTO

334 St. James Street
Montreal

"Everything in Machinery"



REGISTERED U.S. PAT. OFFICE NOS. 50932-61349
CANADIAN PAT. OFFICE NO. 44

"HAWK VANADIUM"
TOOL STEEL

Remarkable in its glass Hardness, Toughness and Cutting Efficiency.

Will give twice the cut of a regular tool steel at one grinding.

Order "Hawk Vanadium" for your End Mills and cutters. Once known—always used.

Large Stock. Prompt Shipment.

Write for full particulars to

Hawkridge Brothers Company

Main Office and Warehouse
303 Congress Street, Boston, Mass
Storehouses Malden Mass.

STEEL
OF EVERY DESCRIPTION
SEND US YOUR ENQUIRIES.

Upon the Health
of your employees
depend your profit
and production



Don't be contented with half-way goodness or makeshift drinking arrangements

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO
(MADE IN CANADA)

SANITARY DRINKING FOUNTAIN



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. tell us how many men, how many departments and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:
McKENZIE BROS.
18 St. Alexis St. Montreal, P.Q.

a payment of 236 shillings, a rise of 36 shillings a ton.

Contracts Closed.—MacKinnon Steel Co., Ltd., Sherbrooke, Que., have closed the following contracts: Structural steelwork for the Salvation Army Maternity Hospital, Halifax, N.S.; Gayton Bros., general contractors; two oil storage tanks, 8 ft. diameter x 32 ft. long for City of Sherbrooke, road department; 60 dry kiln trucks for Singer Mfg. Co., St. Johns, Que.; oil storage tank 8 ft. x 32 ft. for Town of Unity, Sask.; all structural steel required for grain conveyor at St. John, N.B., berth 15, Fegles Construction Co., general contractors; three penstocks 8 ft. 6 in. diameter, and three draft tubes for the Bathurst Lumber Co., Nepisguit Jct., N.B.

Thirty-two Industries.—A report placed before the Hamilton Board of Control by W. C. Kirkpatrick, the industrial commissioner for the city, shows that during the past year thirty-two new industries located in Hamilton. The capital invested in these industries amounts to $15,670,000 and the number of employees will be close to 5,000. The report was very pleasing to the board.

Niagara Bridge Proposal.—A delegation of representative men from Welland County interviewed the Acting Premier, Sir George Foster, recently. They urged the construction of a new bridge between Fort Erie and Buffalo, which would facilitate transportation and serve to mark the one hundred years of peace between Britain and the States. The cost is estimated at $500,000. Sir George promised consideration.

Trade With Australia. — Canadian firms are now competing very successfully with Old Country firms for the Australian trade, which was formerly handled exclusively by the latter. The well-known firm of T. McAvity & Sons of St. John, N.B., have developed a first-class connection in the Commonwealth and are making large consignments of brass valves, steam cocks, and steam fittings to dealers in Melbourne and Sydney, who place them on the market there. They are assisted in this by the fact that there is a direct line of steamships from St. John to Australia and New Zealand. The same firm are also exporting their goods to the British Isles. Lieut.-Col. T. Malcolm McAvity is representing the firm there, and will shortly open a branch office and warehouse in London to take care of the English trade.

MARINE

Toronto.—The famous old "Chicora" has been sold to a Toronto barrister, Mr. Frank W. Callaghan, for $4,400. It is understood that she will be repaired and put in service on one of the passenger routes from Toronto.

Guysboro, N.S.—The steamer "Scotian" from Halifax, was the first steamer to arrive in the port for nearly a month. She was able to reach the mouth of the harbor only, and discharged her freight on the ice, from which it was removed by team to the port, half a mile away.

Chicago.—The seamen on the Great Lakes are demanding an eight-hour day, and it is expected that the next two or three weeks will see them take action to secure it. Their present hours are twelve hours a day at sea and nine hours a day in port.

Mr. Roy Burgeon, well known on the lakes as the chief engineer of the Canada Steamship Lines steamer "Rochester," died recently of pneumonia. His funeral was held from the residence of his parents, Chaumont, N.Y. Deceased was 33 years of age and was working on the ship's boilers at Erie, Penn., when he contracted his fatal illness.

Ottawa.—The International Joint Committee have made restrictions on the pollution of international waters by discharge from vessels plying on them. All vessels operating on international waters must provide equipment for disposal of sewage and garbage, the restrictions applying particularly to the Detroit and St. Marys River.

Brockville.—The steamer "Valcartier" has been purchased by the Montreal Transportation Company from the Algoma Central Steamship Lines of Sault

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Ste. Marie. The "Valcartier" was formerly owned at Cleveland, Ohio, where she was built in 1903, her name then being the "W. H. Mack." Her new owners will place her in service on the lakes and river, and are said to be looking round for more bulk freighters.

Montreal.—The Fracanda Line, which is the Compagnie General Transatlantique, will shortly start a service from Canada to Bordeaux direct. The Canada Steamship Lines are agents for the French line here, and they state that the first sailing will be made about February 24 by the steamer "Wisley," and sailing will be monthly thereafter. If conditions warrant the service will be increased to twice a month.

Prescott.—The Prescott & Ogdensburg Ferry Co. are remodelling their steamer "Miss Vandenberg" so that she will accommodate ten automobiles per trip. The new steamer "Ferdinand" will be put in commission this summer whenever the traffic conditions warrant, and the combined car-handling capacity of the two steamers will be 65 per hour. The company expect a largely increased traffic to follow the construction of highways in the Province.

Montreal.—When the steamships "War Vixen" and "War Magic" were delivered at Halifax in the month of January, the completion of the Imperial Munitions Board programme was marked. The number of vessels turned out under this programme was 46 wooden vessels of 142,600 tons d.w., and 42 steel vessels of 206,563 ton d.w. The operations were conducted under the seal of secrecy as far as was possible, and no definite information as to the extent of the programme was published until recently.

TENDERS

J. M. Miller, city clerk of Calgary, receives tenders up to February 13 for the construction of a five-span concrete bridge.

The city of Brantford requires tenders for cement, sewer pipe and crushed stone. Tenders addressed to Ald. Harry Simpson, chairman of the Board of Works, will be received until Feb. 19. Specifications may be obtained from the city engineer, T. Harry Jones.

The secretary of the town of Ingersoll will receive tenders until February 28 for the erection and completion of a sixteen-room public school, of tile and concrete construction, fireproof. Plans can be obtained from the architect's office.

The City of London, Ont., is calling for tenders for the following supplies. Tenders must be in by Feb. 19. and specifications can be obtained from the office of the city engineer: Refined asphalt, road oil, Portland cement, limestone dust, broken stone, vitrified and land tile, concrete tile, iron castings, general supplies.

The Department of Public Highways are calling for tenders for the supply of and erecting field painting of the steel superstructure for a 170-foot steel bridge over the River Aux Raisin in the vicinity of Lancaster. Plans and specifications can be obtained from the office of the Resident Engineer, Cornwall, and at the Department, Toronto. Tenders will be received till March 9, 1920.

Arthur Sande, consulting engineer, Hamilton, is asking for sealed proposals for the following: Contract No. 1 buildings for a 200-ton sulphite pulp mill to be erected in the Bay de Chaleur, Quebec, site. Contract No. 2, grading, excavation, paving, sewage and water supply for the town site in connection with the mill. Contract No. 3, 150 houses for townsite. All contracts will be given on a cost plus percentage basis, with a fixed commission. Specifications ready Feb. 12 and bids to be in by Feb. 25.

The Lignite Utilization Board, 2 Youville Square, Montreal, are calling for sealed tenders for the supply of material and erection of buildings at the plant in Estevan, Sask. The work includes the construction of industrial buildings and a concrete reservoir, and the erection of a water tank on a 70-foot tower. Complete plans and specifications can be obtained from the Board's offices in Montreal, or at the office of Mr. J. M. Leamy, Power Commissioner of the Province of Manitoba, Winnipeg. Tenders must be in by March 6.

OBITUARY

The harbor master of Port Arthur, Mr. Basil Guerrard, died from pneumonia in that city recently. Mr. Guerrard was 94 years of age, and went to Port Arthur from Quebec in 1869. He was the father of sixteen children and leaves about 200 descendants. On his 90th birthday a banquet of the family was attended by 170 descendants.

COVERING IRON WITH IRON

During the war many worn parts of aircraft machinery and motor vehicles used by the British forces were rapidly repaired in a remarkable way. The metal worn away was replaced by depositing a film of iron by means of electricity. This process was applied in the case of ball bearings and other parts, where even a minute amount of wear was so serious that scrapping would be necessary. It was also used with good results in saving from the scrap heap any parts of machinery which had accidentally been made a few thousandths of an inch too small. The problem of electrically depositing iron is a very difficult one, but the methods developed by British engineers were most successful. By means of heat treatment the deposited film becomes so closely welded to the metal that microscopic examination can detect no dividing line. Much of the research work in this matter was carried on at Sheffield University.

PECULARITIES OF MELTED IRON

Melted iron is always peculiar, but some of it is more peculiar than others. What I mean to say is that in handling melted iron it is sometimes necessary to take more precaution than at other times, but on the whole it is not as much of a trick to get good results as is sometimes imagined. I remember making some rings 3 feet in diameter and one eighth of an inch deep and 3 inches broad. This, it will be understood, was of the nature of a washer, not a hoop. We had round iron flasks which were as small as could be used, but with lots of space on the inside, so we gated them on the inside on opposite sides, and poured them double, and no matter how hard we poured them or how good the metal was there was always risk of cold shot on them, and quite frequently they were not properly run. The metal from the two ladles would not always knit together as it should, and strange as it may seem, I began pouring them singly, but leaving them gated double, and all my trouble was gone. It may be that the unused gate liberated the enclosed air, and it may be that the iron only had to knit at one place, and this place was right at the unused gate, and instead of coming to an abrupt meeting as it had to do on the sides when poured double, the two streams met and went up the risor together, leaving no mark or sign that there had been a meeting. I believe that both of these considerations had something to do with it, but, at any rate, it was successful pouring them single and not a success pouring them double.

Another queer experience which I once had was in making a small cylinder. The cylinder was only a very small one, weighing about 200 lbs., but I misjudged it and tried to pour it with a ladle holding 150 lbs. When I had poured in the 150 lbs. of iron I looked down the risor and could still see the core. I grabbed a hand ladle and ran to the spout and got about 30 lbs. of good hot iron and poured it down the gate, and noticed that the metal came up but not to the risor. I repeated this last move and succeeded in bringing the metal up the risor. Now anyone versed in foundry work would count that casting lost before looking at it, but not so, it was a perfect casting, without a speck the size of a pin point when bored out. The mould was gated on the parting, and the first ladle of iron filled the mould above the joint, and as a consequence, no dirt could get in when the ladle was emptied. When I brought the hot iron it cut right into what was there, not over it as would have been the case if I had poured it down the risor. By cutting through it, the whole mass was forced upward. The second ladle of iron worked the same way with the result as described. Had the casting been thin it would undoubtedly have been cold shot, but being chunky it never showed a scar.



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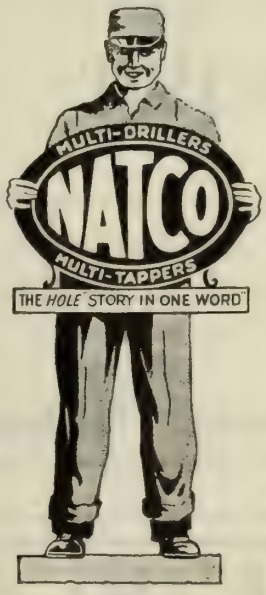
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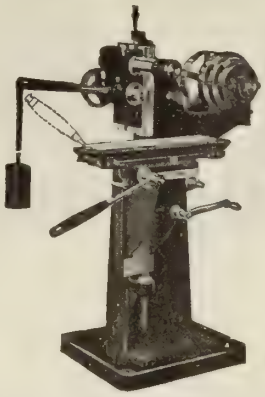
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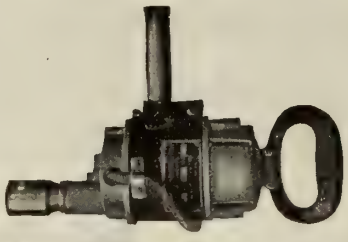
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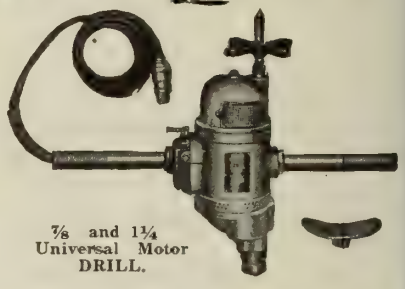
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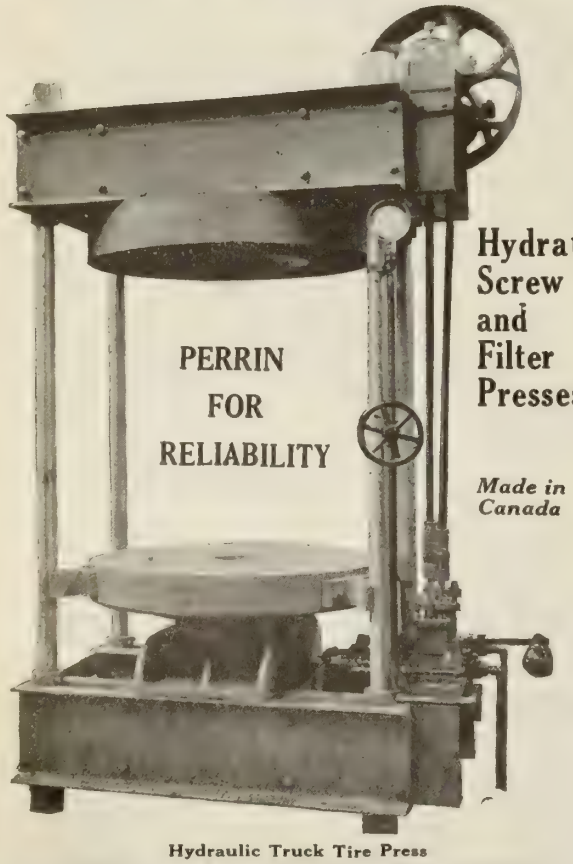
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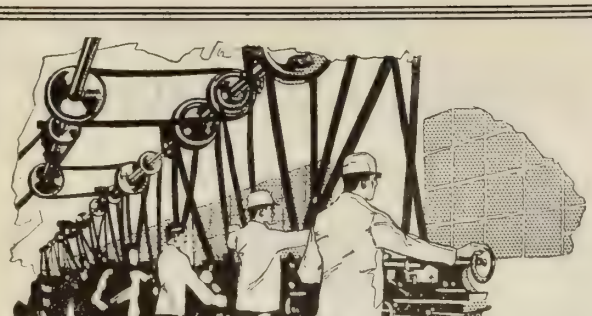
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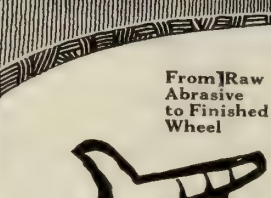
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Send for the High Speed Hammer Book.

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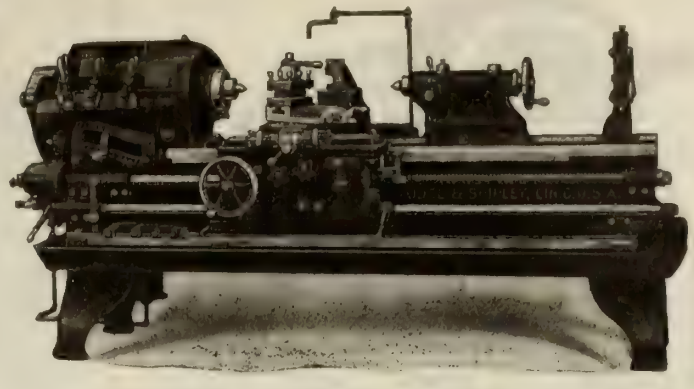
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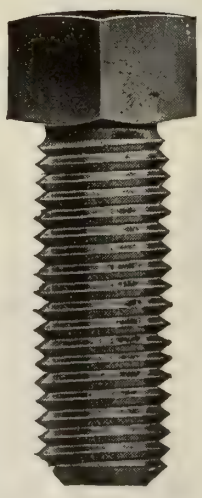
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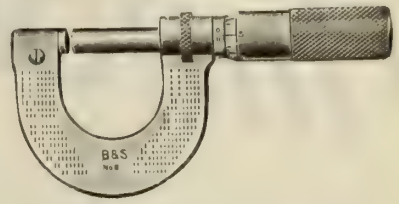
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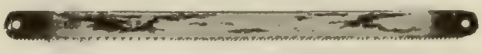


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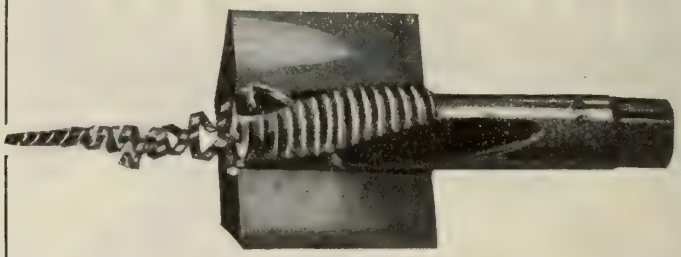
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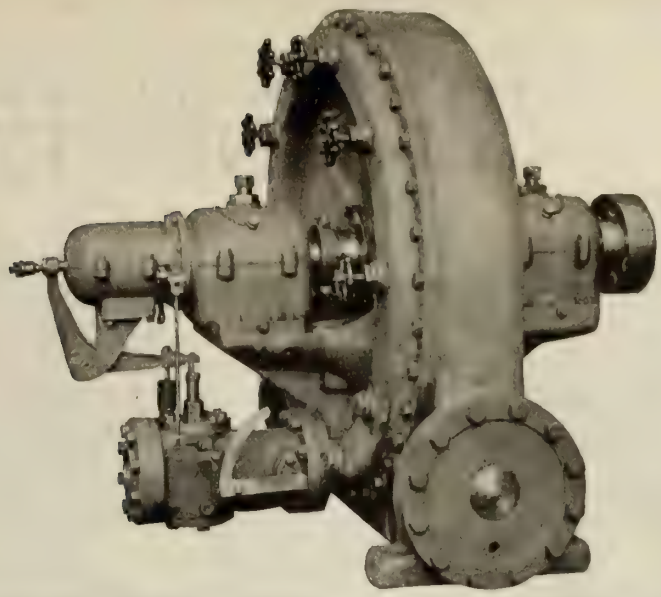
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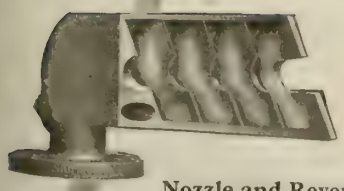


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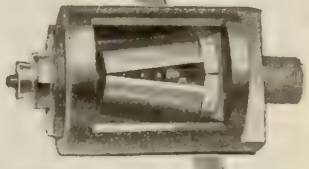
Catalog 256-U tells about them



Nozzle and Reverse Buckets



Rotor

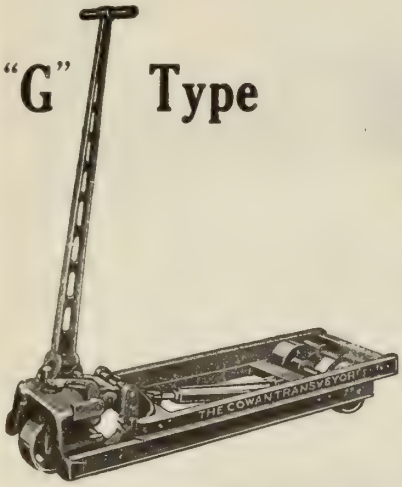


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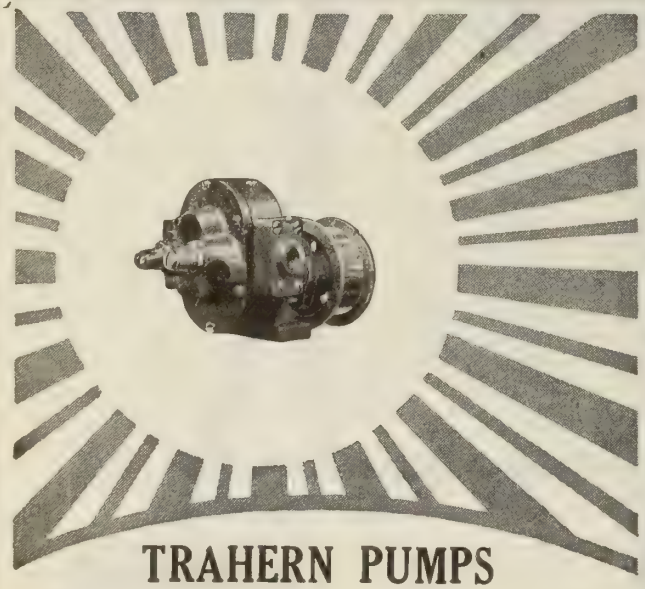
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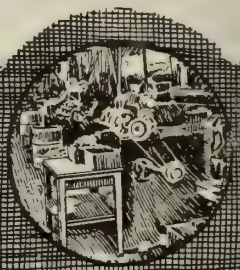
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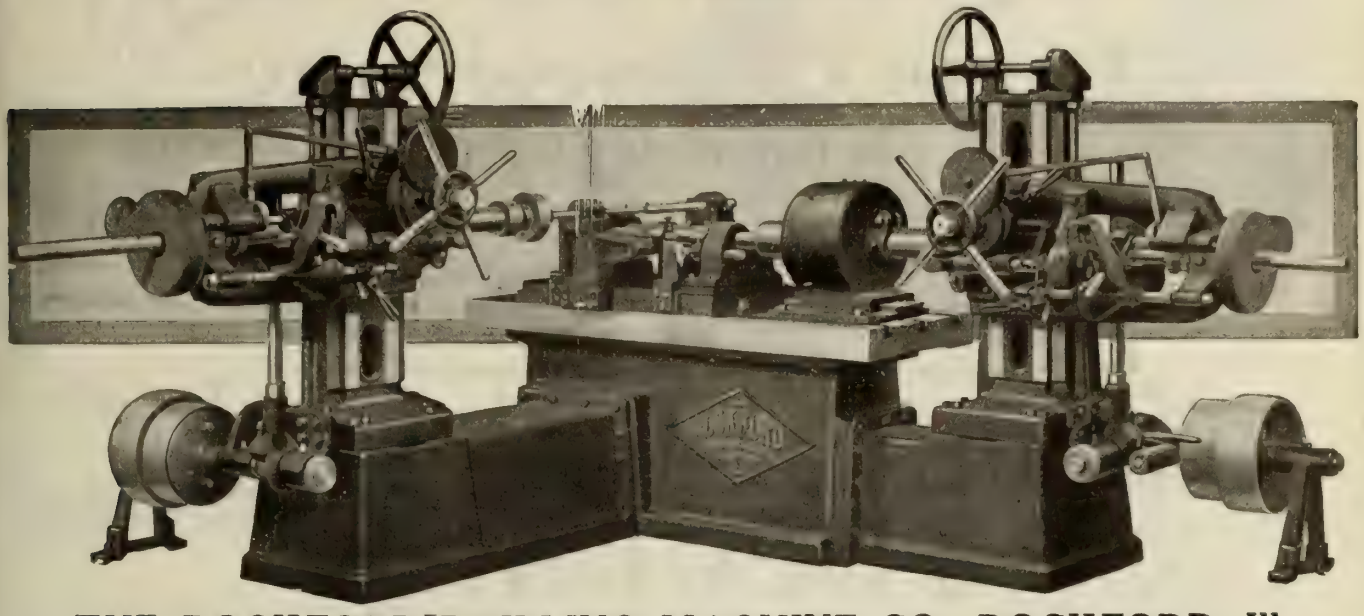


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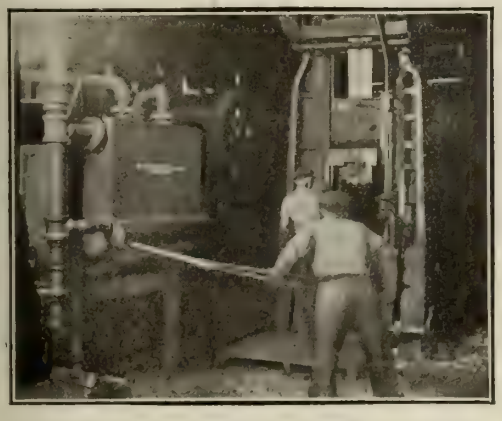
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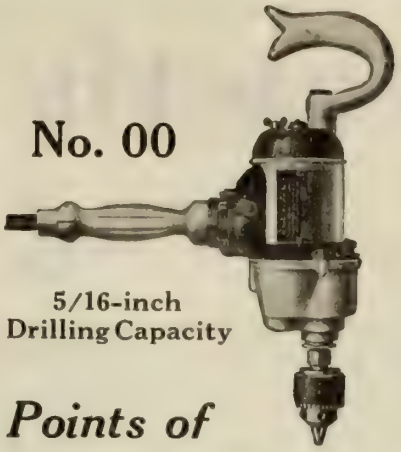
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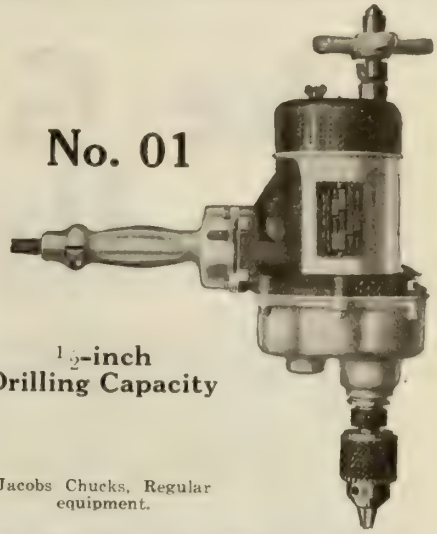
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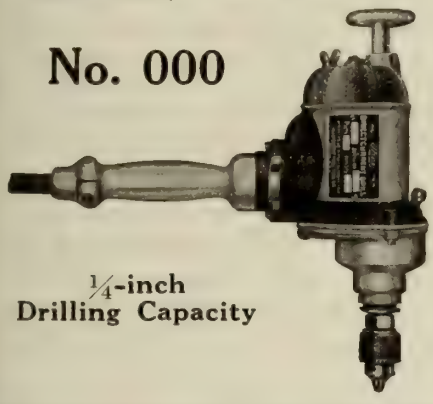
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Jacobs Chucks, Regular equipment.

No. 000



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Points of Superiority:

Light weight—The internal gear driver permits the use of smaller gears and gear case—3 teeth in contact instead of one.

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The Growth of the Deadly Drug Habit

IN the year 1912 only 35 ounces of Cocoaine was imported into Canada. Last year the imports had jumped to 12,333 ounces. In 1907 Canadians imported 1,523 ounces of Morphine. Last year we imported 30,000 ounces.

These figures tell a grim story. The drug habit is growing in Canada—growing so fast that it has become a national menace. The war, by teaching the use of opiates, has stimulated the habit and to-day the insidious disease is creeping into our homes and spreading its coils around countless victims. No class is exempt. It strikes everywhere.

Mrs. Murphy (Janey Canuck), police magistrate of Edmonton, has been engaged by MACLEAN'S MAGAZINE to write a series of articles on the danger and the means of checking it. The first article of this series appears in the February 15th issue (now on sale) and it is a powerful appeal for action against "the human canker-worms and caterpillars who fatten and batten on the unfortunate drug addicts"—the men and women who smuggle and sell the drugs. No better person could have been secured to handle this subject, for Mrs. Murphy is not only a powerful writer, but in her official capacity she has had an opportunity to see all phases of the drug traffic. What she writes has the ring of absolute authority.

Other Readable Features of a Strong Number

This, the first number of MACLEAN'S to appear on the semi-monthly basis, is a particularly interesting one. Here are some of the features:—

THE STORY OF THE ALLENS
By Floyd S. Chalmers

How Jule and Jay J. Allen built up their business from a two-by-four theatorium in Brantford, Ontario, to a twenty million dollar string of theatres—the story, in fact, of a business miracle.

THE BLOOD BROTHER
By W. A. Fraser

A strong, short story by the author of "Bulldog Carney" and "Thorobreds."

THE LAND OF NANNABIJOU
By Charles Christopher Jenkins

There's a huge part of Canada that has tremendous possibilities and yet has been neglected, overlooked. Mr. Jenkins tells about it.

THE MANTLE OF ELIJAH
By J. L. Rutledge

An unusual sketch of a politician, Ernest Lapointe, who is regarded as the successor of Laurier as leader of the Quebec wing of the Liberal party—a fascinating bit of inside political gossip.

THE DIAMOND HUNTERS
By Henry P. Holt

An exciting story of two Canadian sailors in the South Seas.

THE THREAD OF FLAME
By Basil King

A powerful serial story by this famous Canadian author.

And a score of other features—stories, articles and reviews.

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FEBRUARY 15th ISSUE *Now on Sale At All News Dealers* **20c**

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are shown in our Shelby Booklet No. 103. This booklet gives in detail the composition —tensile strength and physical properties —anneals—weights—and limits of variation of Shelby Seamless Steel Tubing.

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Baldwin Chain Drives eliminate slip — economize power—absorb transmission shocks—and give a positive speed ratio. Their first cost is light, and repair parts are easily provided.

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Lyman Tube & Supply Co., Limited

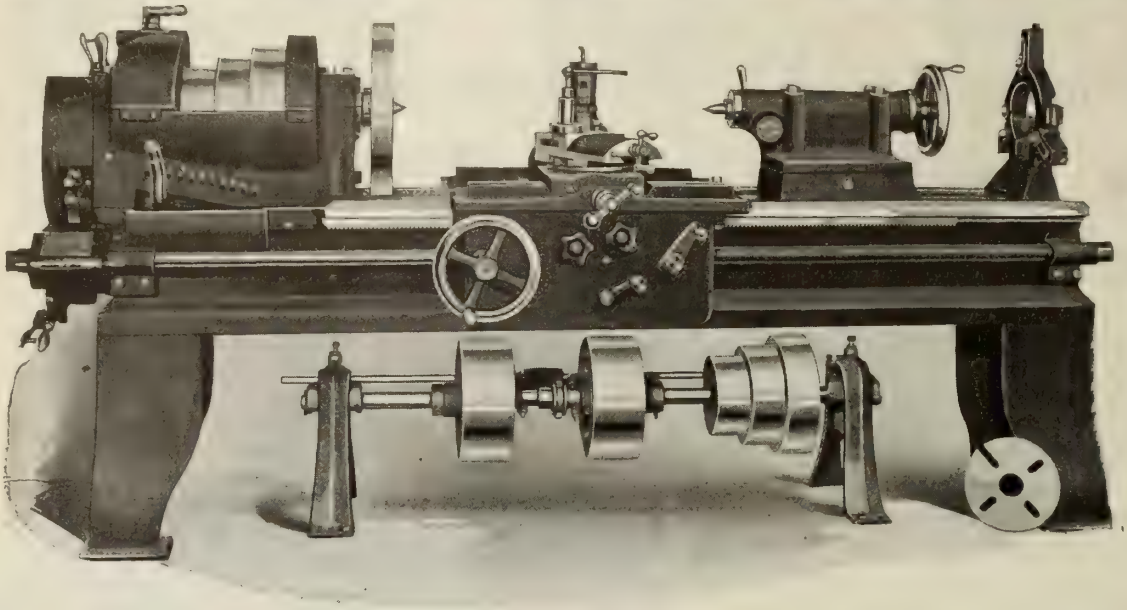
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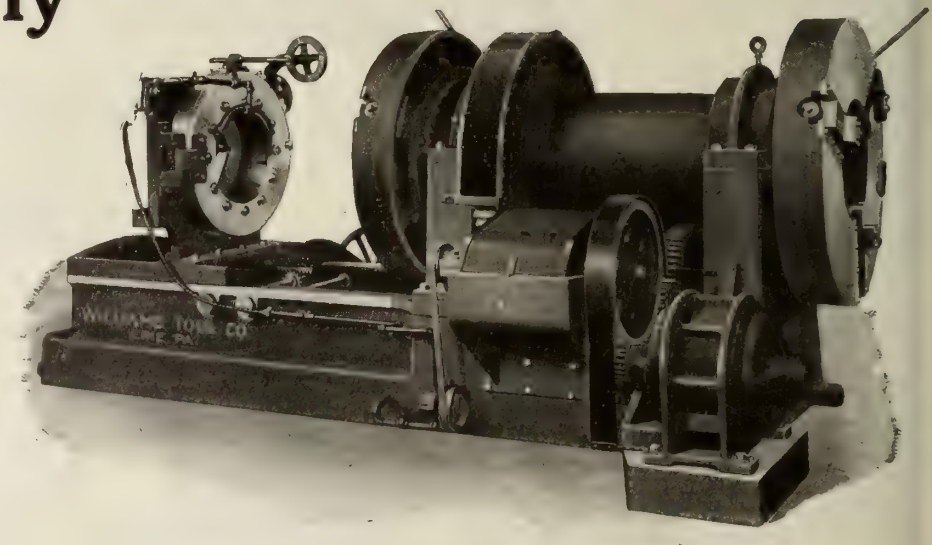
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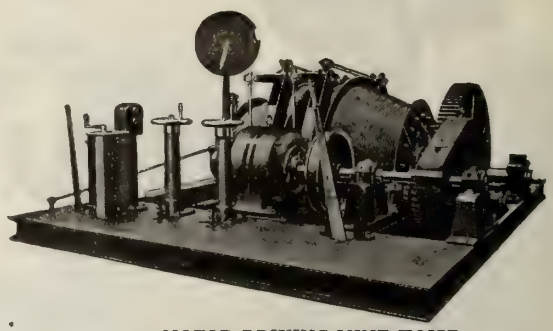
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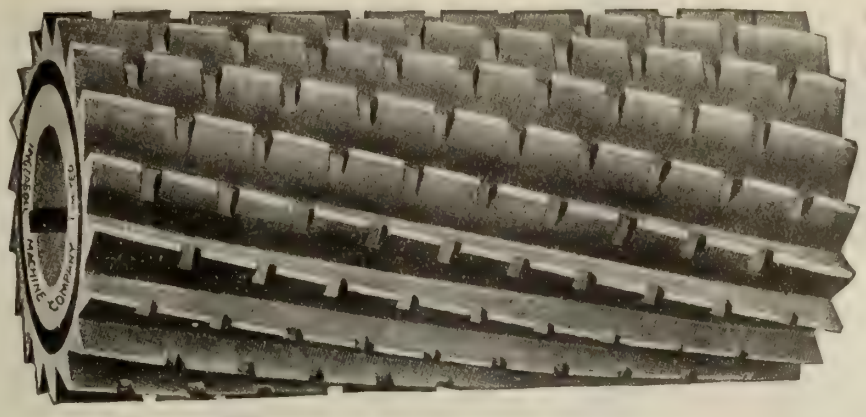
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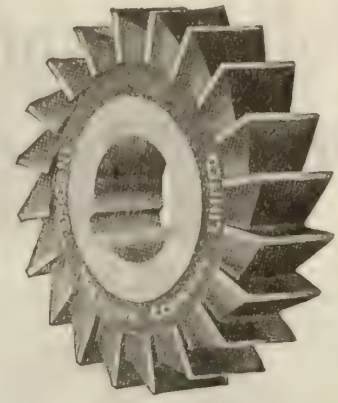
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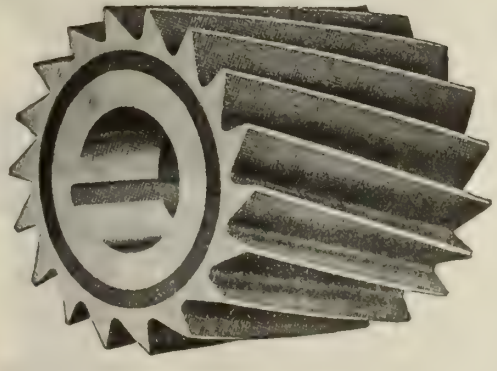
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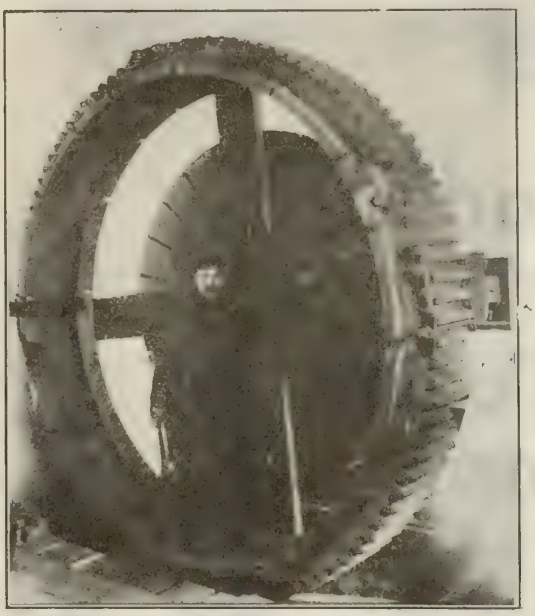
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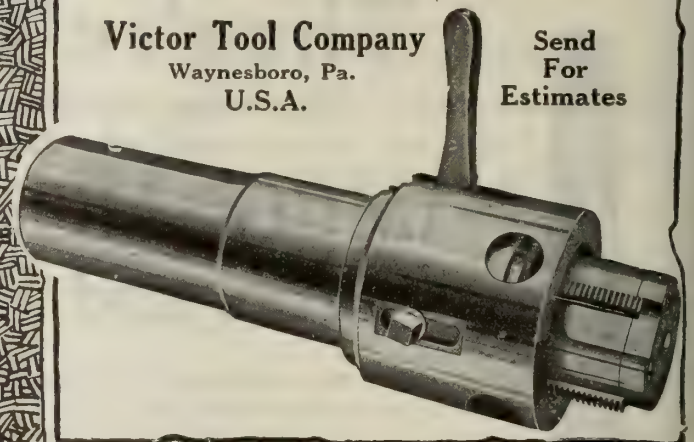
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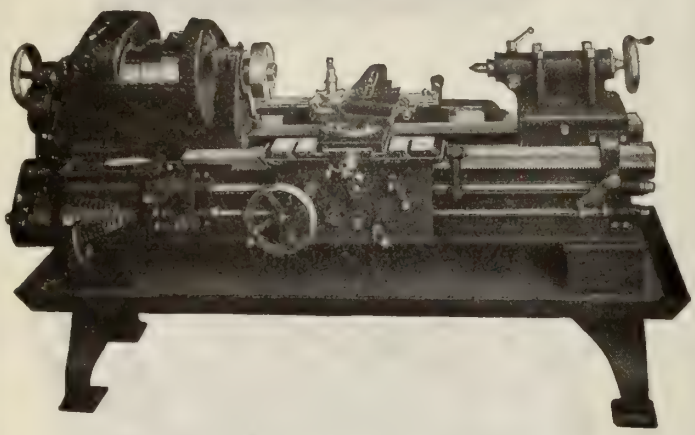


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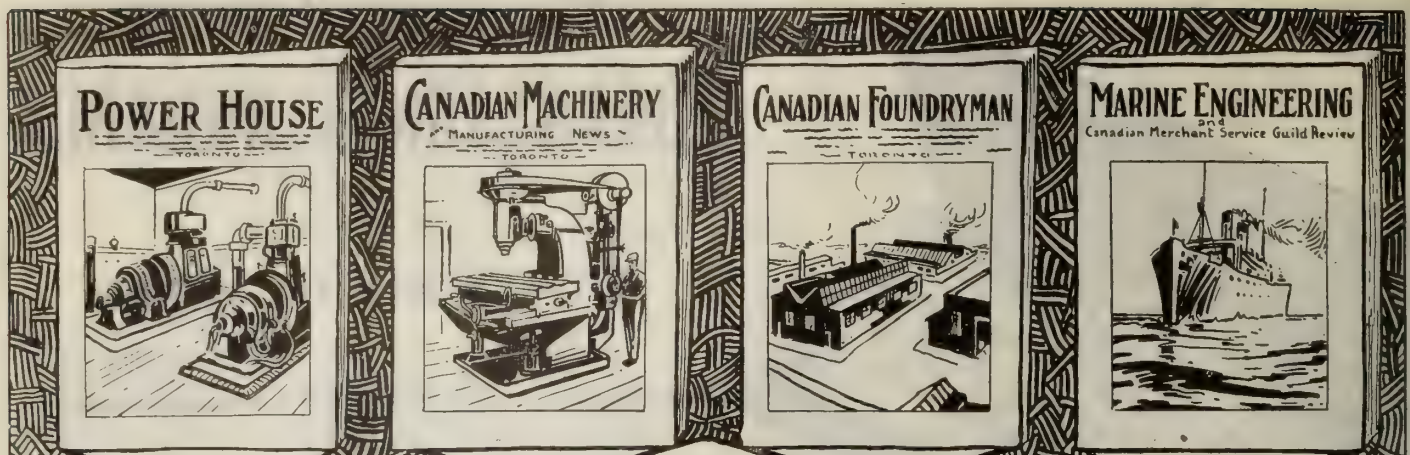
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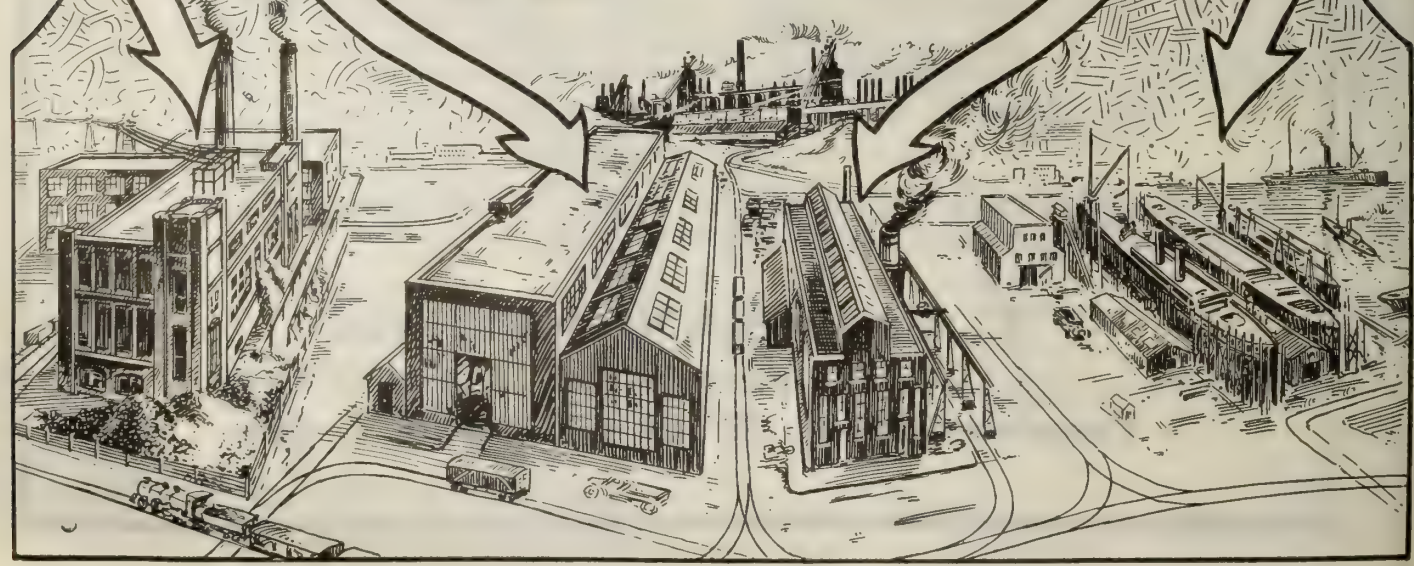
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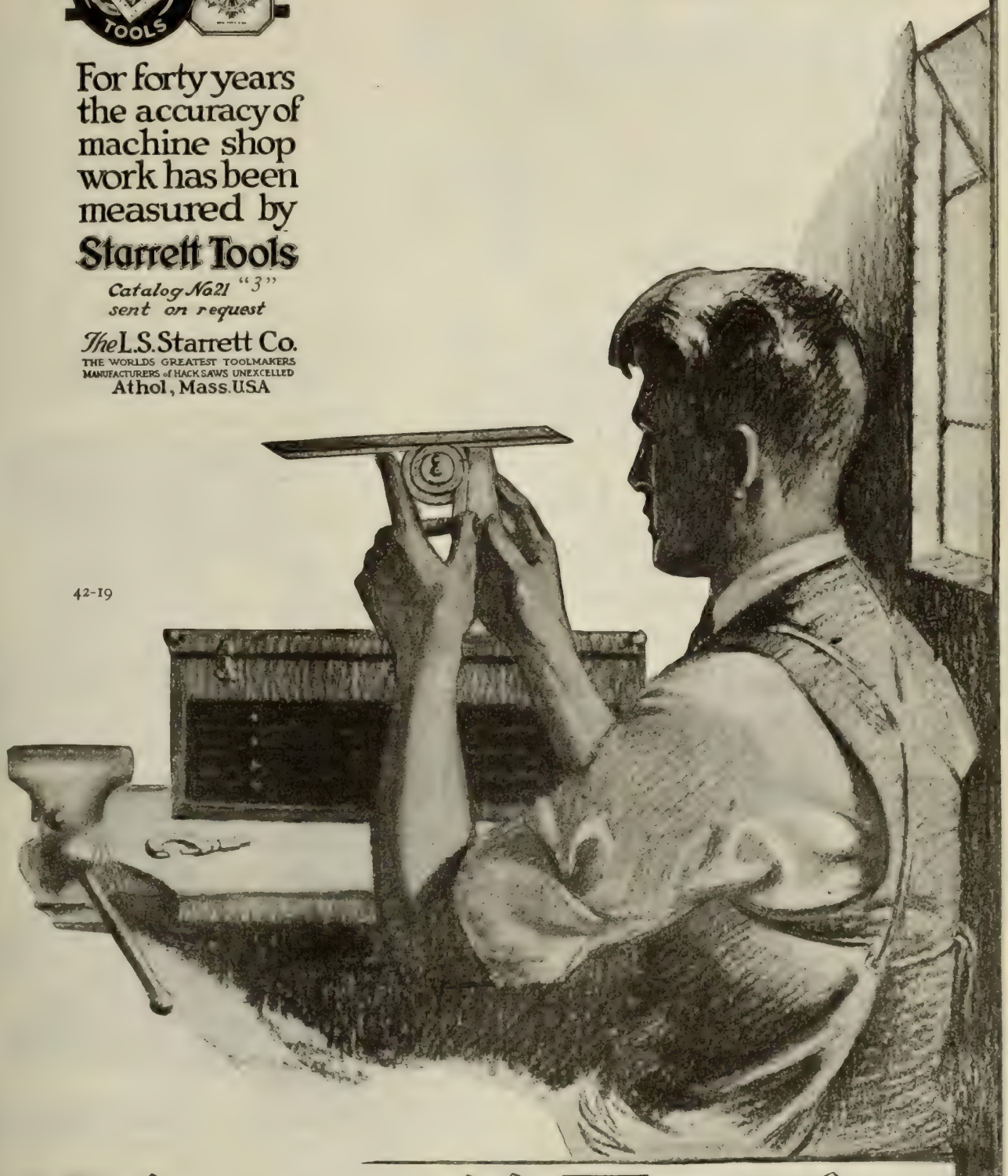
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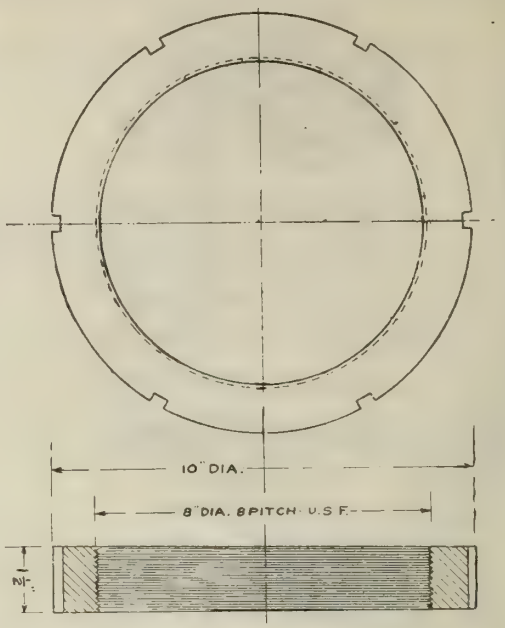
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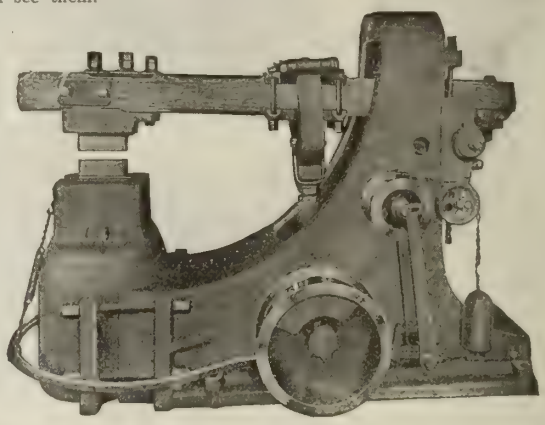
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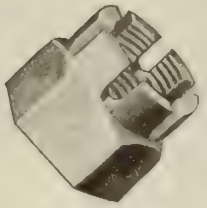
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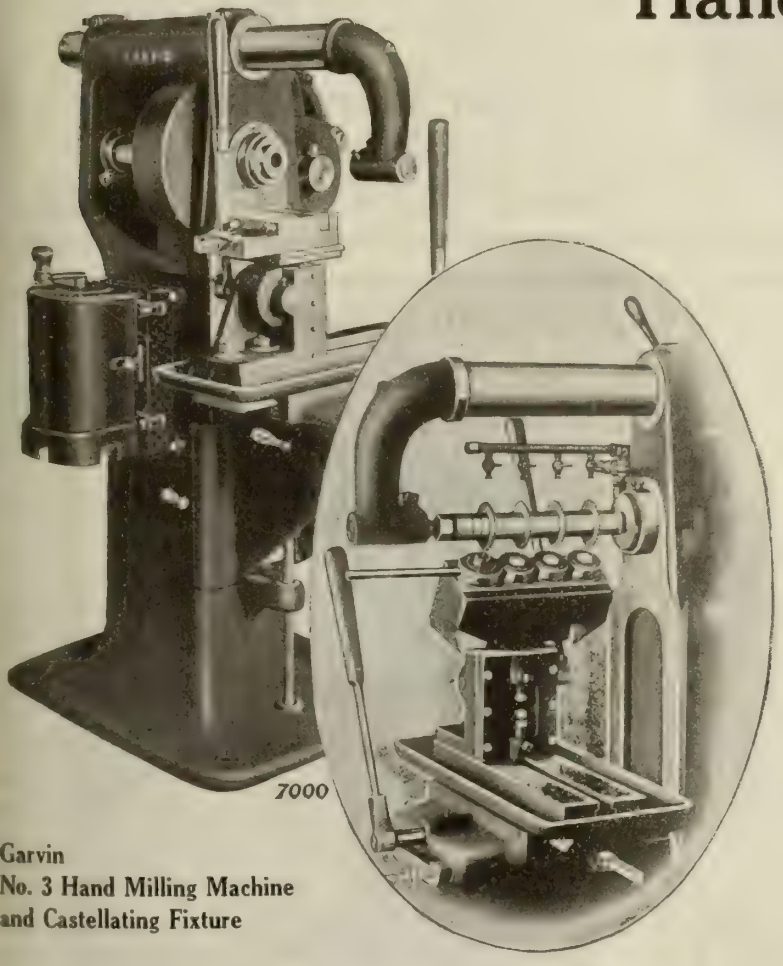
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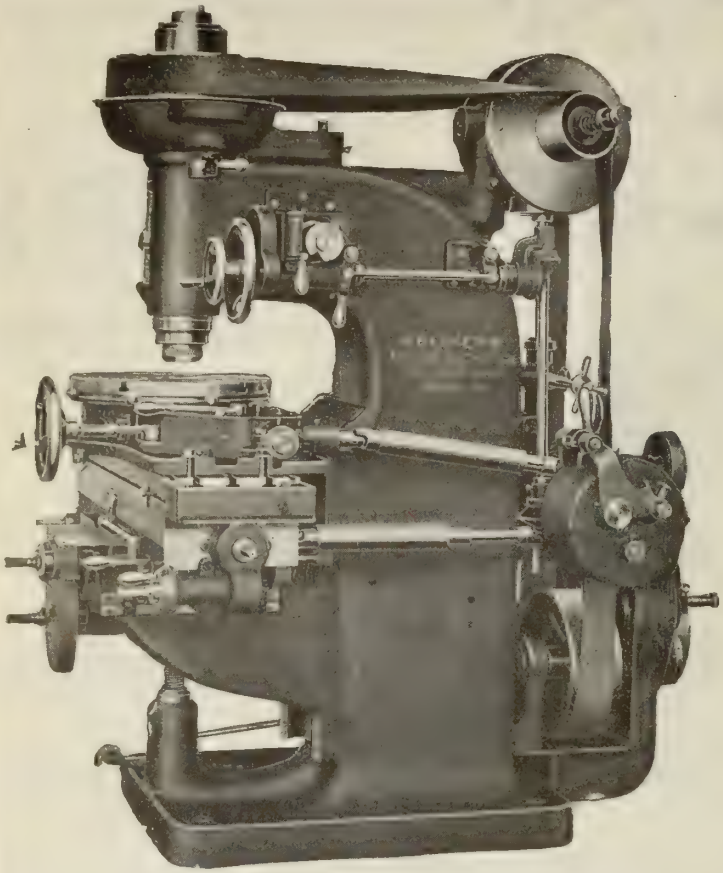
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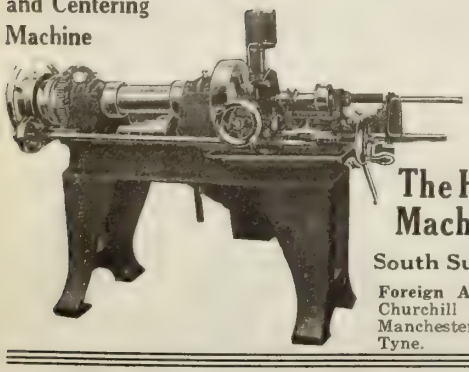
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They Both Cut
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Hurlbut,
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Cutting-off
and Centering
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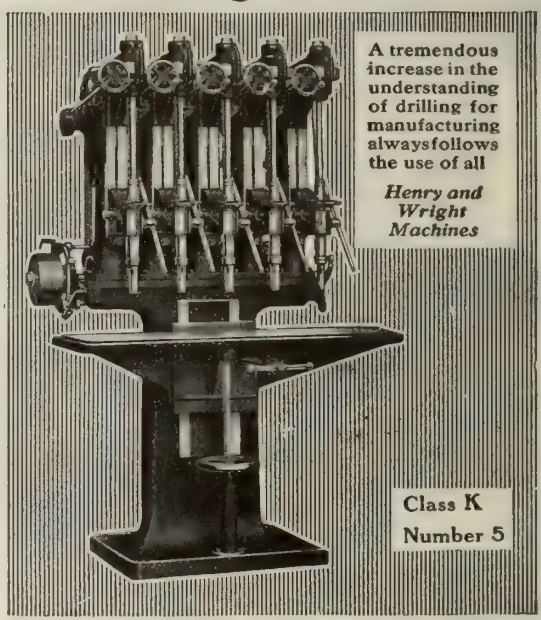
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Drilling Machines



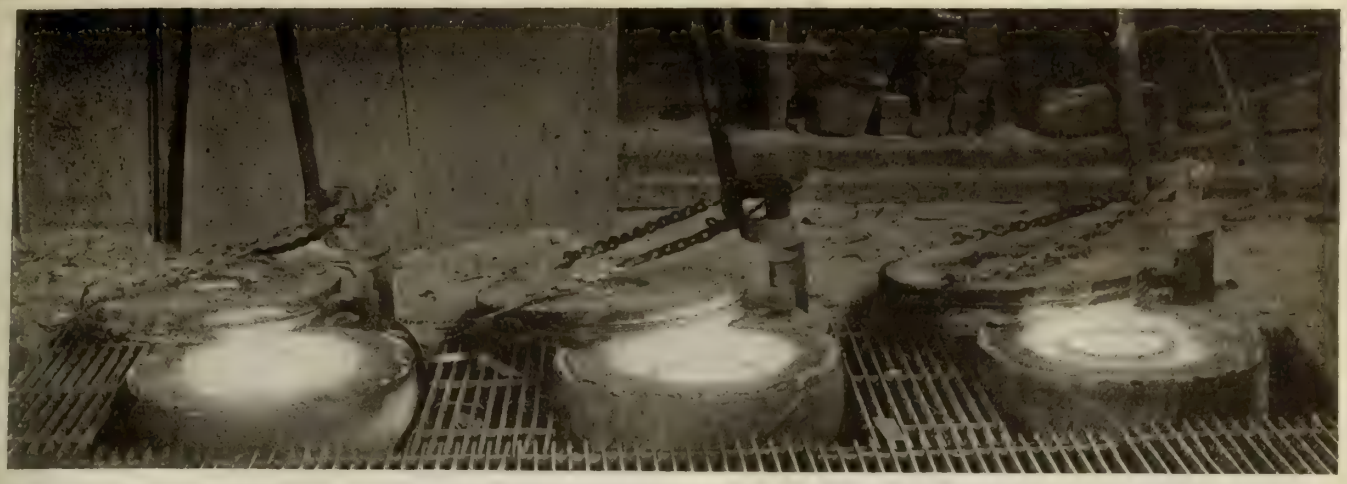
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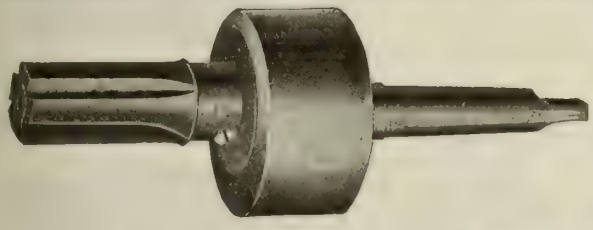
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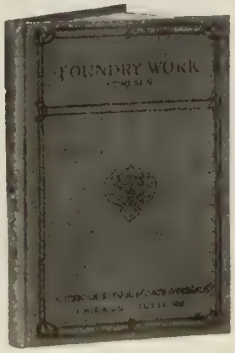
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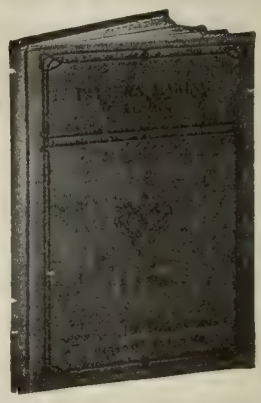
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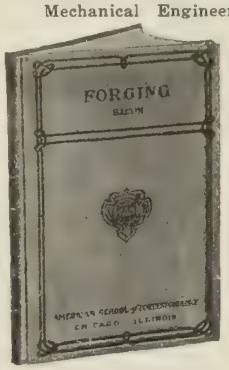
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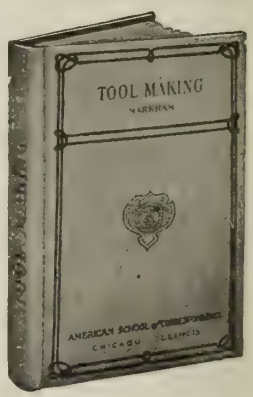


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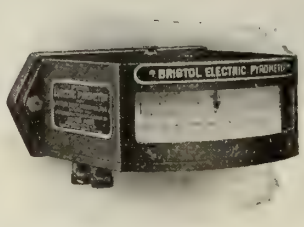
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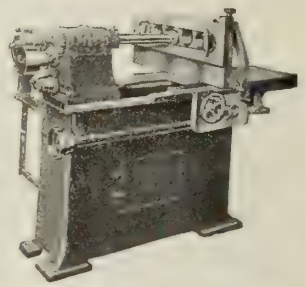
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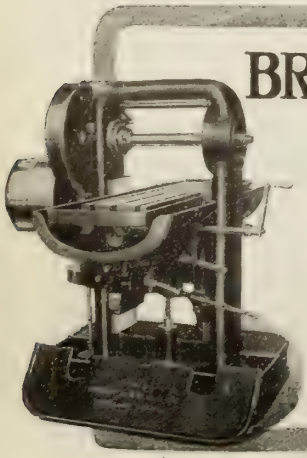
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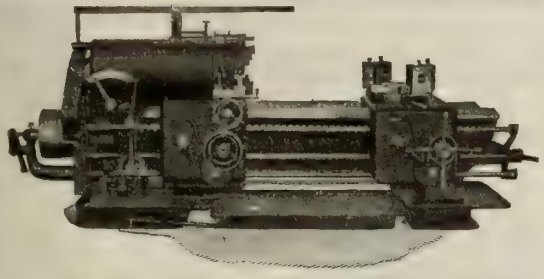
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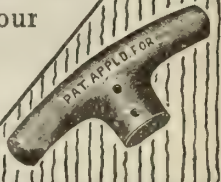
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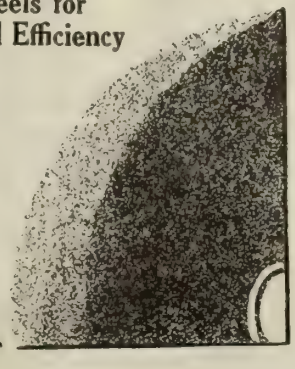
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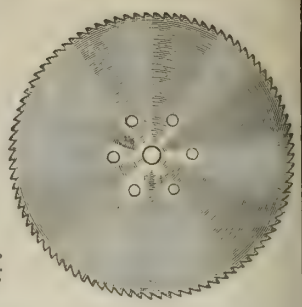
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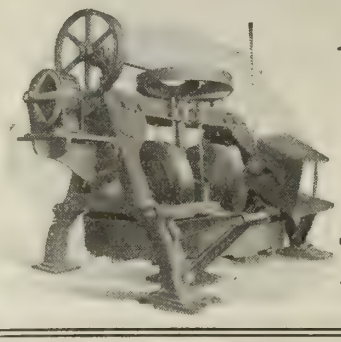
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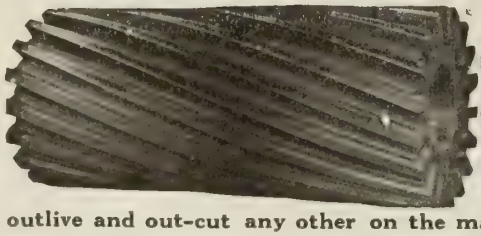
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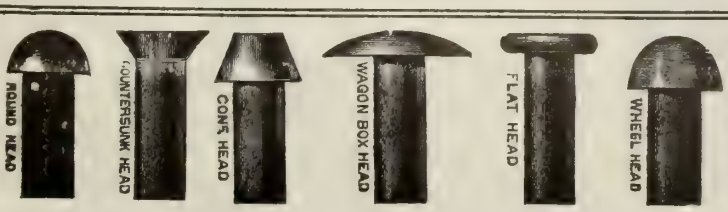


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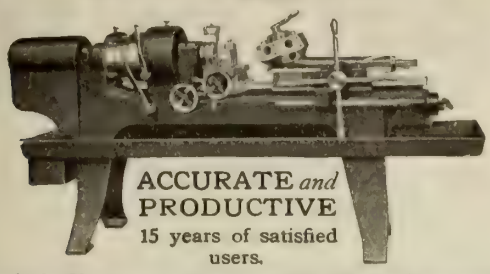
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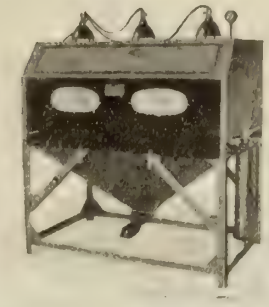
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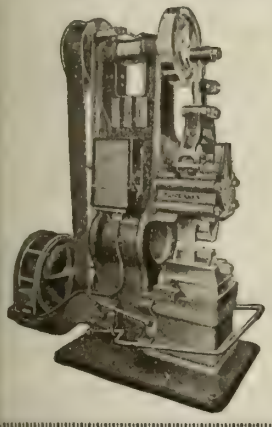
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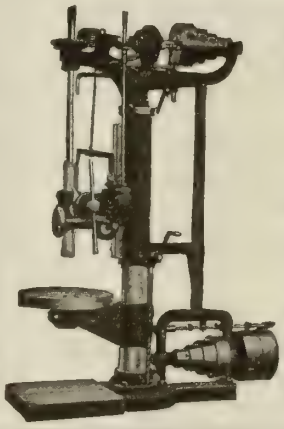
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Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Ford-Smith Mach. Co., Hamilton, Ont.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

ACETYLENE
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Union Carbide Co., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

ACETYLENE GENERATORS
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont
Welding & Supplies Co., Montreal, Que.

ACORN DIE AND HOLDERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

ACCUMULATORS, HYDRAULIC
Canadian Fairbanks-Morse Co., Montreal
Garlock-Walker Mach'y. Co., Toronto.
Metalwood Mfg. Co., Detroit, Mich.
Niles-Bement-Pond Co., New York.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

AIR COMPRESSORS
See Compressors.

AIR CONDITIONS, DEHUMIDIFYING—HUMIDIFYING
B. F. Sturtevant Co., Galt, Ont.

AIR CYLINDERS
Smalley-General Co., Bay City, Mich.

AIR RECEIVERS
Can. Ingersoll-Rand Co., Sherbrooke, P.Q.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Welding & Supplies Co., Montreal, Que.

AIR WASHERS
Can. Blower & Forge Co., Kitchener.
Sturtevant Co., B. F., Galt, Ont.

ALUMINUM
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Tallman Brass & Metal Co., Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

ALUMINUM SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.

ALLOY, STEEL
Armstrong, Whitworth of Can., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Samuel Osborne (Canada) Ltd., Montreal.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ANCHORS
Fellows Bros., Ltd., Chadley Heath, Eng.

ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Burniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Roker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
U. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St Lawrence Welding Co, Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BUYERS' DIRECTORY

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gait Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach. Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg. Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co, Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
[illegible]nce Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
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Gardner, Robt., & Son, Montreal.
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Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
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Jacobs Mfg. Co., Hartford, Conn.
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Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
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Petrie, Ltd., H. W., Toronto.
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CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
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Homer & Wilson, Hamilton, Ont.
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Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
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Bowser Co., Ltd., S. F., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Rutterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield Vt.

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Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

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Becker Milling Mach. Co., Boston, Mass.
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Butterfield & Co., Rock Island, Que.
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Garvin Machine Co., New York.
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Kennedy & Sons, Wm., Owen Sound.
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Prest-O-Lite Co., Inc., Toronto, Ont.
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Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
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Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
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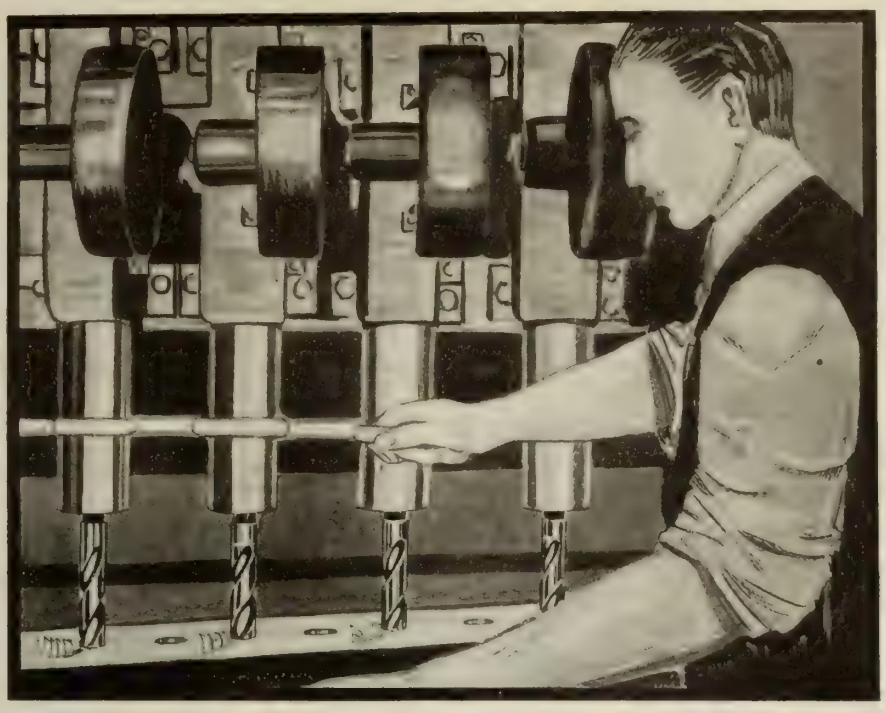
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Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
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Can. Fairbanks-Morse Co., Montreal.
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Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

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Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

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Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

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Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

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Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co. Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
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Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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See Belting, Chain.

DRIVING TOOLS
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DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

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Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER. ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS. NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

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Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY CLOTH
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Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausan Abrasives Co., Chicago, Ill.

EMERY AND EMERY WHEELS
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

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John Morrow Screw & Nut Co., Ingersoll

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ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

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Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
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A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

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Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

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Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

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Page Steel & Wire Co., New York, N.Y.

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Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

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Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

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Barry Mfg. Co., Chicago, Ill.

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Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

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FIRST AID CABINETS
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Crescent Mche. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

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FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

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Northern Electric Co., Ltd., Montreal Que

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FLUMES
William Hamilton Co., Peterboro, Ont.

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Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

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Meeta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamp'g Co., Walkerville.
Steel Co. of Canada, Ltd., St. Catharines.
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
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Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill.

FORGINGS, SPECIAL
Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal.

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St Lawrence Welding Co, Ltd., Montreal

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Brown & Sharpe Mfg. Co., Providence, R.I.
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
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W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal,

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

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Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
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Dom. Forge & Stamp. Co., Walkerville.

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GALVANIZING FLUX
British Smelting & Refining Co., Ltd., Montreal, Que.

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Armstrong Bros. Tool Co., Chicago.

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Meeta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
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Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
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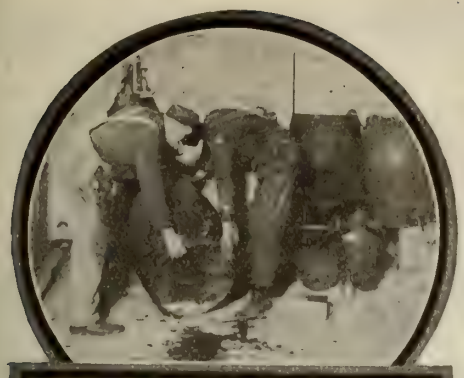
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Wells Bros. of Can., Galt, Ont
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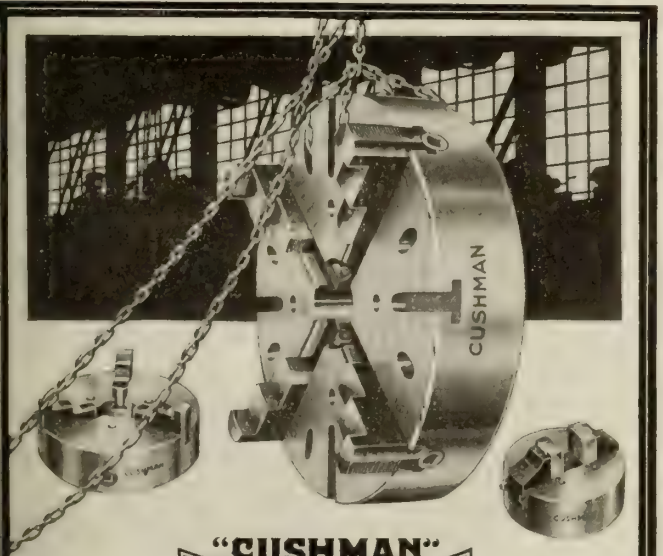
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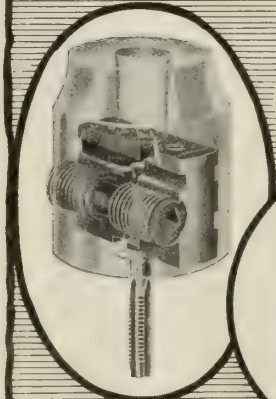
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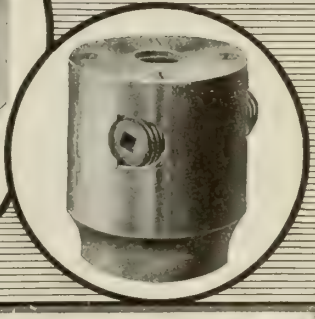
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Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
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Wells Brothers Co. of Canada, Galt, Ont.
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Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

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Katie Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

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Fellows Gear & Shaper Co., Springfield, V.
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Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

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Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
A. R. Williams Machy. Co., Toronto.

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GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

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St Lawrence Welding Co, Ltd., Montreal

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GENERATORS, MOTOR
MacGovern & Co., Montreal
Northern Elec. Co., Ltd., Montreal, P.Q.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

GLOVES, ASBESTOS, ACID PROOF, WATERPROOF, ETC.
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Oliver Machinery Co., Grand Rapids, Mich

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Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

GRAPHITE
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Rice Lewis & Son, Toronto.

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Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

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Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

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Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

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Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
Barber Mchy. Co., Ltd., Toronto, Ont.
Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Fitchburg Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, TOOL AND HOLDER
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Montreal.
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDING DISCS
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

GRINDING AND POLISHING MACHINES, PORTABLE, PNEUMATIC AND SPRING FRAME
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Norton Co., Worcester, Mass.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSER
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

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Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
Dennis Wire & Iron Works, London, Ont.
B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
Strong, Kennard & Nutt Co., Cleveland.

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Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Roker & Co., Inc., H., Montreal, Que.
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Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Plewes Ltd., Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Racine Tool & Machine Co., Racine, Wis.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
L. S. Starrett Co., Athol, Mass.
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Victor Saw Works, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
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Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Wks., Buffalo.
Foss Mchy. & S'ply Co., G. F., Montreal.
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
Victor Saw Works, Hamilton, Ont.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Nazel Eng. & Mach. Wks., Philadelphia.

HAMMERS, ELECTRIC
Haskins & Co., R. C., Chicago, Ill.

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Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton.
Can. Billings & Spencer, Ltd., Welland.
Canada Machinery Corp., Galt, Ont.
High Speed Hammer Co., Rochester, N.Y.
Jardine & Co., A. B., Hespeler, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
United Hammer Co., Boston, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Petrie, Ltd., H. W., Toronto.
West Tire Setter Co., Rochester, N.Y.
Williams Mchy Co, Ltd., A. R., Montreal

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Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Nazel Eng. & Mach. Wks., Philadelphia

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Matthews & Co., Jas. H., Pittsburgh, Pa.

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Rice Lewis & Son, Toronto, Ont.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
Nazel Eng. & Mach. Wks., Philadelphia

HAMMERS, STEAM
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.

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Oliver Mchry. Co., Grand Rapids, Mich.

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Oliver Engineering Co., Montreal, P.Q

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Chapman Double Ball Bearing Co., Toronto.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Can. S K F Co., Toronto, Ont.
Gardner & Son, Robt., Montreal.
Jones & Glassco, Montreal.
Williams Mchy Co, Ltd., A. R., Montreal

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London Bolt & Hinge Wks., London, Ont.

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Pratt & Whitney Co., Dundas, Ont.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Wells Bros. of Canada, Galt, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Ford Chain Block & Mfg., Philadelphia.
Independent Pneumatic Tool Co., Chicago
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co, Ltd., A. R., Montreal

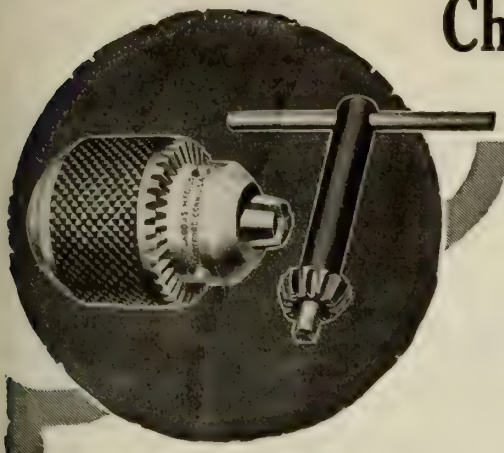
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Dominion Bridge Co., Montreal, Que.
Electric Steels & Metals Ltd., Welland.
Kennedy & Sons, Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

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They have won their place by their durability, their firm grip, their freedom from drill breakage, and the ease with which they permit the changing of drills.

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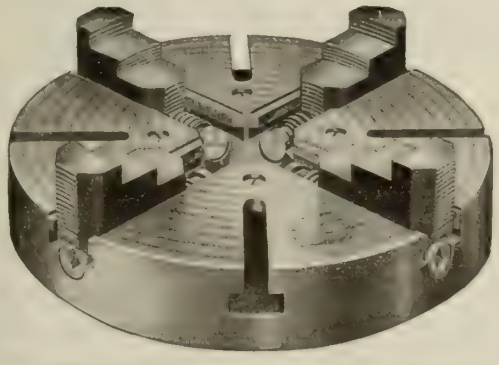
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Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

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William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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Quaker City Rubber Co., Philadelphia, Pa.
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Quaker City Rubber Co, Philadelphia, Pa
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Goodyear Tire & Rubber Co. of Can., Ltd. Toronto
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Dunlop Tire & Rubber Goods Co., Ltd., Toronto.

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Dom. Steel Products Co., Ltd., Brantford.
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Niles-Bement-Pond Co., New York.
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Petrie, Ltd., H. W., Toronto.
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Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
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Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Petrie, Ltd., H. W., Toronto.

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Hanna & Co., M. A. Cleveland, O.

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Swedish Steel & Impt. Co., Ltd., Montreal

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Globe Engineering Co.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.

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Canadian Fairbanks-Morse Co., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Northern Crane Works, Walkerville.

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Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Skinner Chuck Co., New Britain, Conn.

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Gray Ball Bearing Co., Ltd., Toronto.

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Brown Engineering Corp., Toronto.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Fleet & Whitehall Mach. & Tool Co., Galt.
Gisholt Machine Co., Madison, Wis.
Globe Engineering Co., Ltd., Hamilton.
Homer & Wilson, Hamilton, Ont.
Jones & Lamson, Springfield, Vt.
Toronto Tool Co., Toronto, Ont.

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Canada Foundries & Forgings, Welland.

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Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, M.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

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Williams & Co., J. H., Brooklyn, N.Y.

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Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

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LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

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Robertson. Ltd.. H. H., Sarnia, Ont.

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Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

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Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

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Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
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Garlock-Walker Machinery Co., Toronto.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Hardinge Bros., Chicago, Ill.
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Williams Mchy Co., A. R., Toronto, Ont.

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Garlock-Walker Machinery Co., Toronto.
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Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
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Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
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Williams Mchy Co., A. R., Toronto, Ont.
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Garlock-Walker Machy. Co., Toronto, Ont.

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Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
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Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

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Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

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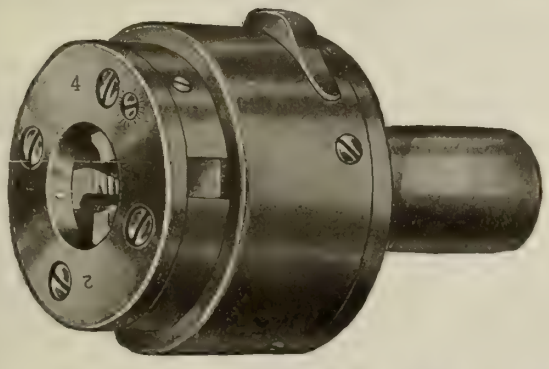
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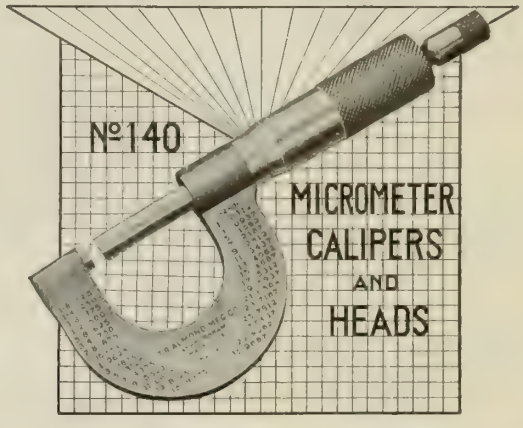
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Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
West Tire Setter Co., Rochester, N.Y.
Williams Machy. Co., A. R., Toronto.

PRESSES, HYDRO-PNEUMATIC
Eastern Production Co., Detroit, Mich.

PRESSES, BALING
Perrin, Ltd., William R., Toronto.

PRESSES, POWER
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R. Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H, Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Bluuney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, Ont.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co. Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St. Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland

RIVETS.
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Ganamoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING.
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

ROLLER CHAINS
Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

ROLLS, BENDING, STRAIGHTENING
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS AND TABLES
Elec. Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALV, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford.
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford.
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland.
Dom. Steel Products Co., Ltd., Brantford.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

RULES
Brown & Sharpe Mfg. Co., Providence.
James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor.

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT

SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md
Lawrence Welding Co, Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland.

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son Montreal.
Curtis Pneumatic Machy Co., St. Louis.
A. R. Williams Machy Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co, Bristol Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes, Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)

SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

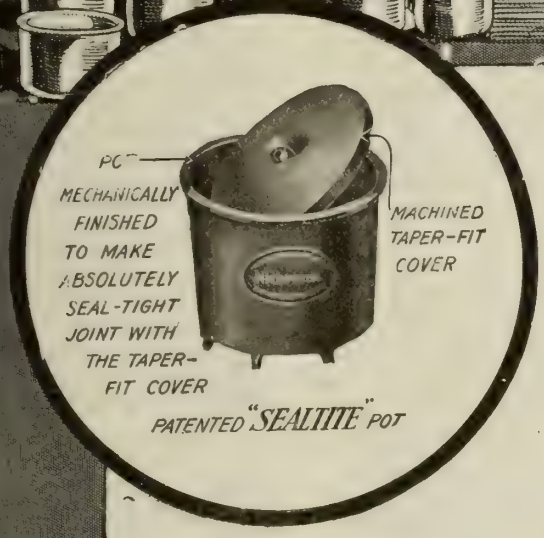
SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

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If interested tear out this page and place with letters to be answered.

SCALES
Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatter, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville.

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
H. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington, Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que
St Lawrence Welding Co, Ltd., Montreal

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dumbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton
Gooley & Edlund, Inc., Courtland, N.Y
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Vesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mchy. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

"MEAD-MORRISON"

CANADIAN MM C

CANADIAN MM C

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Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co, Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd. Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd., Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal.
U. S. Ordnance, Toronto, Ont.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que.
Rice Lewis & Son, Toronto, Ont.
U. S. Ordnance, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
U. S. Ordnance, Toronto, Ont.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q.
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal.
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
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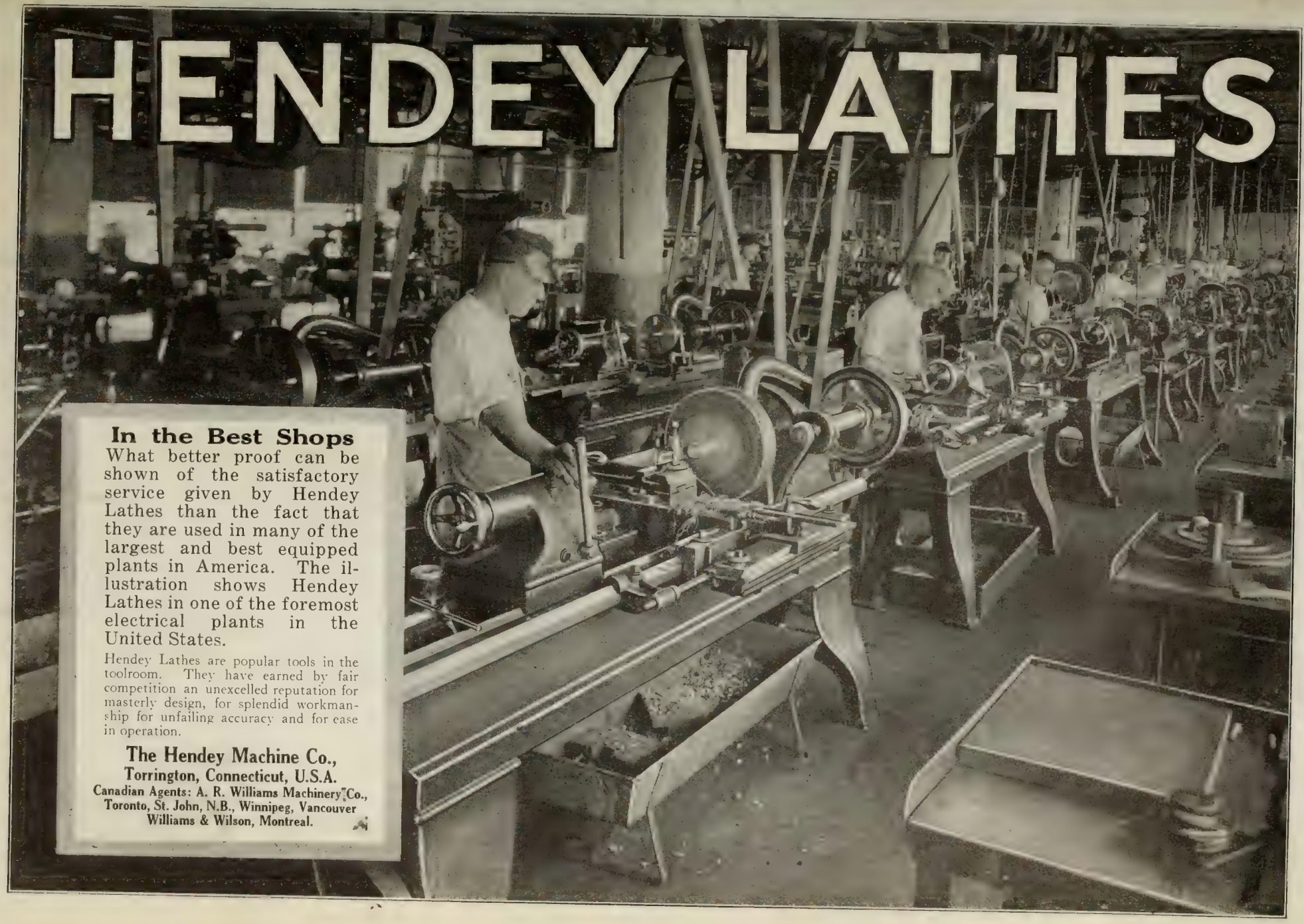
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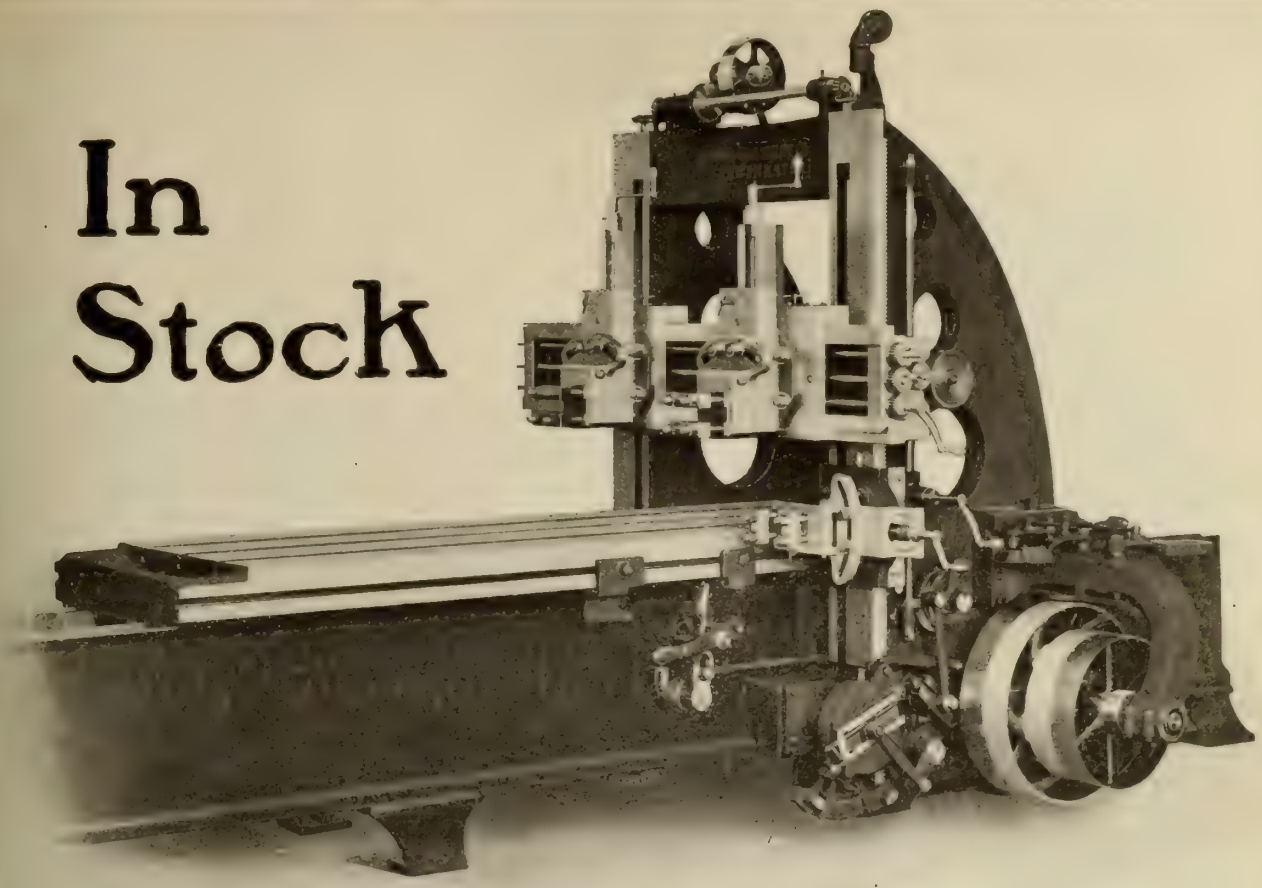
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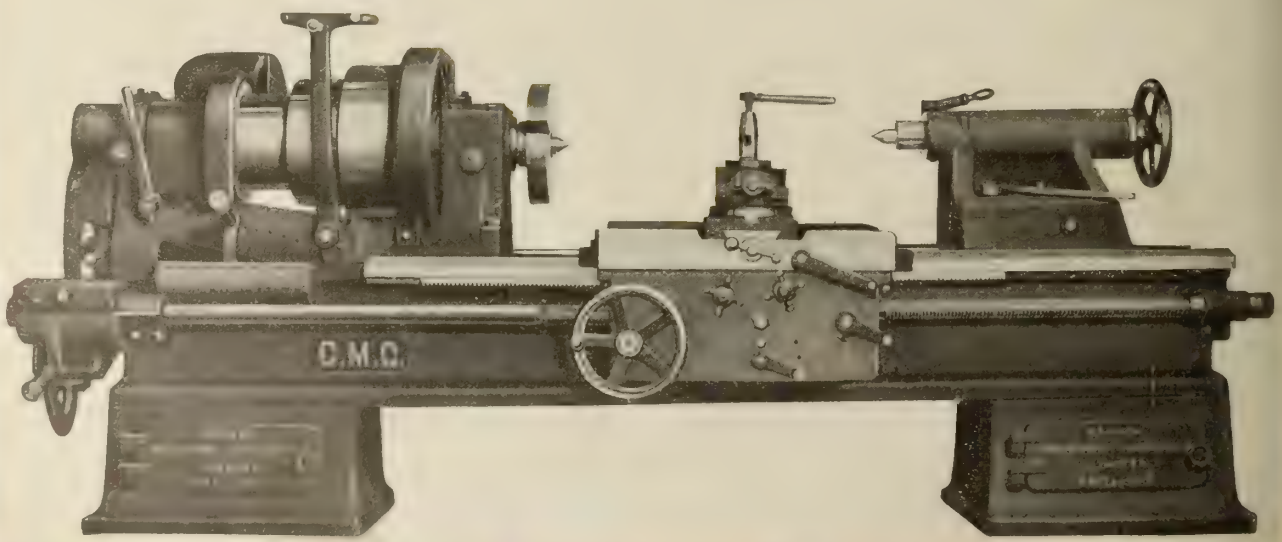
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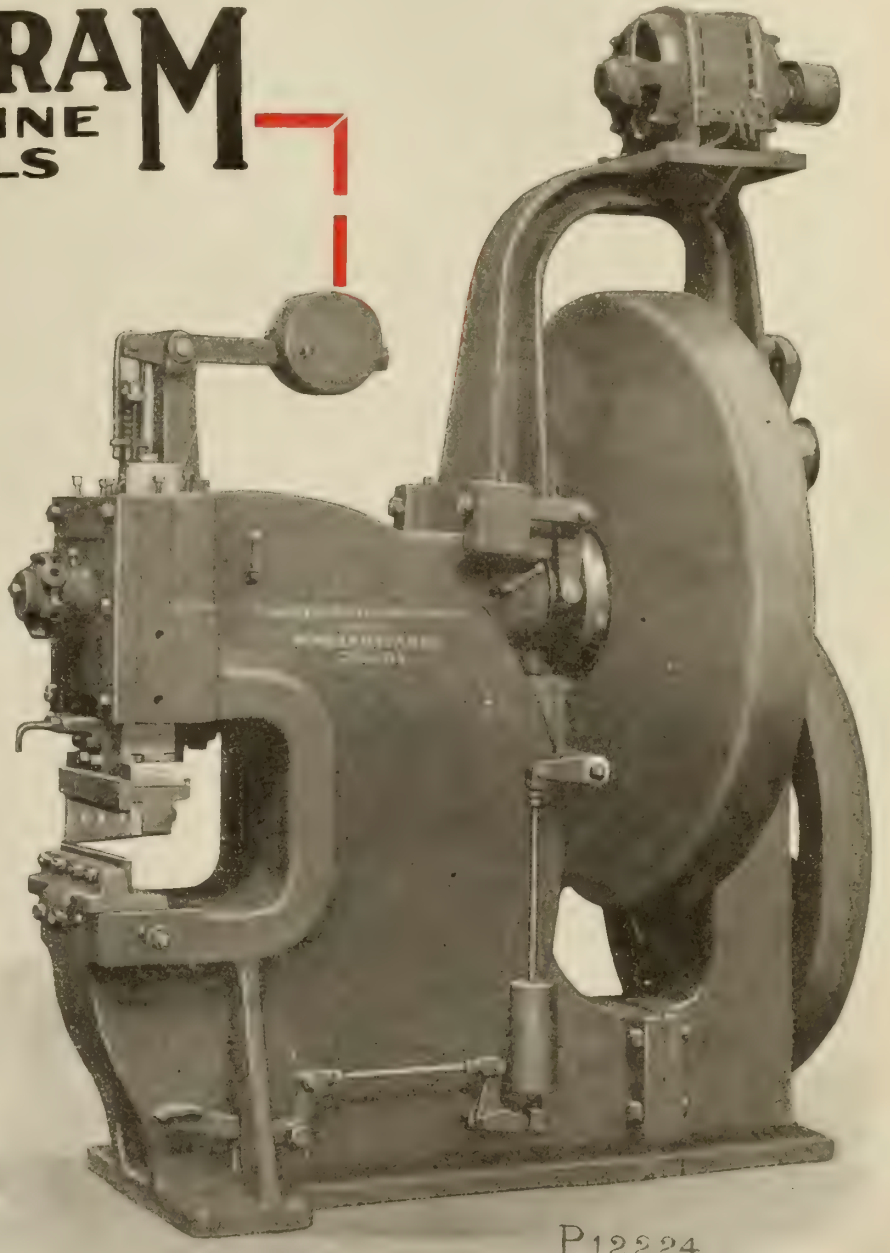
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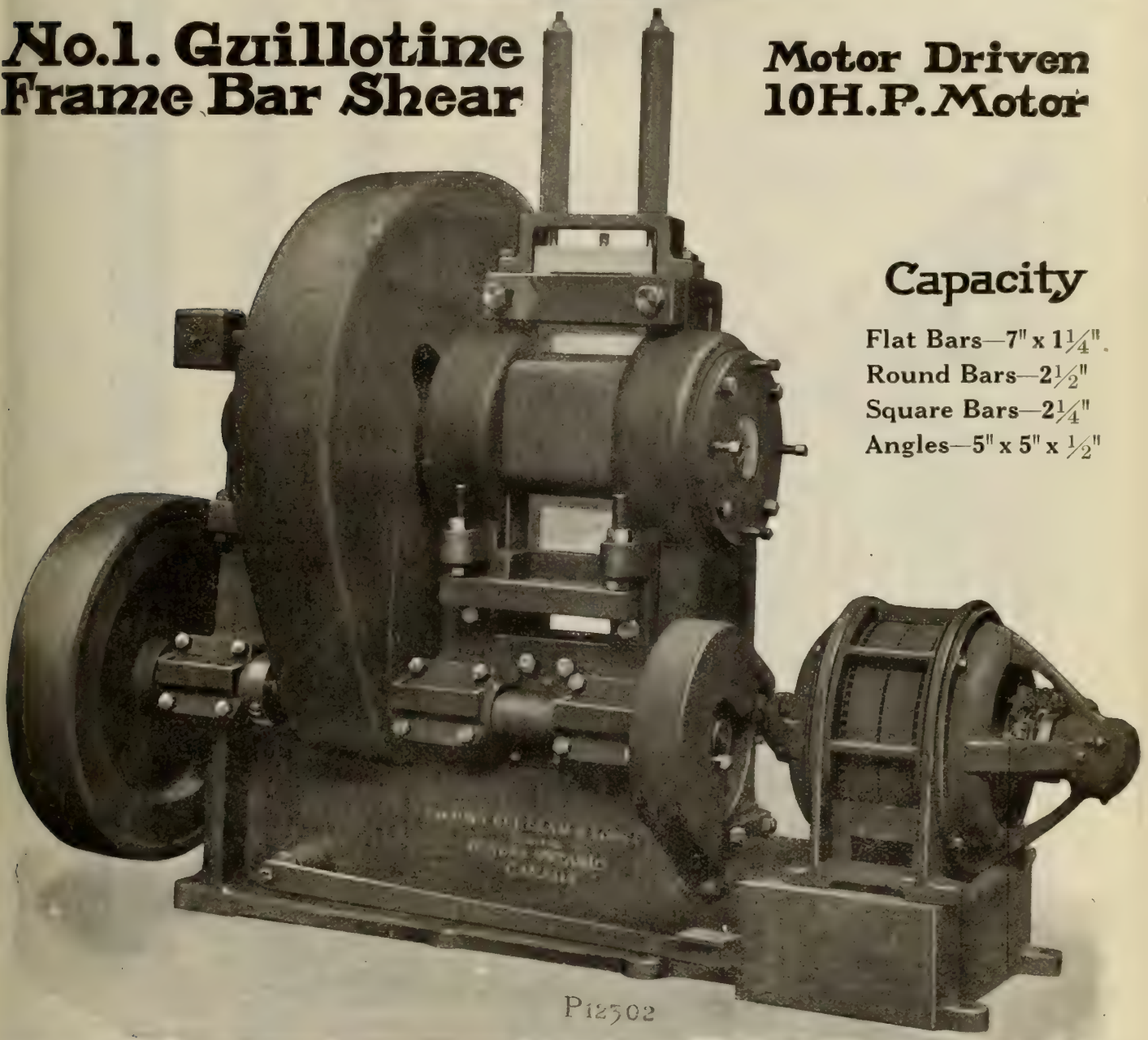
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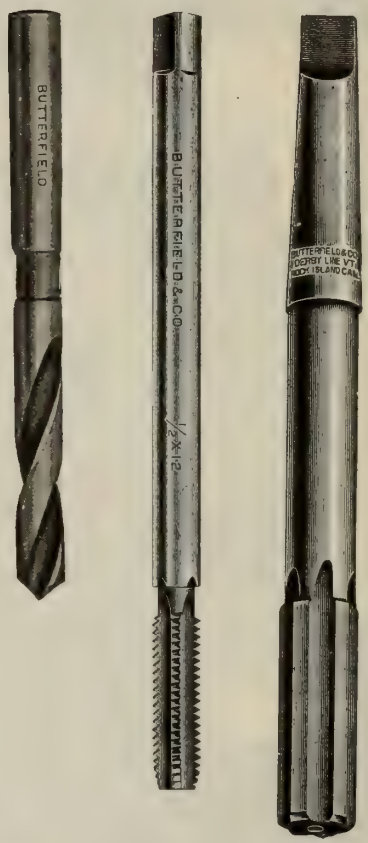
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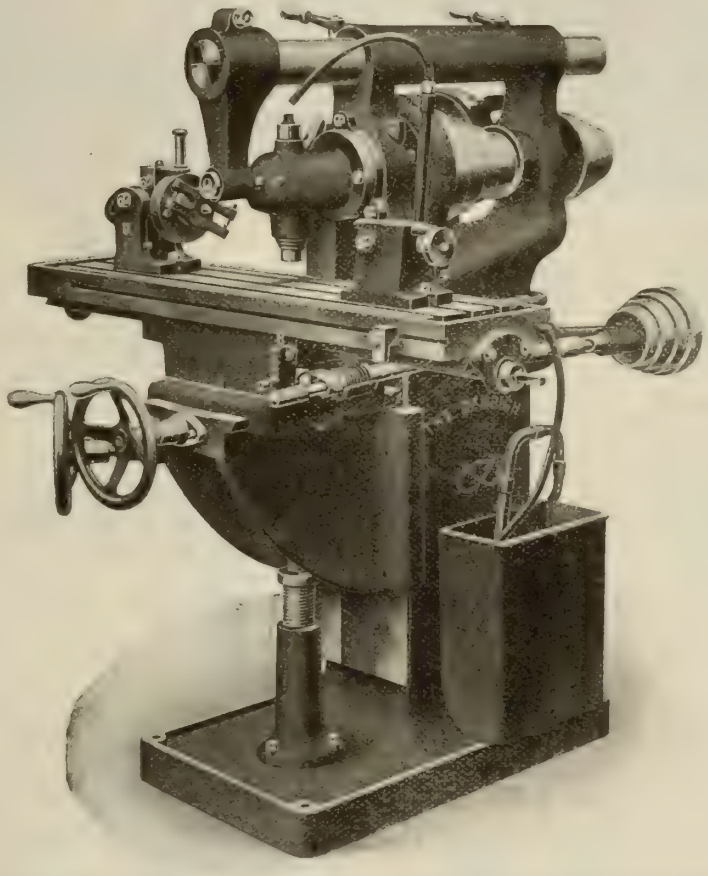
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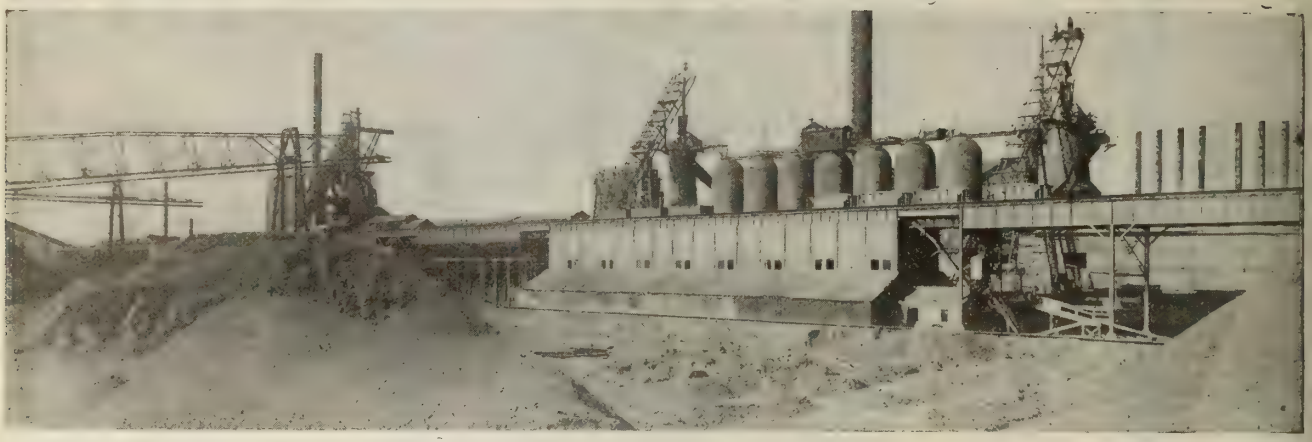
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GENERAL VIEW OF THE PLANT OF THE ALGOMA STEEL CORPORATION FROM THE WATERFRONT

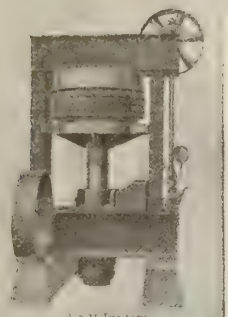


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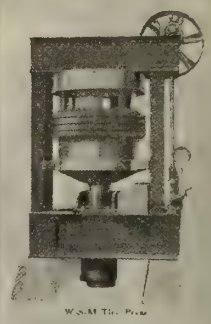
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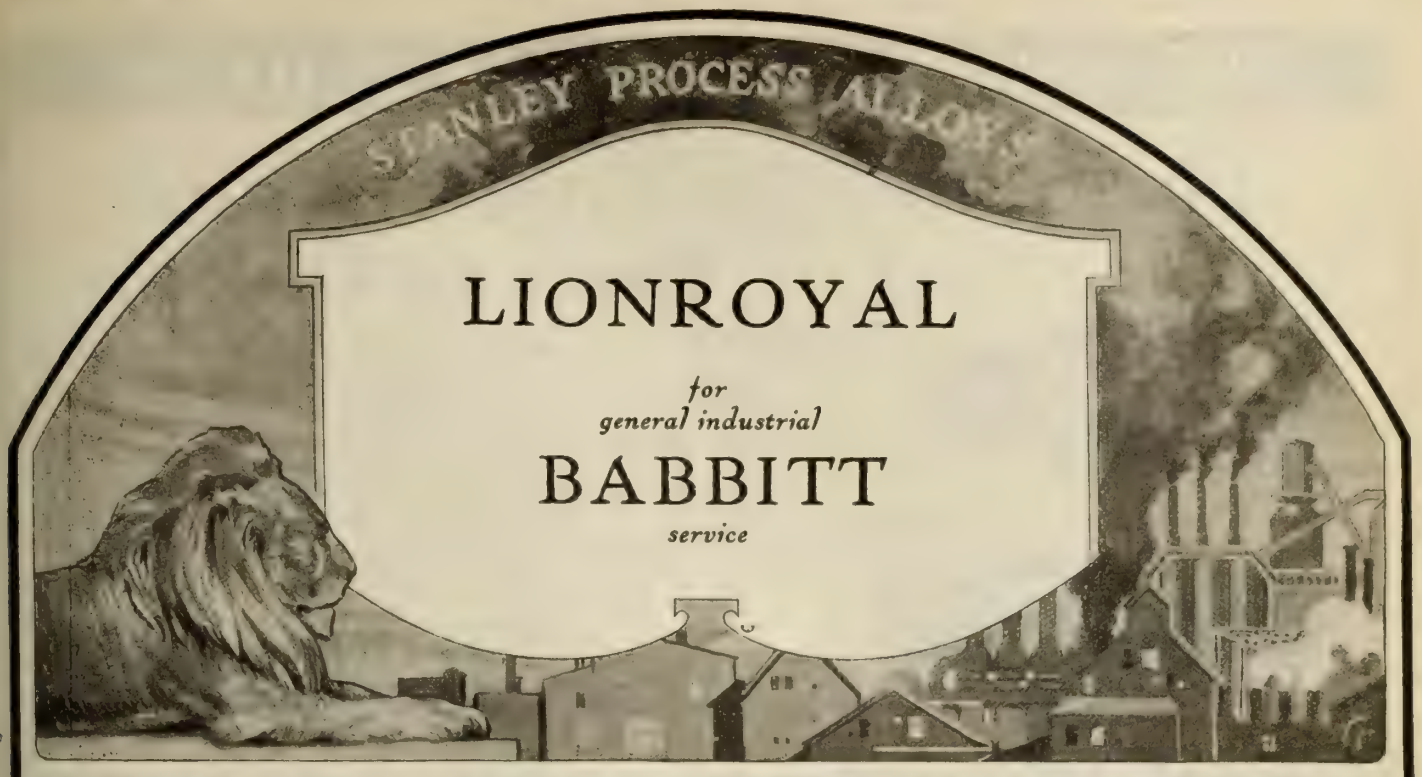
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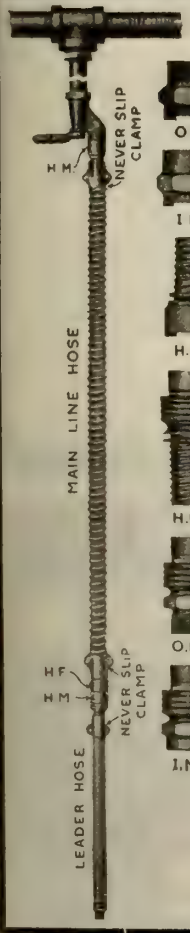
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The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ¾-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-in.

The Cleco Never Slip Hose Clamp

Made in same sizes as Bowes Couplings

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.



CLECO GROOVED HOSE NIPPLE



Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

WIRE CLAMP TOOL

To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.



Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

Write for Bulletin 34A, 41 and 43.

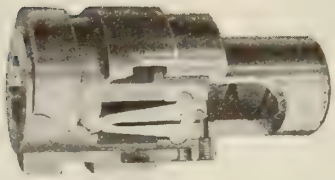
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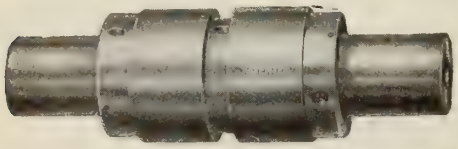
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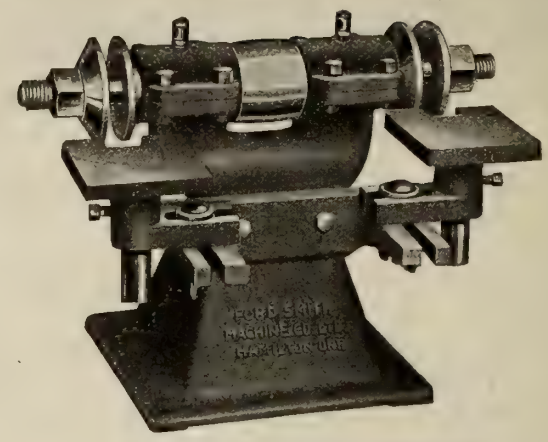
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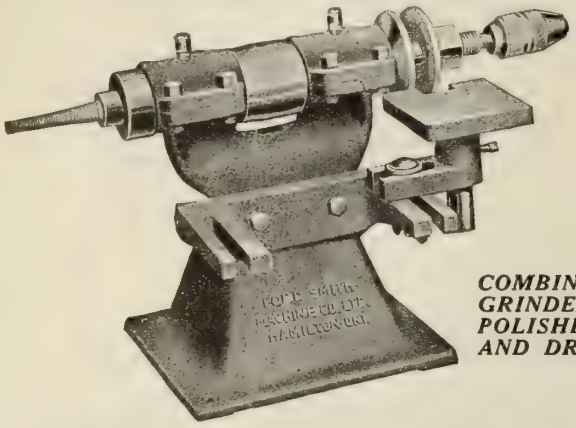
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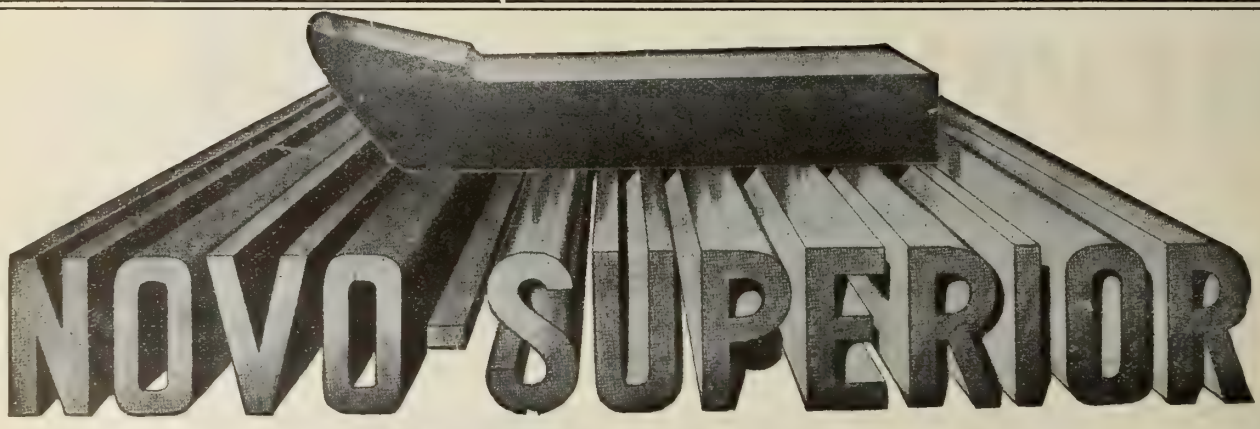
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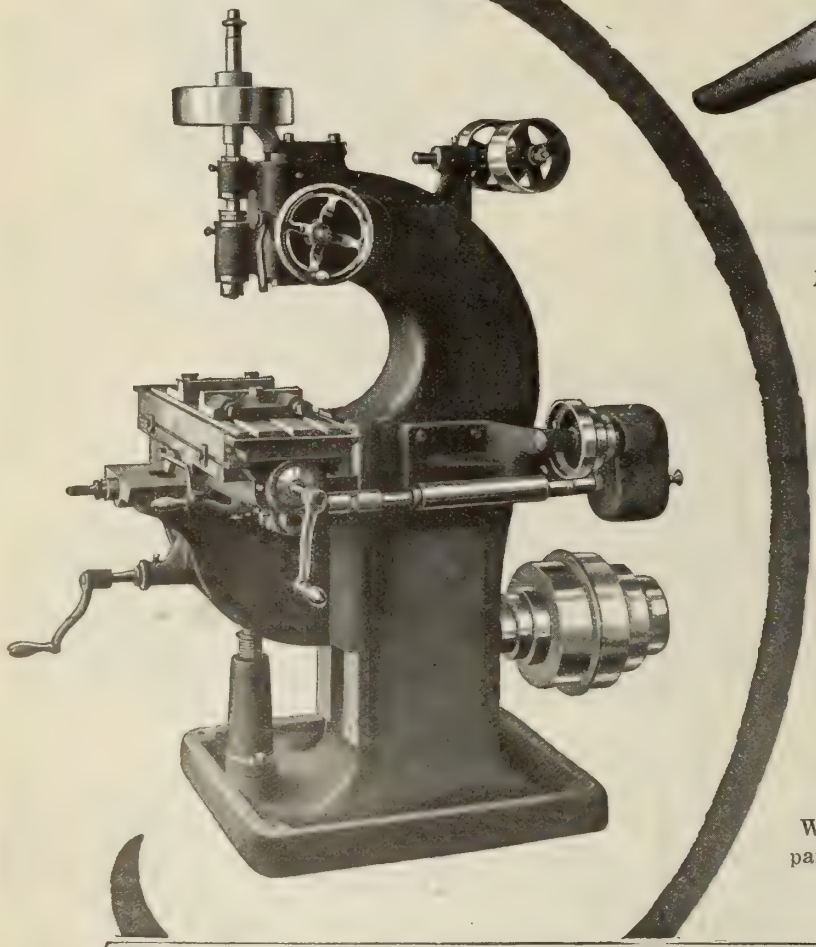
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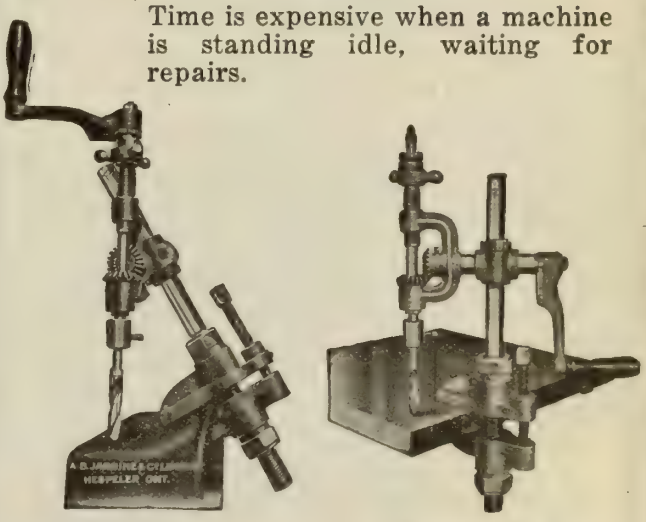
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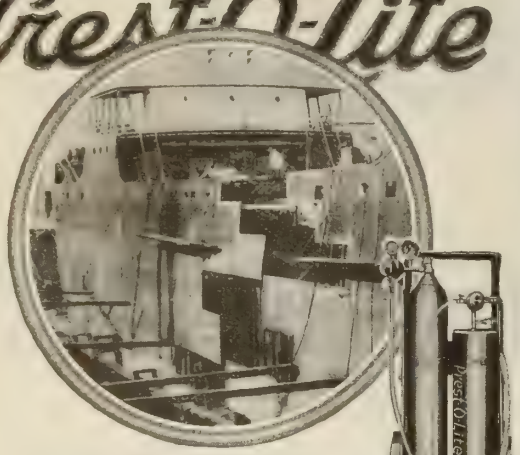
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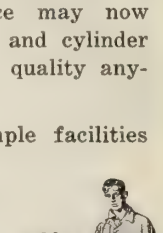
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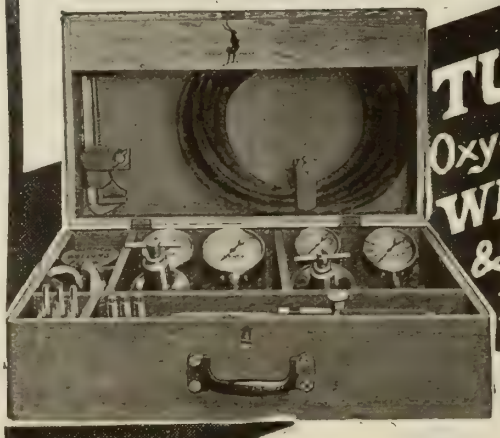
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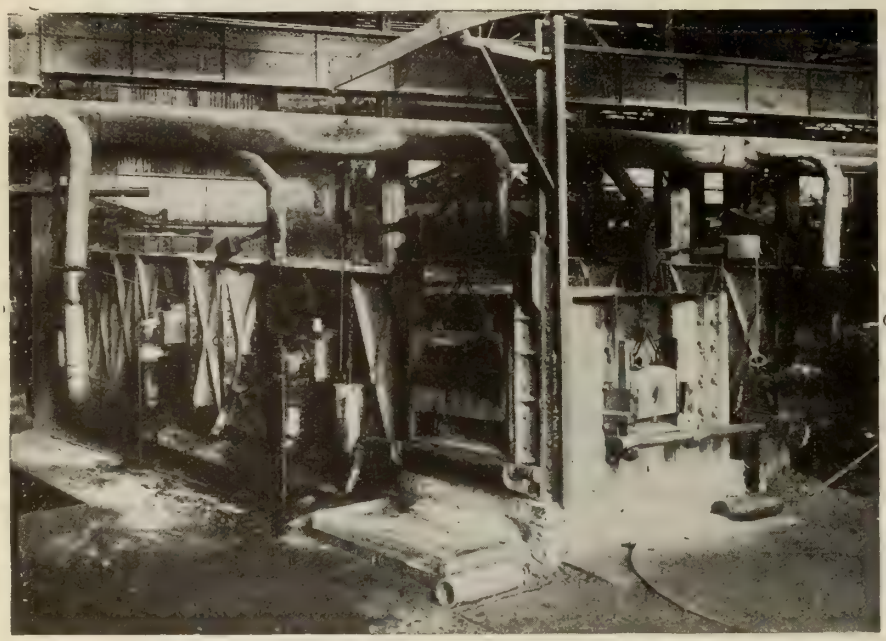


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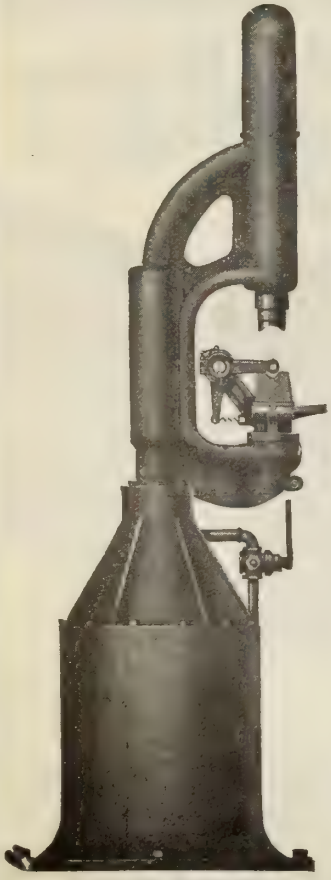


We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

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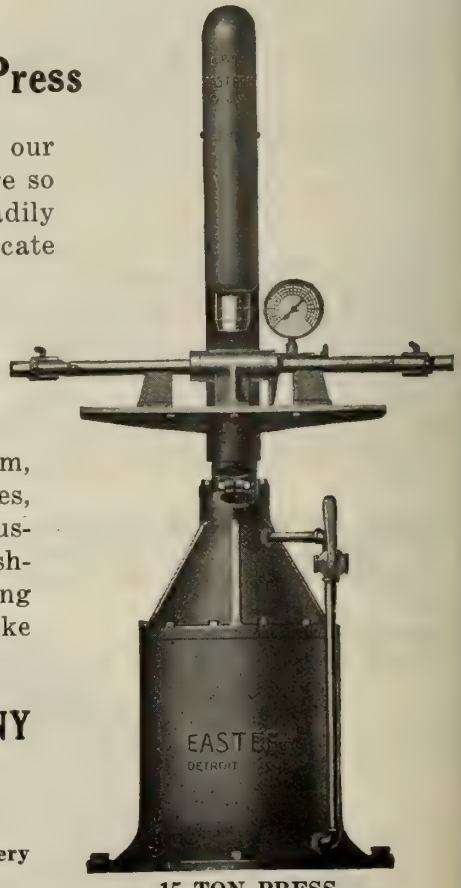
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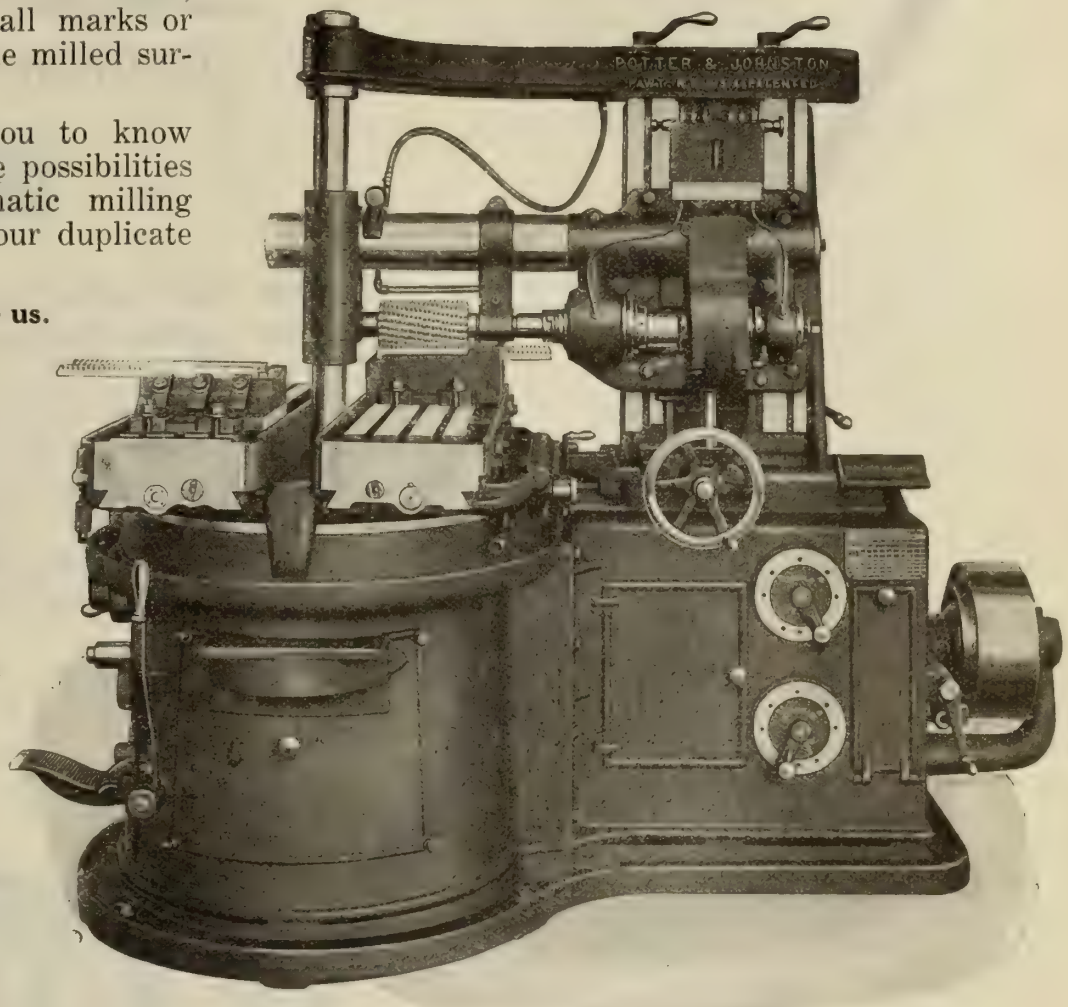
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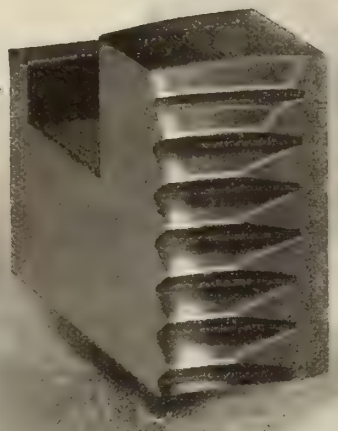
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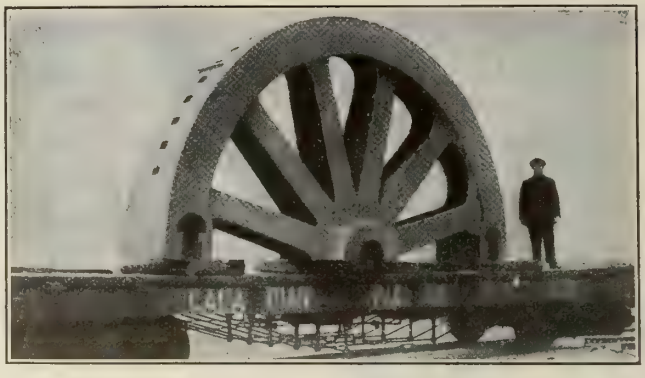
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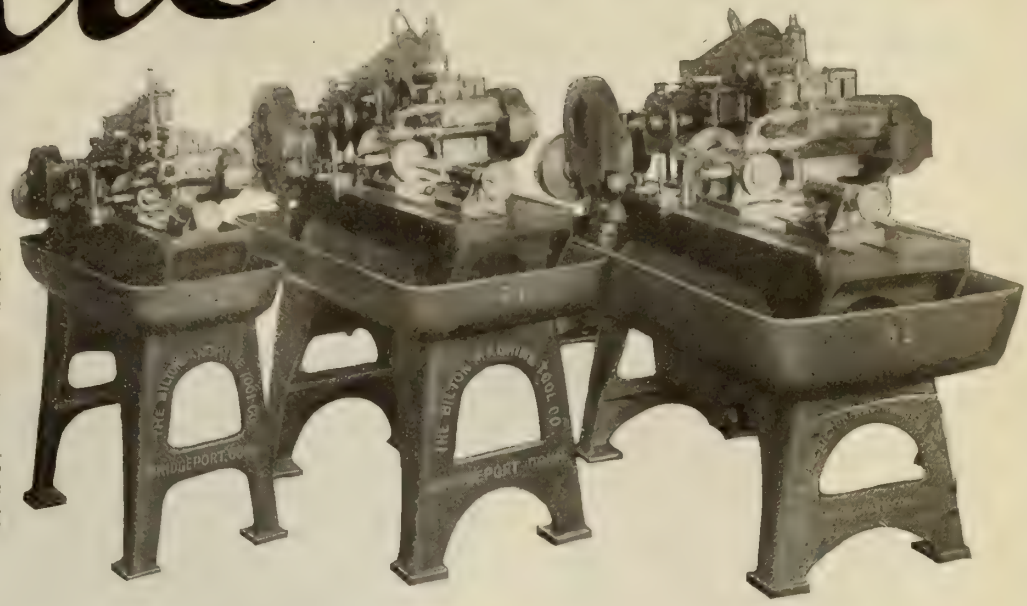
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Diameter	- -	20 Feet
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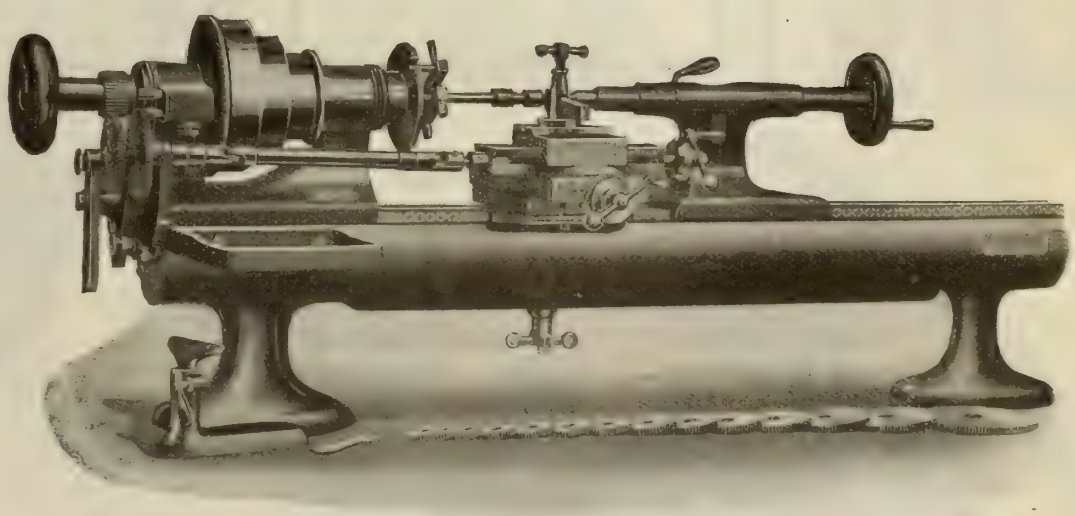
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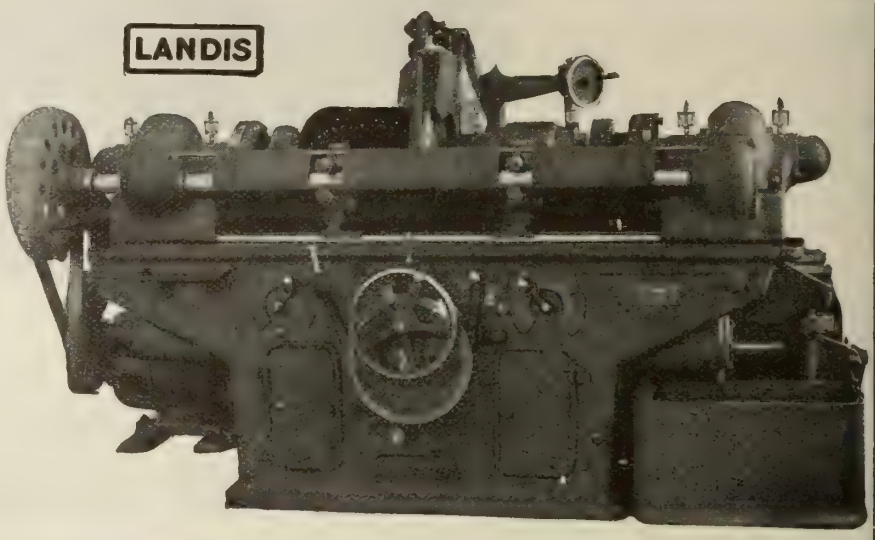
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125—Four cylinder automobile shafts in 9 hours.
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This production speaks for itself, and is possible only because the new Landis crank grinding machine is correctly designed, and because it is substantially and carefully built.



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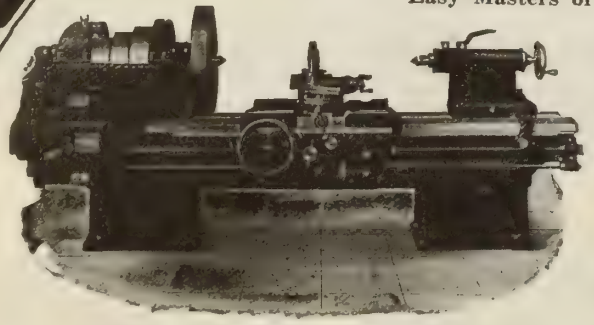
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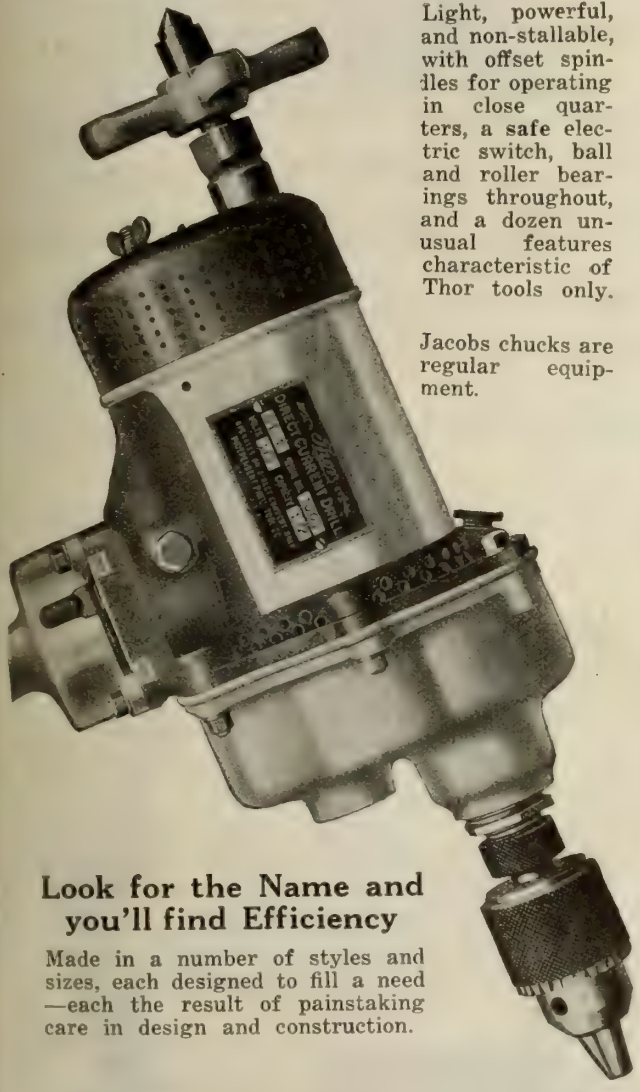
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Throw it away and avoid poor work and wasted labor cost.

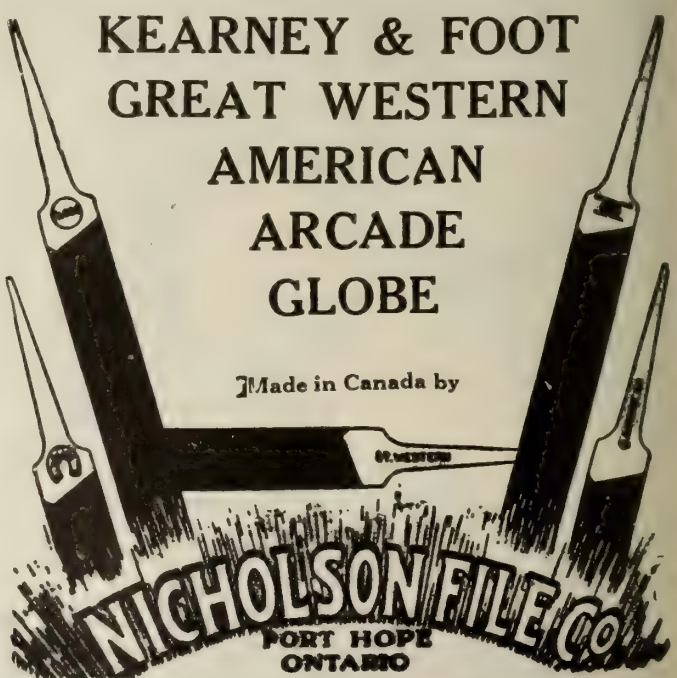
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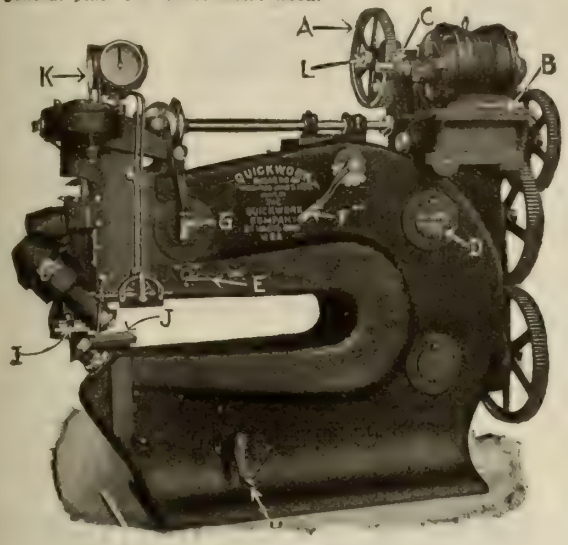
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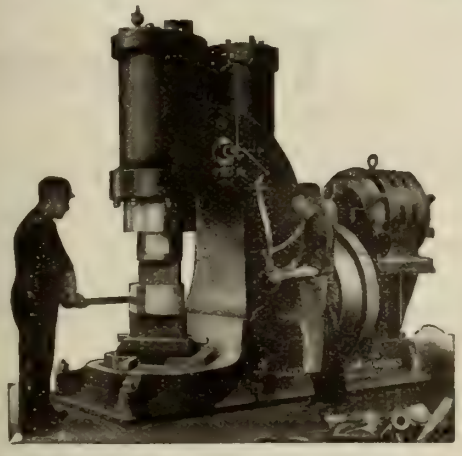
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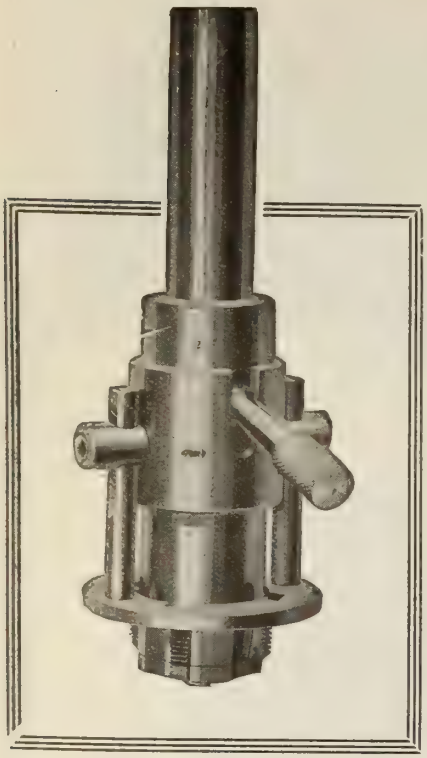
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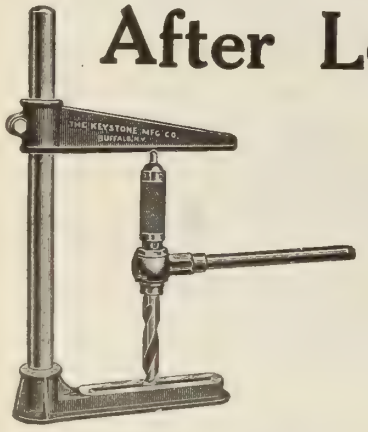
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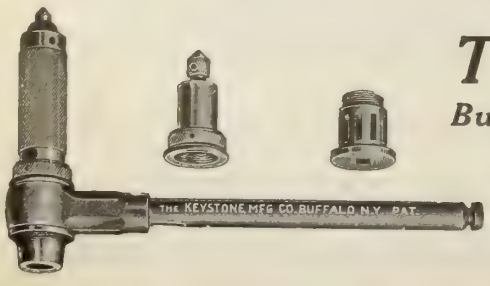
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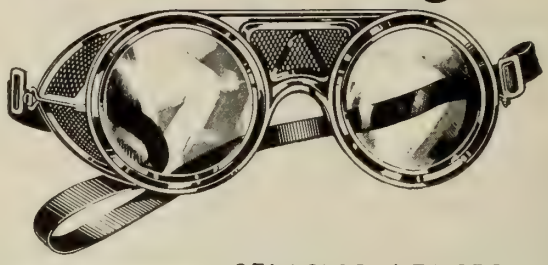
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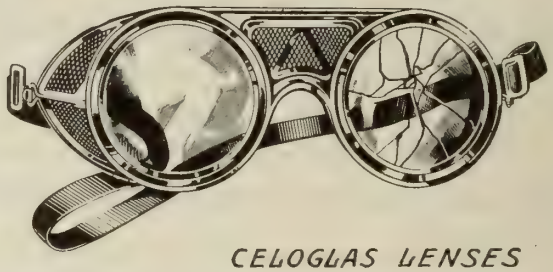


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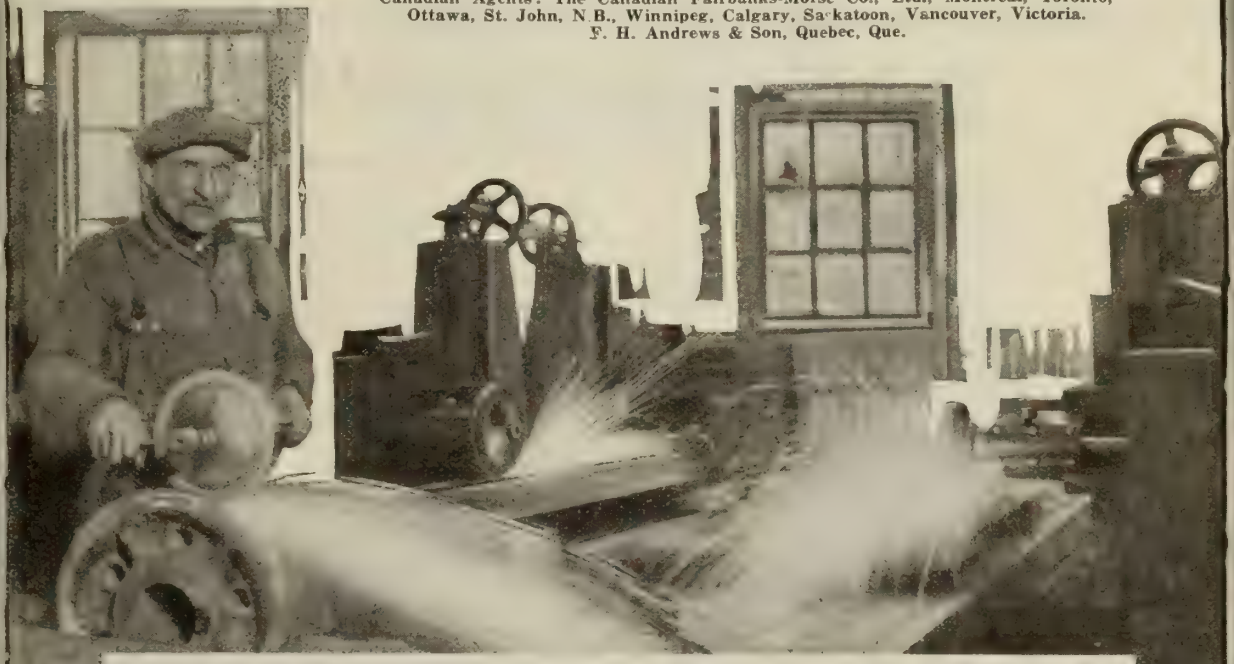
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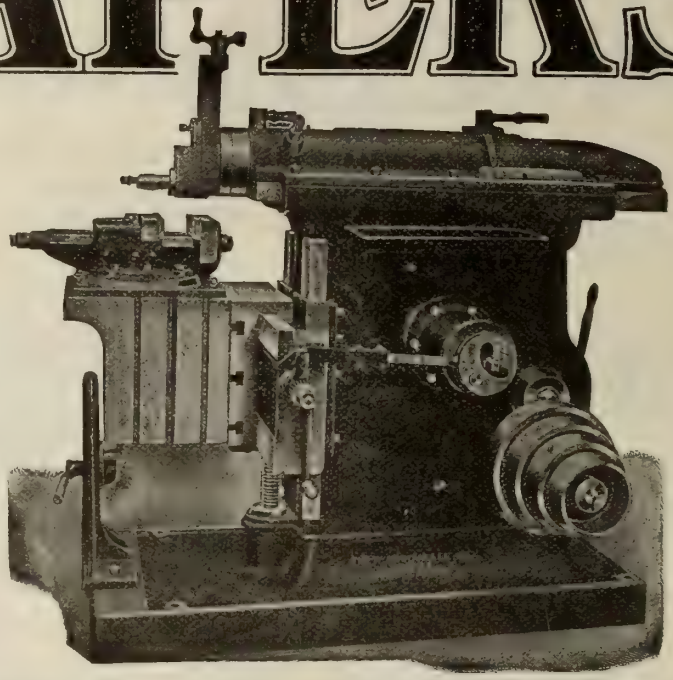
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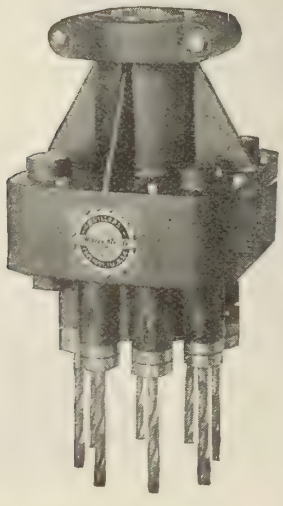


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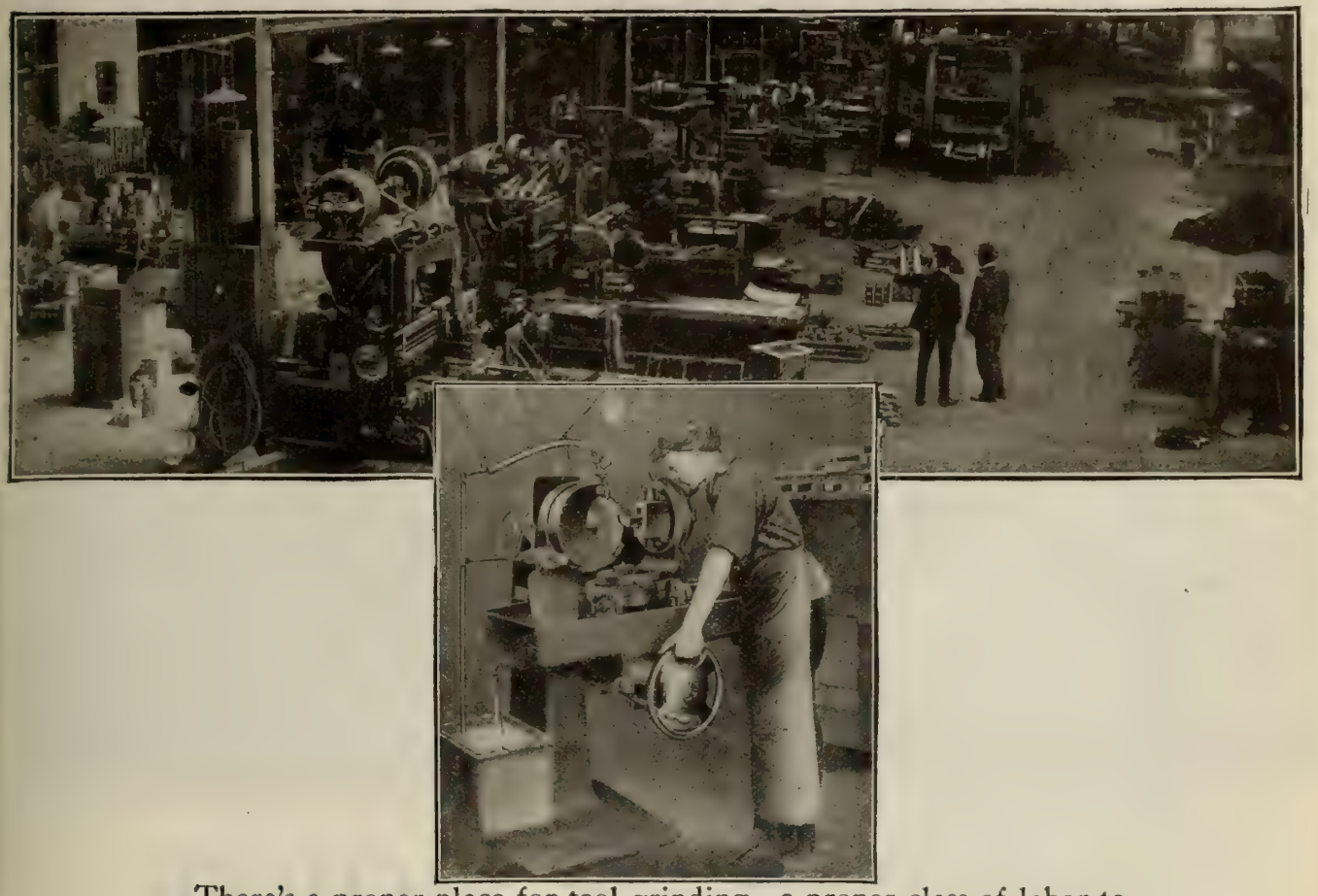
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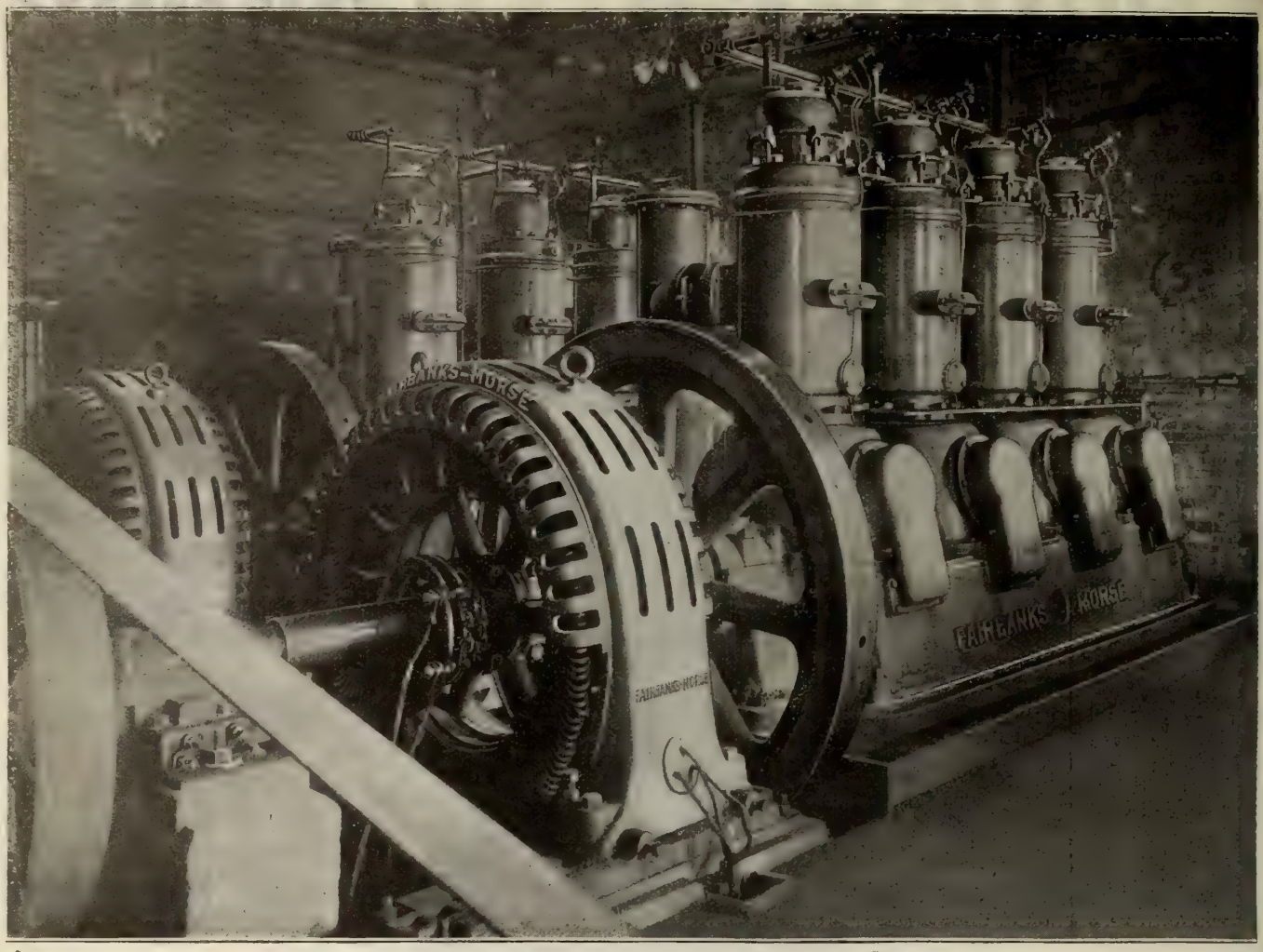
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CANADIAN MACHINERY
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MANUFACTURING NEWS

Vol. XXIII., No. 9 February 26, 1920

Some Examples of Profile Milling Practice

This Subject is One Which the Average Mechanic Should be More Familiar With, as It Often Means Reduced Labor to Adopt This Practice. Various Fixtures Are Shown and Discussed

By F. SCRIBER

THE machining of odd-shaped parts from metal, always a troublesome job, is seldom accomplished in the most efficient manner—due, sometimes, to the necessity of providing formed cutters, and often because proper machines are not available. The profile and hand form milling machine, while a constant ally of gun makers, sewing machine manufacturers and others heavily engaged in hogging forms from metal, is to many others somewhat of a mystery, even though an old-timer on the market.

The purpose of this article is to describe the operation of this machine and present examples from practice, thereby, perhaps, suggesting a way out of form machining difficulties for someone.

A profile milling machine usually consists of one or two revolvable spindles, with guide pins, which are caused to follow master plates by means of two handles attached to feed screws operating slides working in planes at right angles to each other. Such a machine having two cutter spindles A is illustrated by Fig. 1. The handle B feeds slide C, while slide base D is fed by handle E in the opposite direction.

Referring to Fig. 2, this shows a section through the spindle of a profile milling machine, this spindle being carried in a suitable slide which is used to bring the cutter in contact with the work, suitable stops and adjusting screws being provided for that purpose. In the tubes F, Fig. 1, operating springs are located for these slides. Referring to Fig. 2, the cutter A is held in spindle B by draw bolt C, the spindle being of the usual adjustable box construction, and is driven by spiral gears.

Typical profiling jobs are the milling of cams, shoes of odd radius, gun magazine parts, etc., while by referring to Fig. 3 the usual manner of setting up the work in a fixture is illustrated, the means of holding same being, of course, that best adapted to the particular job being done. Referring to the illustration the cam is placed on a stud A, and is clamped by the nut B. An outline of the cam shape C is attached to the base of the fixture by screws and dowels D, and the fixture being attached to the table of the machine, the outline of the cam is milled by keeping a guide pin in contact with the formed plate in the manner previously described, the guide pin usually being held in the same slide as the cutter in hole at X, Fig. 1.

To compensate for wear of the milling cutter, the guide pin is beveled, and this necessitates a corresponding bevel on the formed plate. A fixture for milling a flat plate is illustrated by Fig. 4 This plate is located between blocks A and B, while it is clamped by strap C and

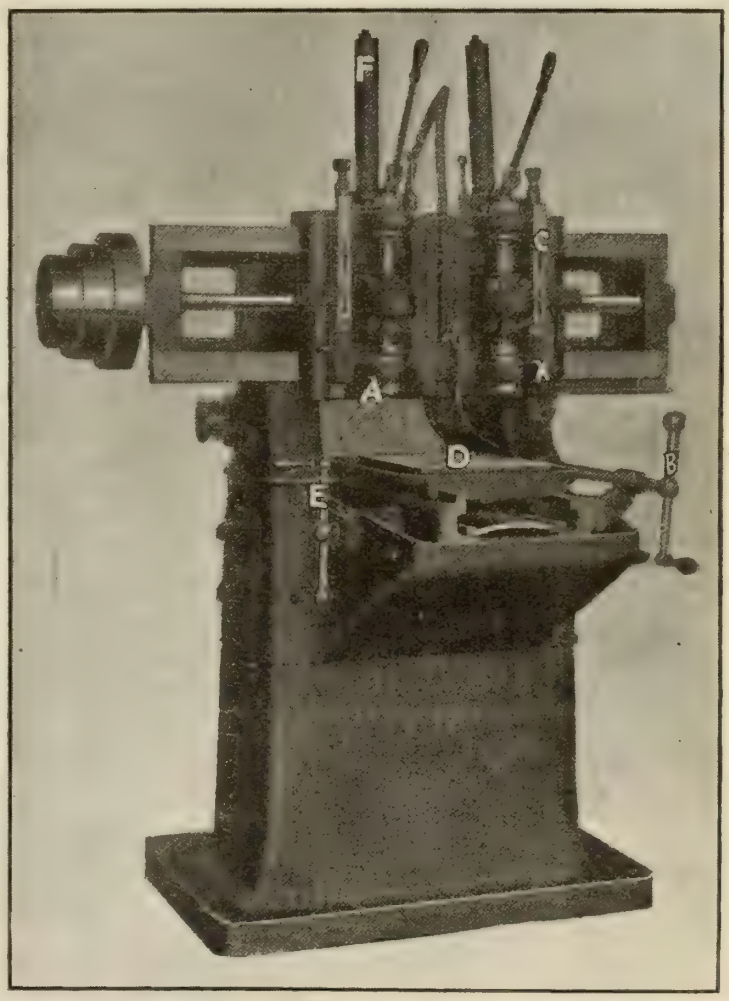


FIG. 1.—TYPICAL EXAMPLE OF TWO SPINDLE MACHINE.

nut D. The outline at X is milled in the customary manner, using plate E as a means of guiding the cutter.

Not all work can be handled by having the guide pin held in the same slide as the cutter, consequently recourse must be had at times to carrying the cutter in one slide and the guide pin in the other slide of a two-spindle profile milling machine. Such an arrangement is

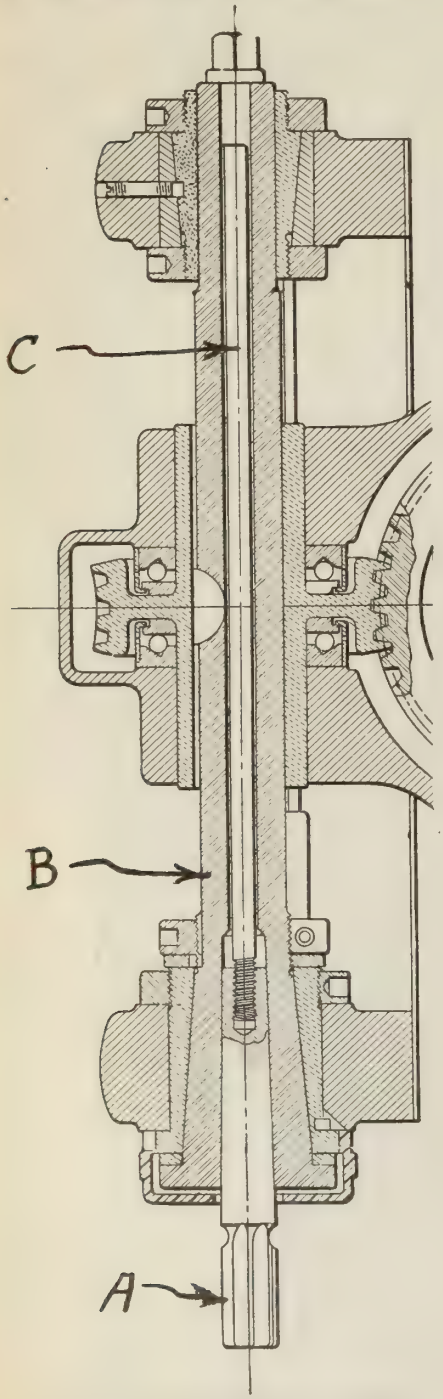


FIG. 2.—SECTION THROUGH SPINDLE.

illustrated by Fig. 5, where the cutter A is carried in spindle B and the guide pin is carried in spindle C.

It is necessary to lock both slides together, so they will work as one in a case of this kind.

As an instance of this application, reference is had to Fig. 6, where the method of milling the point of a bayonet is shown, in which instance the bayonet rests in a block A and on a formed plate B, while set screw C holds the bayonet against block D in a substantial manner. With the work thus secured a profiling cutter mills the outline at the point of the bayonet, using formed block E as a follower for the guide pin. The formed block and bayonet are so far apart in this case that the guide pin in the cutter spindle slide could not be used, therefore recourse was had to the method described in the proceeding paragraph.

A great many times it is convenient to profile mill having the guiding means and cutter combined as one tool, likewise having the formed follower plate above or below the work. Such a condition is illustrated in Fig. 7, while by referring to the different types of cutters shown by Fig. 12, an idea of the method of handling will be obtained.

The fixture, Fig. 7, is a comparatively simple one, consisting of a cast iron base, A, finished top and bottom, while the work rests on the top and is located

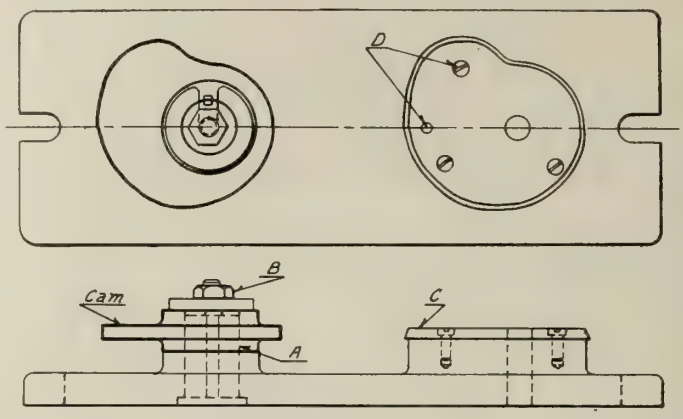


FIG. 3—TYPICAL EXAMPLE OF SET UP.

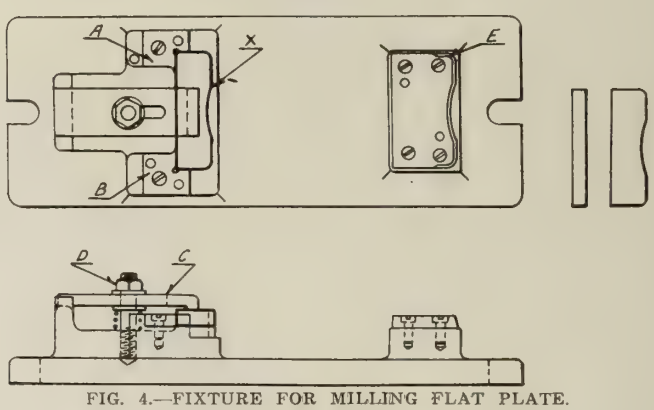


FIG. 4.—FIXTURE FOR MILLING FLAT PLATE.

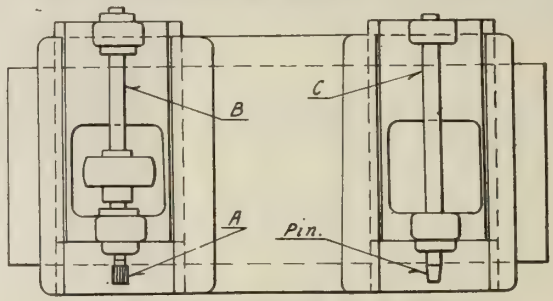


FIG. 5—ARRANGEMENT OF SPINDLES.

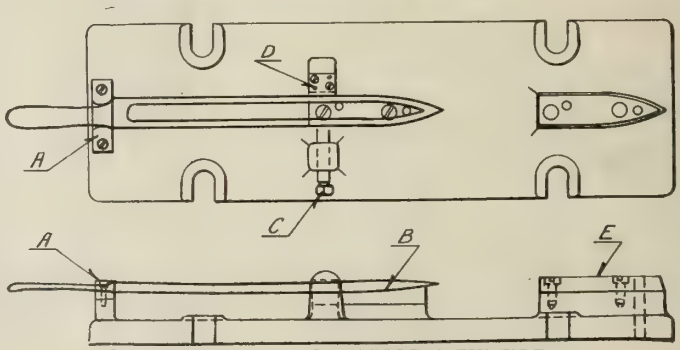


FIG. 6.—BAYONET POINT MILLING FIXTURE.

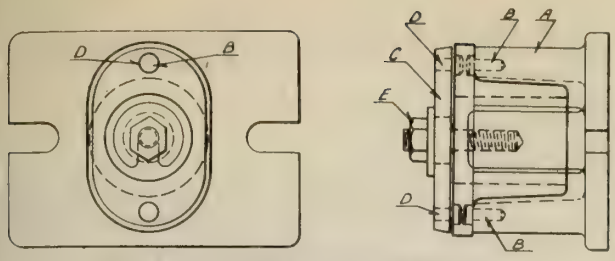


FIG. 7. -ANOTHER SIMPLE FIXTURE.

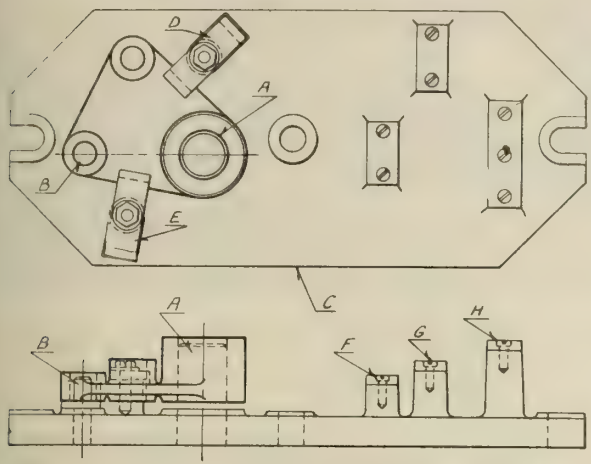


FIG. 9.—A FIXTURE FOR SURFACING THREE BOSSES.

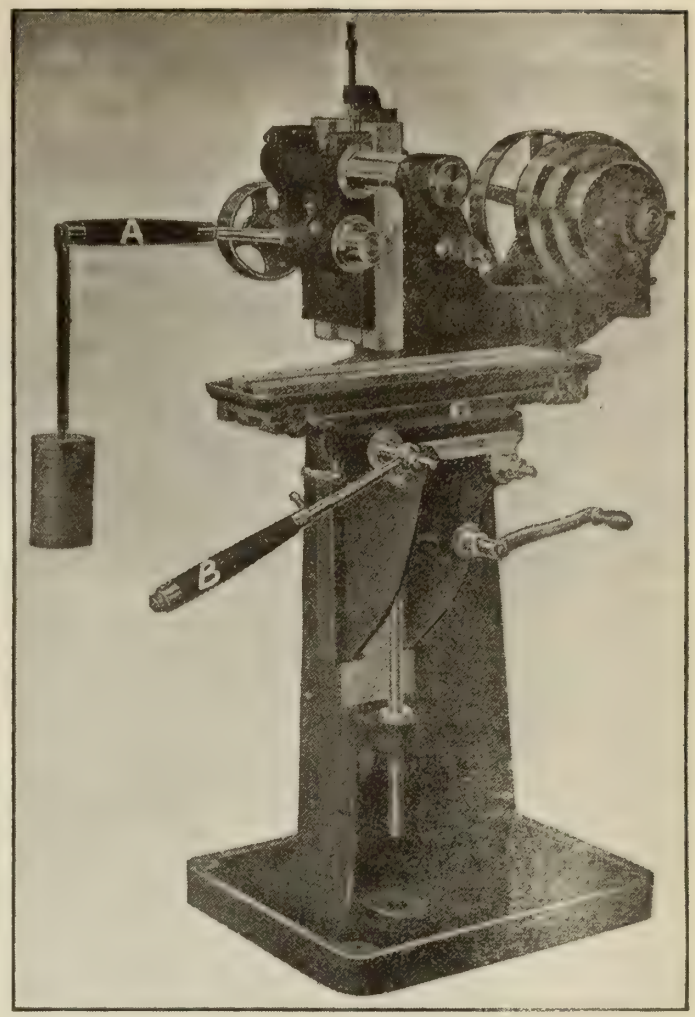


FIG. 8.—A HAND MILLING MACHINE.

by two pins, B. The plate C containing two pins D is located in these same holes, while the combination of stud, nut and washer E clamp the plate and work in position. With the fixture clamped to the table of the profiler, a cutter similar to that shown at C, Fig. 12, is employed, except that the guide roll is closer to the cutter Y. In operation the roll is kept in contact with the formed plate in the usual manner, thus permitting the cutter to form the outline of the work.

Figure 8 illustrates a hand-milling machine, by means of which irregular outlines are often machined, using cutters of the same general type as that just described, it being obvious that the cutter works in a horizontal plane on this machine, instead of a vertical, as in the types previously described. On this machine the roll on cutter is kept in contact with the work by means of the handle A, while handle B feeds the table containing the work under the cutter transversely.

That work for the profiler is not entirely confined to the milling of forms is amply illustrated by conditions as set forth in Fig. 9, where an arrangement for surfacing three bosses of different heights is shown.

To hold the work, two studs, A and B, are provided in a base, C, together with two clamps, D and E. The fixture is held to the machine by two bolts. Three hardened steel plates, F, G and H, are also set on this fixture, the purpose of these being to govern the position of the surface mill by means of a guide pin, which rests on these plates, while the vertical mill surfaces the three bosses.

Again referring to Fig. 12, the first follower shown at A is of the plain beveled pin type to fit the tapered hole of the spindle, or it is made with a straight shank to fit the guide pin hole as required.

The follower illustrated at B is used for surfaces to be milled on a slant, a type of which will be shown later. The third type C is for work with formed plate above work, as previously described, and consists of roll X, cutter Y, shank Z, spacing collar W, cutter drive-pin V, and cutter holding-screw Q. The roll in this case being free to revolve.

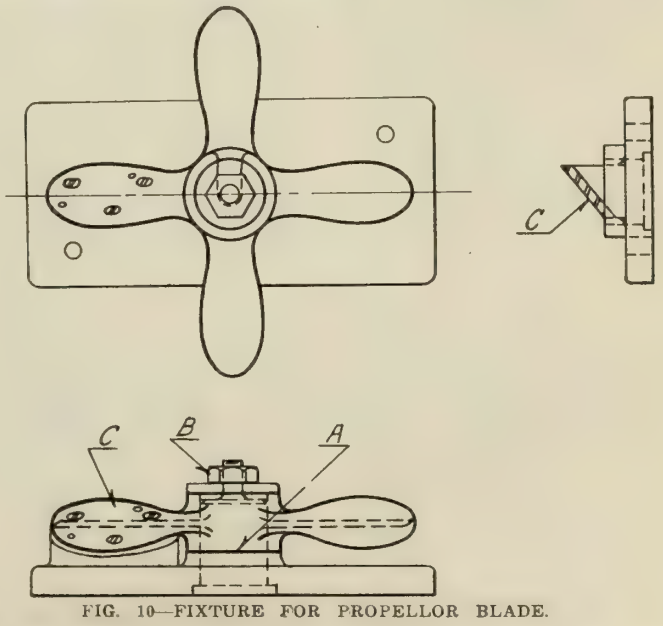


FIG. 10—FIXTURE FOR PROPELLOR BLADE.

At D, Fig. 12, we have shown a cutter R on shank S, which has a roll T mounted below the cutter, this cutter

being driven by a collar U pinned to the shank, while a screw keeps the roll in place.

A type of work for which a roll beneath the cutter is adaptable is shown by Fig. 10, where a fixture for milling the outline of a propeller blade is shown, the propeller being held on a stud A by means of the nut and washer B, the under side of one blade, which has previously been finished, being pushed against a steel plate C while the work is being clamped. The outline of this plate conforms to the desired outline of the propeller blade, thus by keeping the roll in contact with this plate one blade outline is milled, while to mill other blades the propeller is turned, bringing each blade successively into position for machining.

Reference having been made in Fig. 12 to a guide pin B for milling angular surfaces, the illustration, Fig. 11, shows a condition of this kind. This fixture consists of a cast iron base A and means for holding a propeller securely, together with a formed plate B, whereby the desired shape is obtained by keeping the roll in contact with its upper surface. The propeller is mounted on a stud C and is held against formed plate D, while nut E and washer F clamp the same. In this position two adjustable slides G, having beveled ends, grip over the top of the blade in the manner shown, using screws H for adjusting purposes.

In operation a convex end milling cutter is mounted in the cutter spindle, while the convex end guide is mounted in the guide pin hole, therefore, by keeping the roll in contact with the top of guide block and transferring the propeller blade successively back and forth under the convex end milling cutter, a series of cuts are made approximating the back of the blade to the spiral convex form desired, which, by filing, can be made all that is desired. Each blade in turn is successively dealt with in the same manner until all are completed.

Many combinations along the same general lines are met in profiling practice, and it will be evident from the foregoing that cutters and formed plates are the chief items of expense, the holding fixtures themselves generally being quite simple.

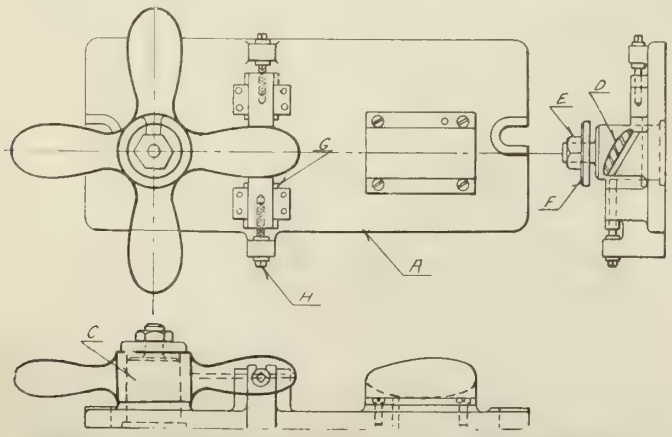


FIG. 11.—FIXTURE FOR MILLING ANGULAR SURFACES.

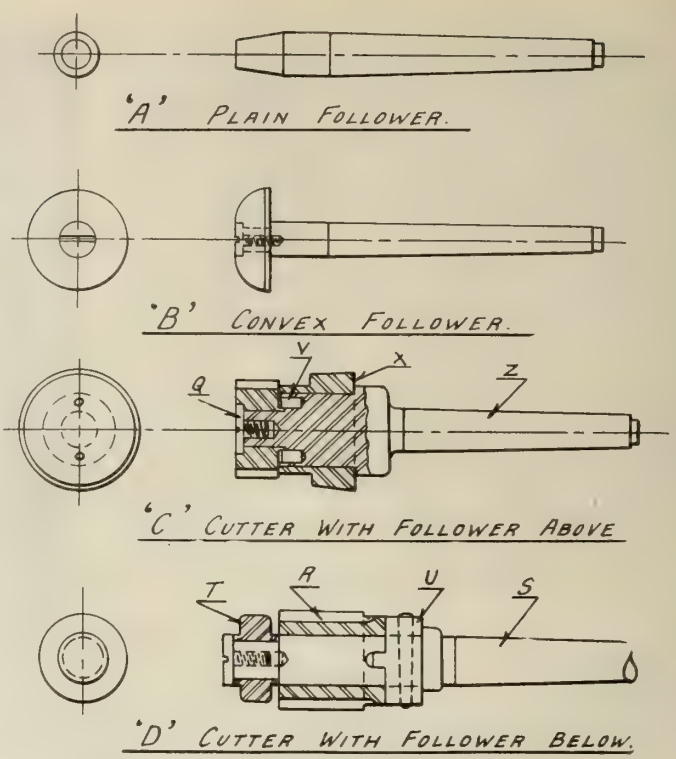


FIG. 12.—VARIOUS STYLE TOOLS USED.

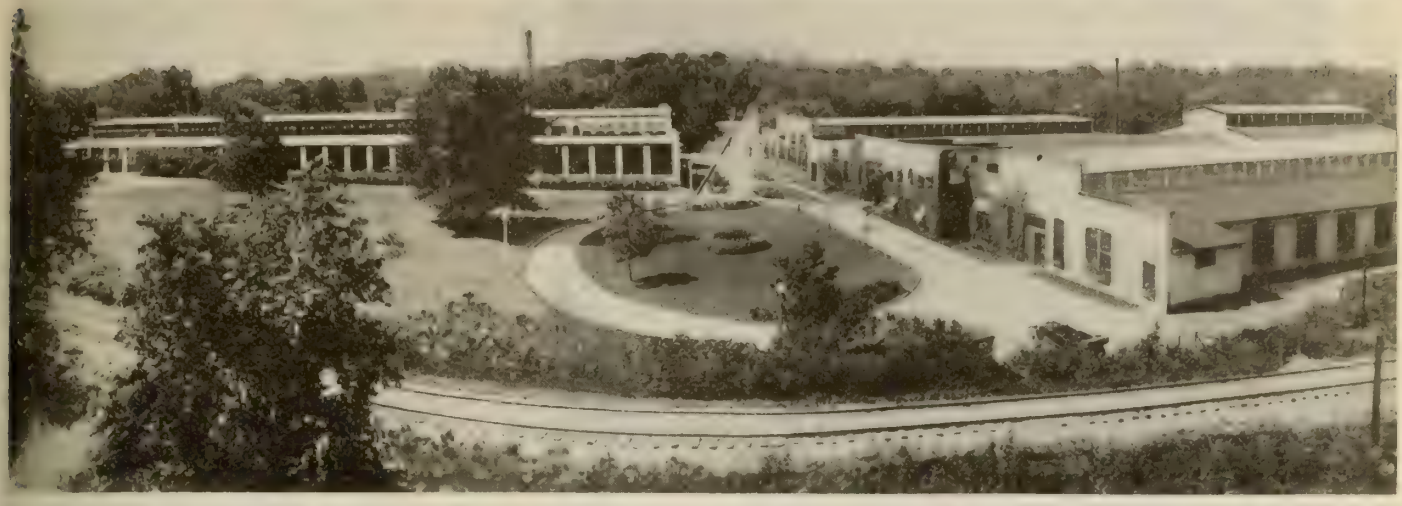
BORING TAPERED HOLES

By W. ERNEST.

I do not presume that the following method of boring a tapered hole with the aid of the compound rest is new by any means, but judging from the way many machinists tackle such jobs it is certain that a great number of men are not aware of such an easy method. Most lathes nowadays have the "rest" graduated in degrees at the base, so that when a hole is to be bored, the number of degrees given it is a very easy method to proceed. In repair work, however, it is simply a case of making one part to fit another piece, or in many instances the taper per foot is given. One does not have to be very elaborate at figures to go ahead on these kind of jobs any more than if the actual number of degrees were given. As an instance, let us assume that we have a hole to bore, and have found the taper required to be 1½ inches to the foot. First of all get a pair of calipers and measure the diameter of the base of the compound rest. Suppose we have found this to be eight inches in diameter, it naturally follows that from the centre it swings on a four-inch radius. Now 1½ inches per foot is equal to ⅛ inch in 1-inch lengths, therefore, in 4 inches it will be four-eighths or one-half inch. However, seeing that the cutting action of the lathe takes off both sides of the hole as it travels around in a circle only half this amount of swing must be given the compound rest, or in other words, only ¼ of an inch. To do this set the dividers to a quarter of an inch off the scale and insert one point on the stationary line on the rest and swing around until the top zero mark comes exact on to the other point of the dividers and you will have the compound set so close to the desired position that it will cut the correct taper. This will eliminate any cutting and trying and continual knocking the rest about, to find the right location. Furthermore, all this can be done in quicker time than it takes to tell, and if the workman happens to be a regular lathe hand, once he has determined the foregoing facts he would hardly have to go over them again. All that would be necessary, if he already knows how much taper he wants, is to use his dividers or even a scale would do. Personally I have got very accurate results by judging the distance with my eye, from the graduations.

Buy Toronto Premises.—Chas. E. Goad Engineering Company has purchased the two-storey brick building at 205-207 Victoria Street, Toronto, and will use it as a warehouse. The building fronts 42 feet on Victoria and the sale price was about $65,000. The building is at present occupied by A. O. Gorrie & Company.

A *Manufacturing Plant* That Is Built in a Park



The Home of the Clark Equipment Company, of Buchanan, Michigan. Can Employees be Anything Else But Satisfied Working Amid Such Surroundings?

By J. H. MOORE

CAN you imagine yourself at work in a huge park with a profusion of trees and flowers surrounding you, yet be working in this park, not as a gardener, but as an employee in a manufacturing concern?

While such a condition sounds like a wild flight of the imagination, it is merely a brief way of stating the splendid plan adopted by the Clark Equipment Co., of Buchanan, Mich., for the benefit and welfare of their employees.

Believing that readers of CANADIAN MACHINERY will be interested in such a story of industrial progress, we have secured various views of the plant, together with the aims and purpose of this new and ideal method of working.

In starting to describe the relations existing at this plant, it is well to bear in mind the fact that all dealings are between the men, not between labor and capital. All plans are made and worked out on the assumption that each and every man is fair and trustworthy. Nobody is considered an eye worker, and every man is given a chance to prove his ability.

This policy has resulted in a cordial human relationship between the men and management.

Various projects have been started outside of the actual working conditions that are well worthy of mention.

Homes have been built, a theatre erected, a profit-sharing plan developed, a system of shop government established, giving the men a voice in the management, a community hospital has been established, and last but not least every encouragement has been given to each employee to join in athletic exercises. All these inducements make better satisfied workmen, which explains why the recent labor troubles never touched this concern.

The town of Buchanan, Mich., is not as large as New York City, having only some 4,000 of a population, but here people live, not merely exist. No doubt readers are already aware that the concern we speak of manufactures axles and steel wheels for motor trucks, also the well-known line of Celfor high-speed drills, etc., etc., so that it is hardly necessary to dwell on this point further, so we will proceed with a description of the plant itself.

The entire plant is laid out like a park, with the various buildings grouped around a centre garden, with well-kept lawns. The factory is approached through a long avenue of Lombardy poplars, and it is merely a minute's walk from the foundry or forge departments to lawns of velvet smoothness.

Each office has a pot of flowers, each window-ledge has its own flower-box, each lawn its flower-bed. The atmosphere and environment is such that one cannot help but feel that all is well with the world as far as this particular spot is concerned.

Tucked away in one corner of the plant is a complete greenhouse and conservatory, where all sorts of bulbs and plants are nursed until strong enough to be transplanted to the outdoor gardens

The various departments of the plant are housed in buildings of most modern design; light and sunshine are everywhere. Blowers and suction fans sweep fresh air into every nook and cranny. Everything possible has been done to beautify the place, and sanitary conditions are considered above all else. The drinking fountains are of white enamel, and are of the fountain type.

Homes for Employees

A little over a year ago the company began building homes and selling them to employees at cost. This step was made only after the situation had been weighed carefully. Employees were given the benefit of long-time credit, and of course cheaper building costs owing to constructing in bulk.

Before going ahead with this housing venture the project was first submitted to the employees in the form of a questionnaire. When these forms were returned a meeting was held in the company's theatre, and, by the aid of talks, sketches, and lantern slides, the plan was explained. This gave the company a good idea of the number of houses necessary, how expensive they would be, etc., etc.

The company then purchased 110 acres of land and planted 40 acres to begin with. This plotted section was provided with all improvements, such as wide streets, trees, grass plots, sidewalks, water, gas, and electricity.

In order to head off speculators and keep profiteers from grabbing the unearned increment, the company, in fixing prices, added 100 per cent. to the actual cost of each lot, plus 5 per cent. on the cost of each house. The houses were sold to employees at prices ranging from $1,900 to $4,500, depending on their size and style.

The employee purchasing the home paid on terms arranged to suit his purse, so much down and so much in instalments, on an amortization plan that paid off both principal and interest, leaving the property free at the end of a certain period of years. The initial payments ran from $180 to $400, averaging about 10 per cent of the selling price.

After five years of payments had given the purchaser an equity sufficient to guarantee his good faith in carrying the deal through to the end, the 100 per cent. on the lot, and the 5 per cent. on the home were remitted and applied on his account. In this way the buyer got the house at actual cost price.

A very peculiar and interesting point was brought out when the company



THE APPROACH TO THE PLANT. WHO WOULDN'T LIKE TO WALK THROUGH SUCH A BEAUTIFUL AVENUE OF LOMBARDY POPLARS.

started to sell these houses, for it was found that the great demand was for the higher-priced homes instead of the smaller four-roomed bungalows. Not only did the employees wish for homes of good architectural lines, but they desired homes with plenty of room for expanding families.

The company was not slow to take the hint, so announced that any purchaser would be allowed to purchase his own lot, pick his own plan for his house, and the company would build it for him, providing it was not freakish in design. This plan proved a decided success, and many have taken advantage of the opportunity

Some 44 houses have already been erected, and plans for additional homes are ready. It is only a question of shortage of material and labor which is holding the project up for the time being.

A Theatre of Their Own

Realizing that men who work must have healthy recreation, the company built a model theatre, with a seating capacity of a thousand people. At first a vaudeville troupe from Chicago was brought to amuse the Buchananites, and tickets were presented free gratis, but the American worker does not take kindly to anything smacking of paternalism, so that the actors played to mostly empty seats. This plan was abandoned and admission was charged the next time, with the result that the house was packed.

At the present time the employees have formed an organization called "The Clark Players," and this able cast presents such well-known comedies as "What Happened to Jones"; "A Pair of Sixes," etc., etc. The theatre is also used for minstrel shows, movies, and other entertainments of like nature.

The theatre is operated without profit, the admission fees paying for scenery and all expenses attached to the rehearsal and production of the plays by the home talent. The use of the hall is also given free for all company activities, or praiseworthy community purposes. The company also boasts of a gymnasium and plant orchestra.



AN INTERIOR VIEW OF THE CLARK THEATRE.



HERE IS SHOWN ONE OF THE NUMEROUS FLOWER BEDS THAT BEAUTIFY THE PLANT.

The Community Hospital

For the proper treatment of sick or injured employees the company has provided hospital facilities adequate in size and equipment for every emergency.

While this hospital was primarily intended for the use of employees only, the company, with a true feeling of team work, opened it to every citizen of Buchanan at cost. The institution is operated and conducted by the Clark Hospital Association, which is composed of employees and representative citizens of Buchanan. The township has shown its appreciation of their being included by making an appropriation of $2,000 a year ago to go toward the maintenance of the hospital.

The building itself is ideally located

between the plant and the employees' homes. It handles accident cases, treats the employees and their families in times of sickness, and cares for the maternity cases in the families of employees and community residents.

The hospital has an ordinary capacity of twelve beds, with provision for additional beds in case of unlooked-for demands, such as the influenza epidemic of last year. There are several rooms and wards, with a number of beds in each. The staff of nurses in attendance have commodious quarters, with all modern conveniences. The hospital has its own garden and poultry yard, and fruit is in abundance in the immediate vicinity. Ideal conditions you will admit.

Profit-Sharing Scheme

A little over two years ago the company inaugurated a plan of combined stock sale and profit sharing. The plan is as follows. Employees are allowed to subscribe for stock in an amount equal to 10 per cent. of their salary. This stock they purchase in lots, each lot consisting of one share of preferred and one of common.

No one can purchase more than four lots in any one year. With each lot is given an employees' participating certificate, which is entitled to a dividend of 6 per cent each year, or higher if the directors so decide.

Of course the idea is obvious. If a workman holds stock it is figured that he deserves a larger dividend than the shareholder who merely invests his cash. The plan has worked out very successfully. Last year the shareholding employees received 7 per cent. dividend on their preferred stock and $12 on each participating certificate.

In addition to this there is at the end of each year a distribution of profits dependent upon the amount of the profits. The dividends to participating employees thus far has gone as high as 65 to 70 per cent. on their investment.

As readers can understand, the labor turnover has always been a big problem with any manufacturing concern, but the foregoing plans for their employees' benefit has brought this company good results in this respect. The firm computes their labor turnover by dividing the total number of employees leaving each month by the average number on the payroll for that month.

In 1917 the index figure was 118.50. In 1918 it was 118.6, making an average of 9.88 for each month in these two years mentioned. For the first half of 1919 the monthly figure was only 7.6, and of this figure 2.3 was desired by the company. This means that only 5.3 employees left each month of their own accord. In these troublesome times this is a record to be proud of, and one that speaks volumes for the spirit of contentment pervading the plant.

Another notable feature is that this plant is operated ten hours a day. The arrangement is approved of by both the employees and the management. This is only another proof that this entire organization is proving not only in theory but in practice, that honesty and justice are the true corner-stones of ideal working conditions.

Some cranks will tell you that there is no sense in catering to a workman's needs, that he doesn't appreciate it, and so on, but if you know of one of these wiseacres, let him read this article and convince him that it does pay to let your employees know that you have their interests at heart.

The Clark organization is like one big family, employer and employee working together hand in hand to attain ideal working conditions together with the aim to get the most out of life by putting the best ino it



SOME SPLENDID EXAMPLES OF THE HOMES ERECTED AT LIBERTY HEIGHTS FOR THE EMPLOYEES.

Modern Methods of Power Transmission

Getting the Maximum Power Out of Transmission Has Always Been a Study Well Worth While. This Article, Which Appeared in "Practical Engineer," Discusses Various Phases of Interest

By HARTLAND SEYMOUR

NOW that the conservation of fuel has become of such vital necessity in industry, it behooves every works engineer to investigate very thoroughly every loophole in his factory where waste is able to creep in. He will probably begin at that part of the works where his fuel is consumed, that is, the power-house. He will bring his power plant up to date, and will satisfy himself that he is obtaining the maximum possible percentage of power from the fuel he is consuming, and it is there he very likely stops. He does not seriously consider the waste of power that is going on in his shops, by the utilization of inefficient power transmission factors. For instance, unsuitable shafting, pulleys and belting. Yet the method of transmitting the power in the shop is no doubt an opportunity for considerable waste of power to occur. The problem really condenses to this: To deliver to the machinery to be driven the maximum possible amount of power received in the shop.

When laying out a new shop the engineer can often effect a considerable saving in his power plant by the judicious arrangement of his machines. One method employed by the author was to have a large scale plan of the shop made, then to cut cardboard figures of the machines to scale, and after this to arrange and rearrange these cardboard shapes on the shop plan until the most efficient disposition has been arrived at. Heavy machinery should always, where possible, be arranged near the main drive, so as to economize in the length of heavy shafting to be carried in the shop. Again, if there are any machines which do not run continuously, these should be grouped together, as continual stopping and restarting involves considerable wear and tear on the belting. There are other considerations, of course, such as an arrangement whereby the constant moving forward of the work in hand is assured.

In many shops the capital sunk in the transmission of power has apparently been of no consequence, for the machines have been arranged in straight lines, it is true, but with the very evident lack of forethought. A machine has been installed in a certain position, the shafting carried to it, and the power finally delivered, but the responsible authority evidently has not considered the fact that every bearing is a source of loss, besides the extra cost in initial outlay as well as the maintenance cost, which is usually very heavy.

Having arranged his machinery and planned the lay-out of his shafting, the engineer must next consider the erection of that shafting. It is extremely important that the shafting be well aligned. This is, naturally, something of a problem where the machinery is heavy and the floors subject to loads which are being continually shifted. The method of levelling from section to section of the shafting by a spirit level is extremely unsafe, as a very minute error in each bay will amount to something considerable at the end. The other method of aligning the shaft sideways with a tightly-stretched wire, parallel with the shafting, is fairly satisfactory, but is inconvenient when the shafting varies in diameter in different sections. One very successful method employed in some shops in America is to utilize a surveyor's level.

The level is supported on two wooden horses beneath one end of the shaft. The instrument is properly set by means of dropping a plumb bob from the shaft to the instrument, and then from the instrument to the floor, on to a mark. An adjustable target is hung from the shaft in front of the level, the cross-hairs being adjusted to coincide with those of the instrument. The target is provided with a set of jaws which engage the shaft and adjust themselves to any diameter, without altering the position of the cross-hairs. A fixed target is hung from the opposite wall on the sight line of the level, then the movable target is shifted from section to section of the shafting until the job is completed. This is a somewhat elaborate method, but is, nevertheless, highly effective.

The main drive should always be placed at the middle of the shaft if possible.

TABLE I.

Shaft diameter in inches.	Shaft revolutions per minute.										
	50	100	120	140	160	180	200	250	300	350	400
	Horse-power transmitted by shaft.										
1	1.0	2.0	2.25	2.75	3.0	3.35	3.75	4.9	5.8	6.75	7.60
1¼	1.95	3.75	4.45	5.25	6.0	6.75	7.50	9.25	11.25	13.0	15.0
1½	3.25	6.50	7.65	9.0	10.25	11.56	12.85	16.0	19.35	22.5	25.9
1¾	5.0	10.25	12.30	14.25	16.50	18.50	20.50	25.65	30.75	35.80	41.0
2	7.55	15.25	18.30	21.40	24.45	27.5	30.58	38.25	46.0	53.5	61.25
2¼	11.0	21.75	26.0	30.50	34.75	39.0	43.50	54.35	65.30	76.20	87.0
2½	14.85	30.0	35.75	41.75	47.75	53.75	59.65	74.58	89.55	104.80	120.0
2¾	20.0	39.75	47.75	55.60	63.60	71.50	79.50	99.50	120.0	140.0	160.0
3	25.85	51.55	62.0	72.25	82.50	93.0	102.80	130.0	155.0	181.0	205.0
3¼	32.75	65.60	78.70	92.0	104.80	119.10	130.90	165.0	196.0	230.0	263.0
3½	41.10	82.0	98.25	115.0	131.10	147.75	163.80	205.0	246.0	286.0	329.0
3¾	50.45	101.0	120.80	140,90	161.0	180.0	203.0	252.0	301.0	353.0	402.0
4	61.20	122.0	147.0	171.0	196.0	220.0	245.0	305.0	367.0	429.0	490.0
4¼	73.40	147.0	175.80	205.0	235.0	264.0	293.0	367.0	440.0	515.0	586.0
4½	87.25	174.0	210.0	245.0	280.0	312.0	349.0	435.0	522.0	610.0	696.0
4¾	102.10	205.0	246.0	286.80	328.0	370.0	410.0	512.0	615.0	716.0	820.0
5	120.0	240.0	286.70	335.0	382.0	430.0	478.0	596.0	716.0	835.0	955.0
5¼	138.20	275.60	332.0	387.0	443.0	497.0	553.0	690.0	830.0	968.0	1106
5½	160.0	318.20	382.0	445.0	510.0	572.0	635.0	795.0	954.0	1112	1272
5¾	182.05	362.70	436.0	510.0	581.0	654.0	727.0	909.0	1090	1272	1455
6	205.0	413.0	495.0	578.0	661.0	743.0	825.0	1032	1240	1445	1650
6½	261.80	525.0	630.0	,736.0	840.0	945.0	1050	1312	1575	1835	2100
7	327.90	656,0	787.0	918.0	1050	1180	1310	1640	1965	2295	2625
7½	402.0	806.0	968.0	1130	1290	1450	1615	2015	2420	2825	3225
8	490.0	980.0	1175	1370	1565	1760	1958	2445	2935	3425	3915
8½	588.0	1174	1410	1645	188	2115	2348	2935	3520	4110	4659
9	696.0	1395	1673	1950	2230	2510	2785	3485	4180	4875	5575
9½	820.0	1640	1967	2295	2620	2950	3278	4097	4918	5735	6555
10	956.0	1910	2295	2675	3060	3441	3825	4780	5735	6690	7645

TABLE SHOWING SHAFT DIAMETER AND HORSE POWER TRANSMITTED BY THESE SHAFTS UNDER CERTAIN CONDITIONS.

and on the same level as the shafting. If the drive is at one end of a shaft from which, say, twenty machines are driven, it is obvious that that shafting must be of sufficient diameter to convey the necessary horsepower to twenty machines, whereas if the drive is at the middle the shaft need only be large enough to transmit the horsepower required for ten machines on either side.

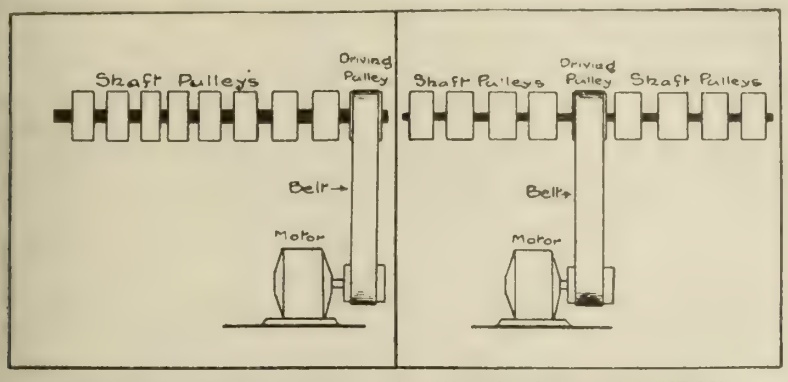
The question of the diameter of a line shafting is one of the most important in the whole transmission system. It should only be large enough to transmit exactly what is required of it. It is safe to run a shaft slightly larger, but the margin should be extremely small from the efficiency point of view. In this connection it is always well to remember that a small diameter shafting can be made up for by running it at a higher speed. Although the speed, or revolutions per minute, varies widely with the type of machine to be driven, it is usual to run a line shafting at anything up to 400 revolutions per minute.

It is obvious that a large diameter shaft, while being capable of transmitting more power than the smaller shaft, requires more power to turn it, and this is a very common source of power loss in many works. In fact, in some works visited by the author, the shafting would with ease operate twice the number of machines required of it.

Table 1, on the opposite page, gives an idea of the horsepower transmitted by good steel shafting.

There are other considerations to be taken into account when the diameter of the shafting is being settled. One of the chief of these is the distance between bearing centres. The line shaft which receives the main drive must be supported by suitable bearings on either side, and the whole section must be absolutely rigid. The location of the other bearings will very often depend on the type of workshop construction, but it is obvious that the further apart the bearings are, the greater will the diameter of the shafting need to be.

There are many considerations to be taken into account when placing the bearings, such as the size of the shaft, the number of pulleys and the speed of the shaft. Naturally, in the latter case, if the speed is high the bearings will need to be closer together than when the shaft is turning comparatively slowly. Of course, from the point of view of economy, every available inch of shafting should be utilized.



LAYOUT SHOWING PULLEY, BELT, AND MOTOR ARRANGEMENTS.

It is possible to effect economies in many ways in line shafting. For instance, supposing eight machines are driven by a motor placed at one end of coupling on the market, each with its own specific qualities. It is not intended to describe these at any length, but to give a few remarks on the use of these types as a whole.

The first point to remember is to see that there are no projecting parts in a coupling, such as bolt heads, nuts, etc., as these projections are a source of considerable danger. To avoid this the coupling can be shrouded or protected in some way. To avoid undue strain on the shaft, a coupling should always be placed as near a bearing as possible and away from the source of power. Further, when coupling two shafts of different diameters, it is economical to turn the larger shaft down to the size of the smaller shaft, and secure a coupling to fit the latter.

An enormous loss of power in the transmission system is the bearing friction. There are, however, many types of bearing procurable, and with a little careful selection this loss of power may be reduced to a minimum.

The ordinary interchangeable swivel bearing is usually made of cast iron and lubricated with oil or grease; the latter is usually yarn grease or calypsol. These bearings are, if required, fitted with glass oil gauges. Another type of swivel bearing is fitted with hardened steel ball bearings. This type of bearing is extremely serviceable where light loads are carried, and require very little attention beyond the lubrication, which is usually vaseline. The load is always carried on three balls, and the bearing is not liable to be ruined by sudden distortion or lowering of one end of the shaft.

When the motive power is supplied by a motor, one of the best bearings for this purpose is fitted with hardened steel rollers. It is said of this bearing that the starting resistance offered to the motor is very little more than the running resistance. This is obviously a great advantage, for instead of the motor having to be of sufficient capacity to overcome the starting resistance, it need only be powerful enough to drive the installation.

Having decided on the type of shafting, coupling and bearing to be employed, the next point is the means of suspending the shafting, namely, by brackets for walls, hangers for ceilings, and pedestals for floors.

Hangers are made closed or open sided. They provide for automatic aligning of the bearing with the shafting, and also permit of the bearing being adjusted horizontally or vertically.

Swivel pedestals are made both adjustable and non-adjustable. That means that in the former case the bearing can be adjusted either vertically and horizontally to the extent of ½ in. or so. The non-adjustable type does not permit of vertical or horizontal motion, but is provided with a swivelling movement, which ensures automatic alignment with the shafting.

For heavy work or first motion shafts, girdle type, rigid pedestals are usually employed. These pedestals are made with an angular or horizontal joint and lined with gunmetal, phosphor bronze and babbitt metal.

Pedestals and bearings can, of course, be obtained in one unit, either swivelling or non-swivelling. In erection of the latter type great care must be taken to see that the shaft is true.

It will thus be evident that there is a very wide range of choice of shafting and its fittings, and also an opportunity for the works engineer to get exactly what he wants. There is no reason why, if efficient transmission factors are obtained and regularly inspected, any works should suffer from loss of time due to a breakdown which might otherwise have been avoided.

A soldering iron, with an electric arc inside of it for the heating element is being used for some kinds of repair work in Europe. The rear surface of the copper head forms one arc electrode, the other being a carbon rod adjusted by hand. Except for a small gas opening, the arc is entirely inclosed and insulated with porcelain. It takes three minutes from the time the arc is struck to heat the copper to the right temperaure for soldering. With a small resistance in circuit for steadying the arc, the implement uses 625 watts at 125 volts. The arc itself operates at 40 volts, the remainder being consumed in the resistance.

Standard Spindle Noses for Milling Machines*

THE activities of the British Engineering Standards Association with regard to the standardization of milling cutters and small tools will be of great benefit both to users and makers, and it is anticipated that the new standards when finally decided upon will be widely adopted.

It has not hitherto been found possible to adopt the standardization of spindle noses of milling machines, mainly on account of the fact that there are so many machines of American manufacture in use in this country, and it is hardly to be hoped that the British Engineering Standards Association will be succesful in persuading American and British manufacturers to agree to one standard for both countries.

It appears, therefore, that the only course which is practicable in this country is the adoption of a standard spindle nose for British milling machines.

The design of spindle noses has changed considerably in recent years as a result of the heavier duty which has latterly been performed by milling machines, which has shown up the weaknesses of spindle noses as formerly, and even now, largely made.

It is generally agreed that some form of clutch drive is necessary on a spindle nose for heavy milling, and experience has proved that the clutch should be of the closed and box type with a view of avoiding distortion in use.

It has also been found necessary for heavy work to harden the clutch with the same object, viz., to prevent distortion.

Screwed spindle noses have been found to be faulty for heavy work, as even when made with multiple threads it frequently becomes impossible to remove cutters which are screwed upon them, and the tendency has therefore been on new designs to adopt either parallel or taper fits, holding the cutter back by a draw bolt through the spindle, the torsion being taken by the clutch drive.

The taper nose has advantages over the parallel nose in that the cutters are more easily applied and removed and more easily kept true. As makers of heavy milling machines these considerations were borne in upon us as a result of troubles which occurred with the earlier types of noses, and we believe it might be of benefit to the engineering trade generally to publish particulars of the noses which we have finally adopted, and which have been proved by considerable use during the last nine years to be satisfactory and to be free from any practical objection.

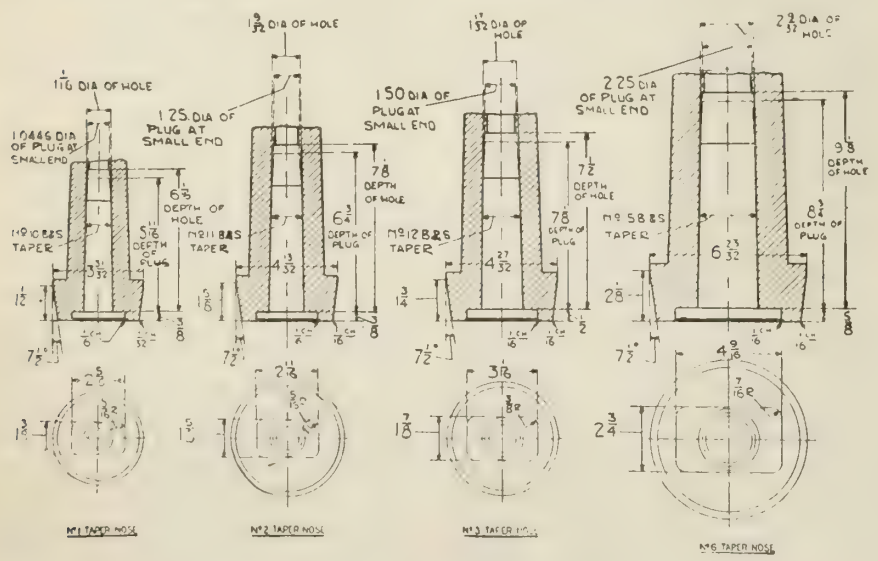
The illustration shows the four standard noses which we have adopted, the external taper being made to a uniform angle of 7½ deg. with the axis, or in other words, an included angle of 15 deg.

Brown and Sharpe tapers have been adopted for the arbors, as these are in almost universal use; the clutch drives are milled out from the solid as indicated. The ends of the spindle noses are hardened so that the hardening applies both to the external taper and the clutch, and both internal and external tapers are finished by grinding.

There are no keys or other parts in this spindle nose which can come loose, and the design enables face cutters to be used very close up to the bearing of the spindle.

We suggest that the particulars which are now offered for publication for the first time may be of assistance to other designers of milling machines and may lead to the adoption of a satisfactory British standard for spindle noses.

*From "Machine Tool Review."



SECTIONAL VIEW OF VARIOUS SIZE SPINDLE NOSES.

GRINDING WHEELS

When grinding wheels are received in good condition, carefully handled and properly installed and operated, they are reasonably safe. To make sure that wheels are reasonably safe, see:

That they are sound and free from cracks or flaws.

That they are not operated at a higher speed than recommended by the manufacturer.

That they do not fit too tight or too loose on the spindle.

That the flanges clamp the wheel at the outer edge of the flange. (The flanges should be "relieved" in the centre, leaving a bearing surface about three-fourths of an inch wide around the outer edge).

That the inside flange is secured to the spindle.

That a washer of blotting or other soft paper is installed between the flanges and the wheel.

That the diameters of the flanges are the same and between one-third and one-half the diameter of the wheel.

That the wheel runs true and in balance.

That the spindle-bearings are neither loose nor so tight as to cause heating.

That oil does not work out on the wheel.

That the nut tightens in the direction in which the wheel revolves.

That the wheel is protected with a guard which would retain it should it burst.

That the arbor-ends and nuts are guarded.

That the belt is guarded at the pulley-contact.

That the tool-rest is securely adjusted close to the wheel surface.

When first starting a grinding wheel stand to one side for about half a minute as this is the time when wheels are most likely to burst.

Wear goggles when grinding.—"National Safety Bulletin."

Many of the Aleutian Islands, which stretch westward from Alaska Peninsula towards Asia, bear deposits of sulphur of the type called solfataras. Sulphur claims have been located at three places on these islands and on the peninsula one of them in the crater of Makuhir Volcano, on Unalaska Island. The sulphur deposit is the only part of the crater that is permanently free from snow and ice, being kept so by subterranean heat and by the discharge of hot sulphurous vapor. In this crater 10,000 to 15,000 tons of sulphur may be available for mining. Another deposit of sulphur is on Akun Island. It covers 15 or 20 acres, and contains about 1,200 tons to the acre. Still another is on Stepovak Bay, on the south shore of Alaska Peninsula.

A *Personal* Chat With Our Drawing Course Students

A FEW days ago we received a letter from one of our students, who was a recent prize winner. He stated that at the time of writing his prize had not yet come to hand. We were greatly surprised to receive this letter as our instructions are that prizes be sent immediately winners are announced. We forwarded another scale immediately, which no doubt has been received by now.

Should there be other students who likewise did not receive their prizes, we would appreciate their writing us at once.

We would like to put a direct question to our students—"Why are we not receiving more plates to decide upon?" We know that over 500 students are following this series, therefore it is only natural that we look for a steady stream of drawings.

Lately the number of plates received has dwindled. **What is the reason? Are our plates too difficult or intricate? Are the instructions not sufficiently clear? Are we traveling too fast, or is our series ceasing to interest?**

We would like readers to realize that this course is being run for their benefit and that additional information and help will be furnished at any time upon request.

We have watched with interest the progress of some of our students and it has been very encouraging. A steady improvement has been noted from the beginning and we are pleased to say it is continuing.

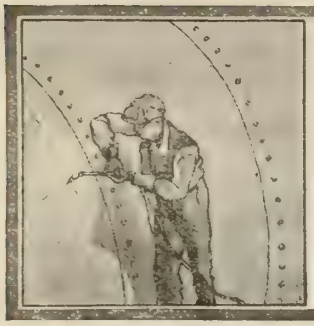
Having stated *our* views on this matter, we expect to hear *readers'* opinions, so request that every student following the course (even if he has never sent in any of his work) write us fully as to his opinion of it. Let us know your candid opinion, be it favorable or otherwise.

Above all, write us without delay. If this course is not interesting our readers we want to know, so that we may, if necessary, discontinue it. Should you wish it continued and to perform your work on it quietly at home, say so frankly.

We look for a steady inflow of letters on this subject and in order to make it interesting we will offer three prizes to the best letters received.

By best letters we mean the letters which discuss the course in such a way as to furnish us with satisfactory replies to the above questions. Let us hear from you—Now.





WELDING AND CUTTING



Electric-Arc Welding Equipment*

By H. L. UNLAND†

PRACTICALLY all arc welding is accomplished by either the metallic or the carbon electrode method. In the metallic-electrode method the electrode consists of a wire or rod held in a suitable holder. The heat of the arc, in addition to melting a small pool on the work, melts the electrode and the current causes the molten metal to be driven in finely-divided particles against the work. By this method metal can be deposited on vertical surfaces, and it is the only way in which metal can be successfully deposited overhead. The metal deposited by this method is more uniform and a weld so made is stronger and has a smoother and more regular appearance than one made by the carbon electrode. For these reasons the metallic electrode is used when strength or appearance is important.

The carbon-electrode method is used for building-up metal, plugging holes in castings, welding, or for joining parts where strength and appearance are not essential, or where the surface is to be machined off. Since heavy currents can be used, metal can be deposited rapidly. In the carbon-electrode method a carbon rod is used instead of the metal electrode. The arc fuses the metal of the work and additional metal is supplied by melting a rod of filling material in a manner similar to soldering with an iron or welding with a gas torch.

Welds that are soft enough to be machined can be made by either method if reasonable care is taken. The deposited metal should not be chilled, and if the carbon electrode is used the arc should be kept long enough to prevent carbon being carried into the weld. Besides the above causes, the principal reasons for hard welds are poor quality of electrode metal or filling metal.

The deposited metal is obviously cast steel, since it is merely fused in place and is not ordinarily subjected to any mechanical working afterward. The metal will have the coarse-crystal structure found in unannealed cast steel and likewise will have comparatively low values for reduction in area and elongation. In some cases the tensile strength of the metal in the weld may be as high as 55,000 to 60,000 lb. A safe figure is 35,000 lb., provided the work is done by experienced welders.

The following table shows the approximate kilowatt-input required for various systems:

	Kw. or Kva.
Alternating-current 100-volt supply	15
75-volt constant potential	15
60-volt constant potential	12
Alternating-current 110-volt supply	7
40-volt constant potential	8
Constant-energy equipment with supply motor-generator set	7.65
Constant-energy equipment operating from 125-volt line	5.35

If a considerable number of operators be employed, the outfit requiring low input is much to be desired, as the cost of operation is reduced.

There are several principal types of welding equipment, among which are:

1. Constant-energy self-excited generator.
2. Constant-energy balancer sets.
3. Constant-potential generator with auxiliary equipment.
4. Alternating-current welder.

All except the constant-potential type are primarily single-operator individual outfits suitable for bare metallic-electrode welding only. The constant-potential type may be used as single-operator equipment for either carbon or metallic-electrode welding or a number of operators may work from one machine. This type of machine also permits the use of the carbon electrode for cutting.

The equipment for each type of apparatus is as follows:

The constant-energy self-excited generator is arranged for belt drive, or to be directly connected to a direct-current motor or to a 60-cycle 3-phase alternating-current motor. This type may also be direct-connected to 25 or 50-cycle alternating current motors or to alternating current motors of any of these frequencies wound for two-phase circuits, the maximum voltage being 550 It can also be direct-connected to gasoline engines or to other engines with speeds of either 1,200 or 1,500 revolutions per minute.

The constant energy balancer sets are suitable only when 110 to 125-volt direct current is available. If the circuit has the positive side grounded it is entirely satisfactory, if not, special precautions must be taken.

The constant potential generators can be direct connected to direct-current motors or to a 60-cycle, 3-phase alternating current motor. The equipment is also suitable for connection to gas, oil or steam engines.

Alternating current welders may be used on 60-cycle circuits of 220, 440, or 550 volts. The welder is single-phase, but where several are in use on a polyphase system they may be distributed among the phases to balance the load in part.

The constant energy arc-welding generators of the self-excited type are designed to obtain in one machine all the characteristics demanded by arc-welding service. This is obtained without the use of external ballast-resistance or separate excitation from any external source. Since the machine provides its own excitation, the voltage characteristics are such that throughout the proper working range of the arc the energy delivered is practically constant. The voltage and current follow the momentary variation in the arc condition practically instantaneously, and consequently the lag between change in arc conditions and resulting corrective change in electrical conditions is reduced to a minimum. This lag is one cause of trouble in welding with self-regulating welding equipments whether the automatic feature is embodied in the revolving apparatus or is mounted on the control panel.

How Generator is Wound

The generator is so wound as to give a no load or striking voltage of 60, which, when the arc is struck, automatically decreases to the voltage required by the arc. This is from 18 to 20 volts for the average operator and average good work. A longer arc is undesirable. Skilled operators on smooth work are sometimes able to hold a short arc with a voltage as low as 16, but in rating the generator 20 volts is used. By adjustment of the dial-switch on the panel the current may be adjusted from a maximum of 200 to a minimum of 75 in 25-ampere steps.

The constant energy arc welding sets of the balancer type is a novel type of arc welding equipment which combines the best electrical characteristics for the arc with high efficiency and light weight. It operates from a 125-volt direct current supply-circuit, but will also operate on voltages as low as 110. A supply voltage of 125 was selected because that was found to give the best results, not only from the standpoint of efficiency, size and weight for the set, but from the standpoint of the distributing system. These characteristics have been demonstrated both from a series of practical

*From "Metal Trades."

†Power and Mining Engineer, General Electric Co.

tests under commercial operating conditions and from oscillograph curves.

The balancer set is of standard two-bearing construction, built for operation on 110 to 125-volt direct current supply circuits. The two armatures are mounted on one shaft and connected in series across the 125-volt supply circuit. One terminal of the welding circuit is taken from the connection between the two armatures and the other from the positive line. By this means each of the machines supplies part of the welding current and, consequently the size and weight of the machines is minimized. The design of the fields and their connections is such that the set delivers the voltage required directly to the arc without the use of resistors or other energy-consuming devices.

The current control gives six steps of the approximate values 50, 70, 90, 110, 130 and 150 amperes. If intermediate current values are required they can be obtained by means of the generator field-rheostat.

Arc welding is usually done on metal that is grounded, and this is unavoidable in ship work where the ship structure is always well grounded. Since successful operation requires that the positive terminal be connected to the work the supply circuit should be arranged so that it can be grounded on the positive side with entire safety.

In the constant potential arc welding generators any direct current can be used for welding, but the voltage must be reduced to values from 20 to 50 volts. One method of obtaining this condition is by using a constant potential supply circuit and inserting resistance in series with the arc to absorb the excess voltage. This is an inefficient method of operation with the ordinary supply circuits as the voltage absorbed by the rheostats is a large part of the total energy. If the supply circuit is 550 volts and the metallic arc is being used at 20 volts, the energy used is only a small fraction of that taken from the line. In order to avoid these losses the General Electric Co. has developed a line of special low-voltage generators and a method of control. The generator is wound for 60 to 75 volts, which is as high as is ever required for welding.

The automatic control equipment gives protection to the generator without affecting other operators, whose welding circuits may be connected to the same generator. The setting of the dial switch on the welding panel determines the amount of resistance in series with the arc, and, therefore, controls the current used. This is regulated as required by the work to be done. Before starting the arc the operator sets the dial switch for the amount of current required for the work so that on starting the circuits are in normal running position. Thus it is not necessary to have any relays or switches open or close, or to change or disturb the electrical circuit in order to weld.

Alternating current arc welding equipment has been developed. A single-phase transformer is used and is provided with taps and connections for obtaining the various values of current and proper voltage required by the bare metallic electrode arc as used in welding. The equipment operates on a 60-cycle circuit and with supply voltages of 550 or less.

It is difficult to give universally applicable figures covering amperes, speed, etc., for electric arc welding because of the effect of the conditions under which the work is done, the character of the work, and, to a large extent, the skill of the operator.

Approximate speeds of welding sheet metal with the metallic electrode are given in the following table:

Thickness of plate, in.	Speed, feet per hour	Cost per foot, cents	Comparative cost per ft. acetylene welding cents
1/16	20	2.12	1.78
1/8	16	3.12	4.66
1/4	10	7.13	13.1
3/8	6.5	12.3	36.1
1/2	4.3	19.8	Much higher
3/4	2.0	41.7	Much higher
1	1.4	61.3	Much higher

The above are based on average figures for materials and labor. They will probably vary considerably for different localities and will vary slightly with the type of equipment, but the relative costs of gas and electric welding will in general hold true.

The carbon electrode can be used frequently for welding and for building up metal where the metal is not subjected to high strains or where it is under compression only. It can be used also for rough cutting of plates and structures.

The following figures for metallic-electrode welding are based on favorable working conditions and a skilled operator. However, they are approximations only and are given merely as a general guide.

	Amperes
Light work	25 to 125
Heavy work	up to 225

Electrode-diameter, inches	Amperes	Corresponding plate-thickness, inches
1-16	25- 50	Up to 3-16
3-32	50- 90	Up to 1/4
1/8	80-150	1/8 to 3/8
5 32	125-200	1/4 up
3-16	175-225	3/8-up

The same size of electrode may be used with various thicknesses of plate. The heavier plate will require the use of the heavier currents.

The average current ranges for different types of work are as follows:

	Amperes
Light welding	150 to 250
Medium welding	250 to 350
Heavy welding and medium cutting	400 to 600
Very heavy welding and heavy cutting	600 to 1000

The maximum values of current permissible for carbon electrodes are as follows:

Diameter of electrode	Maximum amperes
1/4 in.	100
1/2 in.	300
3/4 in.	500
1 in.	1000

Graphite electrodes permit the use of somewhat higher current densities but the higher cost of graphite electrodes is a serious handicap to their use. Lower currents than the above may be used but higher values will cause undue burning of the electrode.

For depositing or building up metal by means of the carbon arc on flat surfaces where the work is accessible and all conditions favorable, the following figures apply:

Current, amperes	Pounds per hour	Cubic inches per hour
200	1 1/2	5.4
300	3	10.8
400	4 1/2	16.2
500	6	21.6

For continuous work the above figures apply, but, for short jobs of ten minutes or less the rate will be double the above.

Welding wrought iron and steel in simple sections by the electric-arc welding process presents no serious difficulties. Reasonable care on the part of the operator in keeping the weld clean and in the preparation of the weld will, with ordinary skill in welding, produce a successful weld. The subject of welding may be divided into three parts, namely, equipment and materials, preparation of weld and welding.

Other Equipment

In addition to the regular equipment and auxiliary apparatus, special jobs make it desirable to have on hand other miscellaneous pieces of equipment. Odd pieces of carbon-block or of copper may be used as dams in holding the molten metal in place. If the weld must be smooth on one side a piece of copper or carbon may be held against the weld and metal filled against it. Iron or steel can be used if care is taken not to weld to it. When a hole is being filled the bottom may be closed by holding a plate of carbon or copper against it until sufficient metal is filled-in to hold. Care should be taken to flow the molten metal against the guide-pieces and not to allow the arc to play directly on them, otherwise the weld will probably be contaminated by this material, or else the guide-piece may be welded solid and cannot be easily removed.

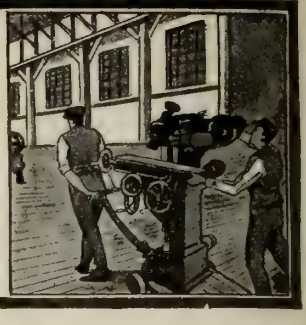
A steel wire scratch-brush is useful for removing light scale and rust if necessary, before commencing to weld, and also at intervals during the welding, usually when changing electrodes.

(To be continued)

A recent application of the oxy-hydrogen flame is to the spraying of metals on to cold surfaces. In what is known as the Schoop process the metal, in the form of wire, is fed into the interior of the flame, where it is melted and then blown by compressed air, in a state of very fine division, on to the surface to be coated. The arrangement is such that when the size of the flame is increased or decreased, the feed of wire is changed simultaneously, so that the rate of deposit per unit area is constant. The finely-divided metal fills all the interstices of the surface upon which it impinges, and becomes firmly attached, and by continuing the process any desired thickness may be deposited. By this method surfaces may be coated with metals of high melting points such as nickel, and the working costs are low.



DEVELOPMENTS IN SHOP EQUIPMENT



TWO-SPINDLE SPLINE MILLING MACHINE

THE two-spindle spline milling machine herewith described and illustrated, has been recently placed on the market by The Taylor & Fenn Co., Hartford, Conn.

This machine is automatic in operation and is designed to simultaneously machine two spline grooves up to six inches in length on opposite sides of the same piece, single splines of the same or different diameters simultaneously on two pieces, or through slots such as drift pin slots or cutter slots in boring bars and similar work. Rapidity of action, ease of manipulation, facility of adjustment and large capacity permit this machine to handle a wide range of machine parts. Once set to cut a certain depth and length of slot it will continue to do so until readjusted.

Two cutters operating simultaneously reduce the machining time by half on work where two spline grooves are cut simultaneously in the same piece or in two separate pieces.

Work of any diameter up to 5 inches and of any length may be splined. A V-shaped vise affords a positive clamp for the work beyond the cutter traverse at one end, while the other end of short work, if centred, is supported on a male centre, and if uncentred, is supported in a female cone. Long work is free to project beyond the confines of the machine both front and back.

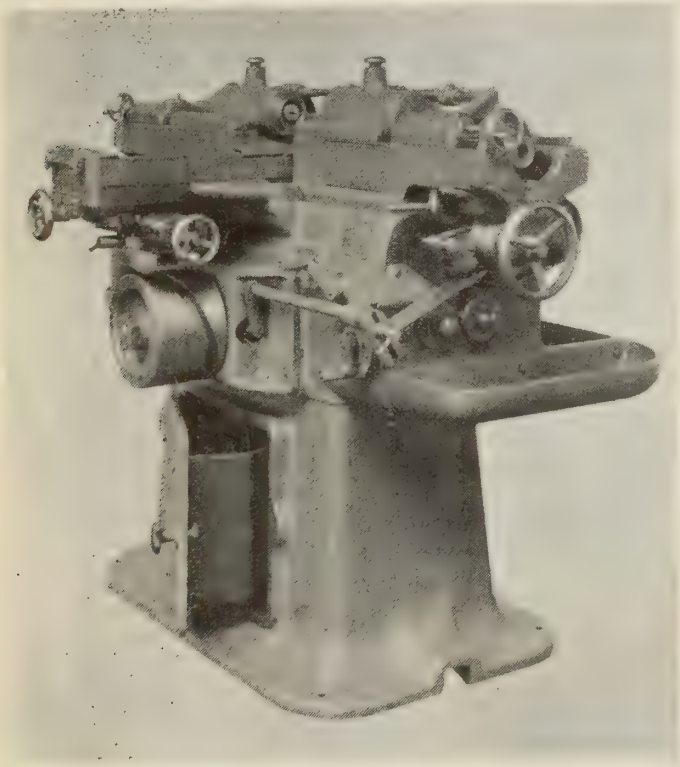
The maximum table travel is 6 inches, therefore the maximum length of spline which may be cut at a single setting is six inches plus the diameter of the cutter. There are six changes of spindle speeds ranging from 302 to 1,885 r.p.m., and ten changes of table feed, so that ample range is provided for handling splining operations in various metals.

Efficiency in this type of machine is dependent on the efficient operation and co-ordination of three functions. The cutters must rotate at correct speeds; the traverses of the table between extremes must be accurate and at correct speeds and the feeding of the cutters to depth must be properly timed and in uniform increments. All these essentials have been incorporated with the result that splines of exact duplicate lengths and uniform high finish and accuracy are produced in a minimum period of time, the duration of which of course depends on the length, width, and depth of the spline and the cutting resistance of the metal being worked.

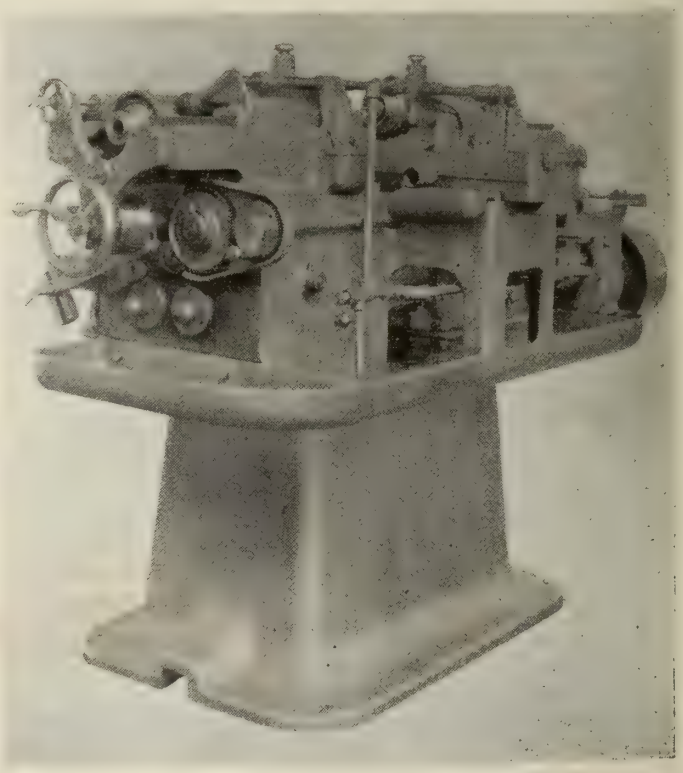
No countershaft is necessary as to the drive is direct from a pulley on the line shaft to a tight and loose pulley to the left at the rear of the machine. The shifter rod extends through to the front of the machine where all other controls are located.

A speed box, within the column and to the left affords six gradations of spindle speeds. The controls for the speeds are within easy reach of the operator when in operating position in front of the machine. Provision has been made so that the machine must be stopped while speeds are being changed, thus providing positive protection against damaged gearing. The speed gears are of alloy steel hardened and run in an oil bath.

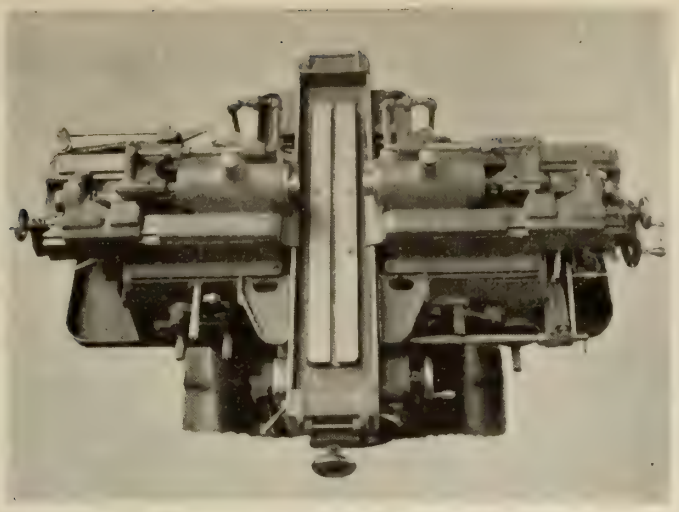
Ten gradations of feeds are available for the table. These are obtained from a speed box containing a cone of five gears and a two-speed clutch, controlled from the front of the machine. Each one of the ten gradations of table feeds



A PARTIAL FRONT VIEW OF THE MILLER.



THE MACHINE LOOKING FROM THE REAR.



A PLAN VIEW, ILLUSTRATING THE GENERAL DESIGN AND PROPORTIONS.

is available with each one of the six spindle speed gradations.

The work table obtains its motion through a lever from a cam mounted at the front under the work slide of the machine. This cam is driven by shafts and gears from the feed box. A simple, easily adjusted mechanism is provided whereby the table movement may be varied from zero to the maximum of six inches.

The feeds to the spindle housings are transmitted through crank and link mechanism from a cam mounted behind the table reciprocating cam just mentioned.

Following is a description of the manner in which the cutters are fed into the work:

At each end of the machine there is a small handwheel geared to a feed nut that turning this wheel moves the screw back into the nut. During this process that nut remains in fixed position lengthwise, but rotates, while the screw is pressed by a compression spring back into contact with the nut. Turning of the handwheel is continued until a pointer, moving over a graduated scale, assumes a position corresponding to the depth to which it is desired to sink the cutter into the work, this sets the depth of cut.

When the machine is started the feed mechanism causes the two feed nuts to rotate but as they are held against lengthwise movement the screws push the two opposed cutter heads inwardly against the pressure of the compression springs. Feeding of the cutter heads continues until the predetermined depth is reached at which point the screws run out of the nuts and feeding stops. In cases where the slot is milled through, as for instance the drift slot in drilling machine spindles, it becomes necessary to avoid leaving a small fin in the center of the work. This is accomplished by withdrawing one cutter just before it reaches the centre of the work and causing the other cutter to continue its feed movement beyond the center. After the centre of the work has been passed by this cutter the head which carries it recedes. This synchronized movement of the cutter heads is, of course, performed automatically by power.

In spline milling operations it is of the greatest importance to provide for efficient cooling of the cutters and work. With this in mind the cut lubrication system of machine has been developed along lines which afford exceptionally efficient results. A reservoir is secured to the door of the column within the body of the machine. When the door is opened this reservoir swings out with it and the supply of cut lubricant can be readily replenished or the reservoir cleaned. The coolant pump is driven at constant speed from the main drive pulley, thus making cutter spindles themselves. Passing through these and through grooves in the shanks of the cutters it is projected under considerable pressure direct on to the lips of the cutters, cooling them and at the same time ejecting any chips immediately they are formed.

Summed up the features of machine are as follows:

The machine is driven by a single belt direct from the line shaft. Although of compact design the machine will handle larger and longer work than previous models.

All controls; starting, stopping, feed, speed, adjustment of stroke, depth of cut, adjustment of table, placing of work, changing of cutters, etc., are operable from the front of the machine.

Provision is made so that the table, attached fixture and work as a unit are easily and quickly adjusted from the front of the machine is exact relation with the cutters after the work has been clamped to approximate position in the fixture.

In this machine but one cam of moderate size is employed. This is at the front of the machine below the work slide and does not project beyond the table travel.

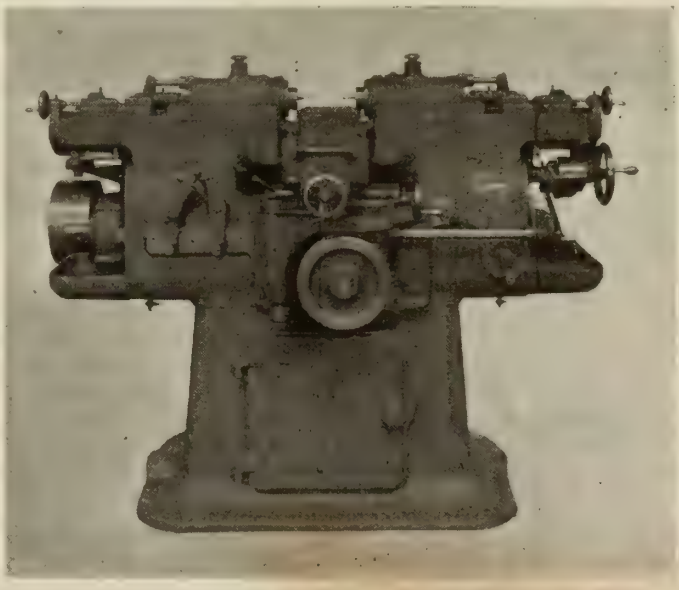
The spindles are axially in fixed position in the bearings of their housings. The overhang is, therefore, constant for shallow or deep splines and is dependent on the length of the cutter iself. The spindles being thus axially fixed in the housings they are absolutely protected from the entrance of the cut lubricant into their bearings.

The adjustment is made by two handwheels conveniently placed at the front of the machine. The cutter spindles are lubricated by an efficient splash system. The locations of the cutter lips in the splines are at all times indicated on an easily read, plain flat scale on the spindle adjustment slide to the right of the machine.

The cutters can at will be made to advance either in unison or alternately and either to knock off in unison or alternately. This feature is controlled instantly by a conveniently located shifted knob. The cutter spindles can be locked while changing cutters. This is accomplished instantly from the front of the machine.

The cutters are held rigidly and concentrically in a chuck of special design. This feature, in conjunction with the fixed relation of the spindle bearings to the cutter, assures the cutting of slots of a width equal to the diameter of the cutter.

The cut lubricant is under uniform constant pressure. It is conducted through the spindles and projected through grooves in the cutter bodies directly on the cutter lips. Thus no adjustments are necessary as the stream of cut lubricant is at all times focussed on the cut, not only lubricating but on the rebound ejecting the chips the instant they are made. The incorporation of this cut lubricating system has made possible the installation of efficient guards which retain the coolant within the confines of the machine itself.



FRONT VIEW OF THE MACHINE.

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Meeting the Exchange Rate

IT is evident that there is a growing tendency on the part of the American manufacturers to take Canadian money at par, or else to absorb part of the adverse exchange rate. The Oakley Chemical Co. of New York this week advised the Canadian trade, "All Canadian remittances made by draft on New York will be accepted, less allowance thereon of one-half of the current rate of exchange." In the same mail the Norton Co. of Worcester, Mass., wrote in part as follows: "We will be pleased to assist you by accepting Canadian funds in payment of your purchases." The exchange business is a nasty sinkhole for Canadian firms that have much to liquidate in the American market. It is absolutely a drain where no value is received, and there are many cases where it cannot be passed on to the public.

For instance, a Canadian firm making automobiles has already announced its selling prices for the year. It is caught now with from 15 to 18 per cent. on exchange for raw material it must secure from the States. It has no come-back. It must pay and lose.

American firms are making no mistake when they keep one eye on the future trade of this country. It is a serious error to get the 15 or 18 per cent. exchange so largely stuck in their eye that they cannot see past it to the greater things in the future.

* * *

NOW there is another phase to this exchange situation, and it cannot be overlooked if we ever expect to come even with the boards. The reason our money is discounted in United States is because we have bought much more from them than we have sold to them. The rebating or absorbing of the adverse exchange rate may alleviate the financial pains of some concerns for the moment, but what will it do? It will stimulate buying in the American market on the part of Canadian firms, and in this way aggravate an already serious situation, and create a problem that sooner or later must be liquidated by this country.

In a number of letters that CANADIAN MACHINERY has seen from American firms, written to the Canadian trade, it is stated that these firms have faith in the future of Canada. This country appreciates the compliment, and should seriously consider on what this faith is founded.

We speak glibly of OUR vast resources, of OUR mineral wealth, of OUR forests and streams, and of OUR broad acres. In some queer way we seem to imagine that these things are going to rise up and pay off all our obligations, restore to us a favorable trade balance with United States, and, in short, pull us out of all the holes into which our industrial and commercial laziness and indifference have dropped us.

Face the thing now. All these resources are not going to help us out to the extent of a dollar unless we are prepared to stop our short-day nonsense and get down to work. The confidence of American manufacturers in the ability of this country to discharge its obligations is based on the belief that we will produce sufficiently to place in the markets of the world as much as we take out.

Canadians should not be short-sighted in this matter. Remember—the action of American firms in taking Canadian money at par is only a stop-gap. The final solution rests with the Canadian people themselves—not with United States or any other country.

Our one sure way out rests in greater production and more hours, rather than in fewer hours and decreased output.

A Candid Admission

THERE is considerable significance in this despatch, coming from London, England:

> The General Federation of Trades Unions announces that during the last quarter 145,700 pounds was paid out by the organization in connection with the cotton employees and iron moulders' strikes.
>
> "The saddest thing," says the Federation in connection with the announcement, "is the failure of this expenditure to obtain anything beyond what might have been secured through negotiations."

If one were to apply the same reasoning to the steel strike recently staged in United States, similar results would be forthcoming. Right in our district we have similar examples.

Strike pay, at best, is a miserable joke to play on any home. It would bankrupt any union were it to attempt to stage a prolonged strike and pay to its members anything in keeping with the demands that are made on the family purse.

At this time of year the strike talk begins, becoming rampant about the first of May. If there are matters that need adjustment, try negotiation first. When the results of that are available, give it a big and a serious think before voting strike for the sake of a few cents an hour, or a few hours a week.

If there is a big, vital question up, where your rights are at stake, and where the only way open is to strike—then strike, and strike hard. But remember that in these days of high wages and short hours these cases are few and far between.

Do not make the serious mistake of allowing the professional agitator to think and decide for you. Remember, the men who make money out of strikes are not safe counsellors.

The peculiar financial conditions of the moment make strike talk dangerous this year. A slackening on this account, on top of all the other obstacles, such as shortage of material, exchange rates, etc., may be the final monkey wrench in the big wheel.

A real example of thrift is the man who is sifting ashes as religiously at the first of March as he did the first week he lit the furnace.

It's Easy to Get Out and Sell Machine Tools

By ARK

MR. JOSEPH PRUNE wanted to go on the road as a machine tool salesman. He heard that it was good business. In fact he knew of one chap who, in the war days, had written business amounting to $76,000 in one day. Joe reckoned that was a good living, more splendid than he had ever dreamed of. And so it was that friend Prune got past the switchboard girl, the private secretary and into the office of Mr. Machine Tool. Mr. Tool owned



"OUR LATHE HAS NO SWING. IT IS PERFECTLY RIGID."

up to Mr. Prune that they needed a man, whereupon Mr. Jos. Prune admitted that he was certain he could sell machinery, as he had had his hands all over a machine when the war was on. He was head soda water man on rough turning operations and had never been fired. The war ended too soon.

Since the war-shop blew, Mr. Prune had sold several things. He had strengthened his manner of approach. He had read a book on "Closing Big Business," and as he strode into Mr. Tool's office he looked him in the dead centre of the eye and grasped his hand with a regular "Helloo, Steve" atmosphere.

Mr. Tool was very busy and he was short-handed, so it was that Mr. Prune sidled past, got his little tan bag, a short list of prospects, some literature and order forms and sidled out.

His list of prospects showed that John Screw Co. needed a lathe. Lathes were strong points for Mr. Prune. He had seen them in shell shops. He knew what they did. And so it was that Mr. Prune steered himself out to the premises of Mr. Screw. Now, Prune didn't take time to think what the John Screw Co. made. He didn't know that they specialized in toolroom stuff. He didn't know they were noted for being high class all through. And so it was that Mr. Prune simply butted in. He mentioned lathes. Mr. Screw pressed a button. A lad appeared, and left with instructions to ask Mr. E. X. Pert, the superintendent, to come in. Mr. Prune was asked to be seated. He let loose on Mr. Screw the first chapter of his book on "Closing Big Business." He was seeking to plant in Mr. Screw's head THE BIG IDEA. Mr. Screw seemed more interested when Mr. Prune spoke of the prevalance of the flu and how the steady winter weather was kicking the shins of the coal bin. At this point Mr. E. X. Pert came in. He seemed to be in a hurry, but Mr. Screw explained that Mr. Prune had a lathe proposition that might interest him. Prune took a look at Mr. E. X. Pert and suddenly remembered that he had charge of the shell shop where he (Prune) had been soda water squirter. He thought then that E. X. Pert had a soft job, so just to get on good footing with him he mentioned that he had been associated with him in winning the war. Mr. E. X. Pert did not seem much impressed, but asked Mr. Prune to go ahead and show what he had in a lathe.

"Our lathe," began Mr. Prune, "is a good lathe. It will do what we claim it will do. (Clears throat). It has given satisfaction in other shops and there is no reason why it should not give satisfaction here. It is made of good material and will stand up under hard usage."

Prune was not satisfied that he was going right. First chapter on "Closing Big Business" had mentioned impressing the prospect. But neither Mr. Screw nor Mr. E. X. Pert seemed impressed yet. Screw was already thumbing a pile of papers and the superintendent had glanced at his watch and measured the distance between Prune and the door. Prune cleared his tubes again as though to spray his victim with speech, but E. X. Pert beat him to it.

"Now, that's all right," he said, and there were brass tacks in his voice, "all this stuff is waste time. We want to know why your lathe is suitable for our work."

But Prune was ready. Chapter two in "Big Business" was on "Never Be Flabbergasted." So Prune smiled blandly at Mr. E. X. Pert, the sort of smile that was supposed to make technical detail smell like trifles. "Why, of course, Mr. E. X. Pert, we want to give you every bit of information we can."

"What swing has your machine?" started Mr. Screw's sup.

"None, whatever," replied Mr. Prune, with a deliberation that was tremendous, "bolted to the floor—perfectly rigid." Mr. Screw snickered, but by this time his back was conveniently turned, so Prune mistook the snort for a sigh of relief to think that such splendid advisory service was at his disposal.

"Very good," agreed E. X. Pert. "We are fond of rigid machines. Now about the bed, its width and length, and is it cone-driven or with geared head stock?"

"It has a good bed, good length and wide enough for the length. (Cough). The head stock is also good material. We never had any complaints about the cones either."

"Very good," assented E. X. Pert. "Now, the changes of feed and speed and in what ratio. Also, is there a universal or independent jaw chuck, pipe, or just an ordinary centre for the tail stock?"

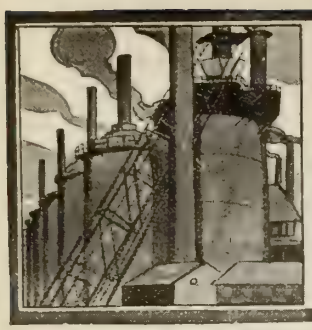
Mr. Prune got another leg wound around the leg of



E. X. PERT'S HAND WAS ON HIS NECK.

the desk and grasped the darn thing with the free fist that wasn't hugging the little yellow bag. What the sam hill did this man want to ask so many questions for. Chapter three in Big Business said: "Never Be Bluffed." So he'd show Mr. E. X. Pert just where he got off at.

Continued on page 54



MARKET DEVELOPMENTS



More U. S. Firms Accepting Payment at Par

Matter of Convenience to Canadian Firms—No Improvement in the Supply of Steel Coming to This Country—Tubes and Sheets Scarce—Supplies Increased in Price

THERE is a noticeable increase in the list of American firms that have expressed their willingness to accept payment of accounts in Canadian currency at par. Payment of exchange becomes a more serious matter for many Canadian firms who have to settle for large purchases of material across the line that they cannot secure elsewhere.

It would take a confirmed optimist to find any improvement in the steel supply situation. The remarkable thing is that nearly all the business that is sagging the books of the mills remains good, cancellation being rare. Of course, many of the mills refuse to cancel, holding to the principle that a contract is a contract. The shortage of sheets and tubes is becoming a more serious matter than was thought possible a month ago. There are large repair works held up because tubes are not forthcoming. This refers to regular, standard sizes and lengths.

Warehouses are facing a peculiar position, and so are the agencies for the steel mills. They are witnessing business in large quantities coming to their door every day of the week begging acceptance, and they know they are not in a position to entertain a bit of it. It is surely a long cry from the situation that existed barely six months ago when these same people were out trying to make the trade see the wisdom of coming into the market and covering their requirements.

Makers of many lines of machine tools announce an increase of ten per cent. this week. This refers to some firms both in Canada and United States. Price revision is likely to be general in Canada if the exchange keeps at its present figure, as many manufacturers have to pay the peak exchange rate on their raw material. Makers of taps and dies have given notice of a ten per cent. increase, and instructions have also been given to dealers not to quote carbon drills at old prices.

The scrap metal dealers find it to their advantage to ship as much material as they can into the U. S. markets to take advantage of the exchange.

SICKNESS AND SHIPPING TROUBLE ARE BOTHERING MONTREAL TRADE

Special to CANADIAN MACHINERY.

MONTREAL, February 26.—Several circumstances combine to make the present week a comparatively quiet one, both in commercial and industrial circles. Many of the larger concerns are considerably handicapped by absence of employees on account of sickness, and this has had the effect of general inactivity all along the line. The curtailment of activity, as a result of a quieting down in the business done between here and the States, is another feature that emphasizes the uncertainty that prevails in present trading. Delays in shipping and receipt of materials is another factor that adds to the difficulty of solving the present complex situation.

Steel Lines Still Scarce

The steel situation is one where it taxes every effort of the dealer to meet the constant needs of customers. In the opinion of steel men here the present unsatisfactory conditions will continue for some indefinite time, as reports from dealers that have visited the mills in the States, with a view of picking up material, are not of an optimistic character. Labor conditions are such that production is considerably below what is possible, and with the steady cry for more steel from every line of industry the scarcity of material must remain a pronounced feature of present business. It is expected that the opening of the new Canadian plate mill at Sydney will assist in relieving a condition that is daily becoming more pronounced. This new source of supply will help out any heavy demand for plates but will not aid in giving much relief to the urgent and constant demand for more sheet lines. The local condition noted last week, namely, a nominal market, is still effective, as individual sales determine the price on which each sale is made, the basic prices quoted serving only in a general way. Present warehouse stocks of tubes and sheets, both black and galvanized, are quite low, and standard sizes are very difficult to obtain.

Used Tools Again Active

A feature of recent activity in regard to machine tools has been the increased demand for used equipment. The requirements for new tools is still of considerable volume, but the difficulty of obtaining supplies from the States continues to hinder the maintenance of normal business from American manufacturers. Tentative arrangements have enabled some of the machine tool dealers to secure machinery on a basis satisfactory to their customers, but the burden of high exchange is still a deterring factor in carrying out any excessive plans for additional expansion or factory development, many contemplated moves in this direction being temporarily suspended, awaiting more favorable trade conditions. It is believed that several inquiries for equipment, of varying volume have been withdrawn, as manufacturers here are reluctant to pay the high rate now effective. While this condition has resulted in diverting some business to Canadian houses it has had the effect, also, of holding up other business, where the delivery of tools available here would not suffice for the delay in obtaining the machines that must needs come in from the States. In this way what tools could be secured here are not ordered, as little would be gained by securing some tools and not the others. This situation is one that should awaken the Canadian maker of machine tools and show them the advantages that would accrue by supplying a need that up to the present, has been taken care of by American makers.

The Need Decides the Price

There is little of interest to report in the old material situation as dealers report a quiet week in all classes of scrap. The feature of present trading is in the distribution of cast iron scrap and the market in this respect is very strong owing to the pronounced scarcity of material. The market is a selling one and the prices ruling and the difficulty of supplying the demand indicates that all available cast scrap is in a transient condition. Dealers are satisfied to let quotations stand, as there is little to be gained in quoting prices when actual sales are made more on the nature of the need than any particular price.

INCREASES COME IN SEVERAL LINES

The Securing of Steel Supplies Has Become a Complicated Piece of Business

TORONTO—Price changes are frequent this week, but in no instance have we come across a case where any dealer has announced that the price change had anything like a downward tendency attached to it. It seemed a while ago that prices had gone to the limit, but the exchange can be blamed for some of them, as it is necessary to bring in so much raw material from United States, on which the exchange must be paid. Makers are not anxious to have prices go to higher levels, in fact they would welcome an opportunity to bring them to a lower plane. As a general thing machine tools are about twice what they were before the war. Nearly all the standard lines have sent out notices that prices have advanced ten per cent. On top of this put from fifteen to eighteen per cent. exchange, and a peculiar situation is created.

The list grows of those firms that are willing to accept payment of Canadian accounts at Canadian banks at par. Others are splitting the discount with Canadian firms, all of them having a tendency to make business conditions a little easier. It is a serious matter for a number of manufacturers who have contracts for supplies on the other side and which they cannot secure in Canada. Many business men see in the present situation a lesson for the people of this country on the need of greater production in order that the condition may be righted. Some firms have long lists prepared of firms who are willing to forego the exchange rate, and the total makes a goodly showing now.

Some of the concerns are wondering just how they are going to handle business in future. They are taking in material now, some of it for stock, and paying for it with a peak exchange rate of around 18 per cent. They are certain that rate will go down later on, and then they will be in competition with cheaper goods. The result is that many of them are keeping their buying right down to what they must carry in order to look after their trade. In this case they are simply adding the exchange to their selling price.

Speaking to CANADIAN MACHINERY this week one Toronto dealer said: "I noticed in your paper last week that some of the firms here had quoted a definite price, and allowed too little for exchange, and that they were losing money now on deliveries. We have not lost in this way. I don't think a consumer should expect a firm to bear the loss that is incurred by reason of exchange—something they cannot control—coming in and changing the selling price. We have met that situation like this: We simply explain to our customers that we allowed a certain rate for exchange, and that if at time of delivery the rate is lower they get the benefit, and if it is higher, they will be expected to put up the difference. We have not met any objection to this way of doing business. There is no reason why a dealer should be called upon to bear the brunt of the exchange rate."

There are a number of good inquiries in the market at the present time, some of them representing the expenditure of large sums of money. There are a number of small and large projects under way, and in many channels it seems that there is going to be a great deal of development this year.

Increase in Some Lines

Dealers have been notified that there has been an increase of ten per cent. in the price of taps and dies. For some time they have been selling at about 50 off the list. There is now a difference in the method of selling, as the number of different classes for discounts has been increased. The sizes mostly called for are 1-4, 5-16 and 3-8. The increase announced will amount to ten per cent., and is dated to become effective on the 23rd. This is the first increase that has been made in the prices of taps and dies for some time—in fact it must have been a year or over since they have been altered.

It was intimated in these columns some time ago that there would be an increase in the price of Canadian carbon drills. The new lists have not been issued at this writing, but dealers have received notice not to quote carbon drills at the old prices, so they take it from that that the new lists will be mailed to them any time now.

There is a nice volume of business moving in small stuff. Large orders are not very plentiful, as several of the largest buyers bought very heavily some time ago, and so they are more or less out of the market in consequence.

A Starved Market

Even the most optimistic can hardly put a finger on anything that shows improvement in the steel market. If there is any change it is not for the better. Added to the other features that have been hindering progress there has been a shortage of cars and a shortage of coal to keep the trains in operation. This refers not only to shipments going some distance, but also to the shipping of material from plant to plant until it reaches the finishing mills.

Plate is the one best feature, but where there is anything like a decent delivery promised it is invariably tied up with a demand for a stiff premium.

One thing seems certain, and that is that in spite of all the delay and the manner in which delivery schedules are stretched to months in advance, most of the business booked remains good, and there are very few cancellations. Some of the mills insist on doing business on the hard and fast rule that a contract is

POINTS IN WEEK'S MARKETING NOTES

The exchange rate provides an incentive to scrap metal dealers to export as much as possible to U. S. buyers.

A number of price changes are announced. Many makes of machine tools go up ten per cent. Taps and dies are similarly advanced, while the old prices on carbon drills have been withdrawn.

A large number of American firms have sent word to Canadian customers that they are prepared to absorb the rate of exchange and accept Canadian money at par in a Canadian account.

Boiler tube shortage is a serious matter with a number of firms, and a large amount of repair and rebuilding work has been held up in consequence. Even standards are impossible to secure.

Transportation troubles are holding up a lot of steel that otherwise would be in Canadian warehouses now.

Plate production shows some signs of improvement, but the premium market is still active, and good delivery generally carries a good price.

New York begins to wonder how much longer the automobile trade can or will stay in the market as the greatest purchaser of machine tools.

One Pittsburgh mill is reported as offering $80 for sheet bars for conversion.

American rolling mills continue to turn down practically all the business offered. There is a feeling growing that it is inadvisable to keep on booking business for delivery twelve months off.

a contract, while there are others that never press an unwilling buyer.

Sheets and boiler tubes are wanted, and wanted badly. There are places where a lot of repair work is being held up on account of inability to secure tubes. One firm in particular that does a lot of heavy boiler work is out trying to secure a supply of 4-inch 18-foot tubes, but they cannot locate anything in this line.

The Scrap Metal Trade

Prices are well maintained in the scrap metal trade, and a fair amount of business is being done. Dealers are finding it very advantageous to export as much as possible to American points, the rate of exchange more than offsetting the rather low prices prevailing there at present.

No improvement is noticed in the lines where shortage prevails, especially cast iron scrap of good grade. Some small lots of this have been changing hands, and as high as $38 was paid.

NO LET UP TO THE BUYING THAT THE AUTO BUSINESS DOES IN U. S.

Special to CANADIAN MACHINERY.

NEW YORK, Feb. 26—Though there is a degree of uncertainty in business circles, due largely to the money situation, which has been reflected in some degree in machine-tool inquiry and buying, machine-tool business, as a whole, continues to be very satisfactory. Probably some buying has been held up, and sellers report a falling off in inquiries, this has not excited much apprehension yet, because the machine-tool manufacturing plants have all the orders they can handle for the next three to nine months. Some companies are sold up practically for a year.

An adverse factor is the railroad transportation situation. New England is in worse shape than most sections of the country, and some cities in that section have been under absolute embargo for weeks. Nothing but warmer weather can alleviate the tie-up of freight.

There has been some fairly large buying in the East in the past week or 10 days. The Westinghouse Electric Mfg. Co., South Philadelphia, has bought some tools to equip additions to its plant; the New Britain Machine Co., New Britain, Conn., has bought 50 machines; the Willys Corporation, Elizabeth, N.J., has added about $150,000 worth of orders to its recent purchases, its total purchases in the past two months having run well over $1,000,000, possibly as much as $2,000,000. Many other concerns have been active, and there have been several sales of tools totalling from $10,000 to $25,000.

Railroads are inquiring, but have done very little buying. It is expected that some business from this quarter will develop after the return of the roads to private ownership on March 1. Among those which have made known their needs of equipment are the Pennsylvania, Baltimore & Ohio, the Nickel Plate, Missouri, Kansas & Texas and the Boston & Maine.

A matter of concern to the machine-tool trade is, how much longer can the unprecedented buying of the automotive industries continue? There appears to be no let-up at present, and much of the business of the past few months has emanated from companies which either manufacture automobiles or parts and accessories. In the Philadelphia district there will shortly be two new plants, one to be built by the Fox Motor Co., Philadelphia, which will manufacture an air-cooled motor, and the other by Dupont Motors, Inc., now at Wilmington, Del., which will build a plant at Moore, a suburb of Philadelphia.

A WEAK EFFORT BEING MADE TO STABILIZE THE PLATE MARKET

Special to CANADIAN MACHINERY.

PITTSBURGH, Feb. 26—There is nothing like unanimity in appraisals of the car supply situation made by different shipping interests, and after a little investigation the close observer is disposed to conclude that the personal element enters, appraisals being subject to a personal equation. There is no definite evidence that the situation as to there being a free movement of finished products from steel mills, bringing the necessary relief, yet there is no assurance that the situation has grown any worse. It is believed that there is more steel at mills awaiting shipment than there was a week ago, or even two weeks ago, but at any rate the accumulation has not been more rapid this week than formerly, and the mills can still store away some of the finished product before reaching the limit of their storage facilities. In some cases there are reports that there is no more accumulation than existed six weeks ago. An illustration is given in one large producer of finished steed having had an operation better than 90 per cent. since the first of the year, and having no more material on hand now than on January 1.

Instead of a letting up in the demand for plates it has increased in the past two weeks, if prices that can be obtained are any criterion. One fairly large producer who has always been a conservative seller was quoting as high prices as seemed possibly obtainable, 3.50c and higher on fair-sized lots, but soon became so well sold up that it was decided to sell no more at any price, and he is now out of the market for an indefinite period. One particular cause of high prices for plates that seemed important two or three months ago, restricted production, can no longer be regarded as an important factor, as the plate mills, generally speaking, are doing quite well in point of tonnage. One or two independent interests, strongly disposed to stabilize the plate market, are quoting plates to regular customers in a limited way of 3c, but this figure is to be regarded simply as a settling price for regular customers, as such mills do not sell in the open market at all. The general plate market is quoted at 3.50c to 4c.

In line with other products, the sheet trade reports transportation conditions as execrable, which has resulted in an increased shortage of sheet bars as well as of loading facilities for the finished product. Sheet consumers are working very hard to secure larger deliveries, which are very large as it is, but it seems as if the consumers want to operate at greater rate than at any time in the history of the trade. The American Sheet and Tin Plate Company was very short of steel this week, and operated their mills at an average of only about 70 per cent. of capacity. Part of the week they were operating at only 60 per cent. There is no general market, as far as prices are concerned, but an upward tendency is seen in various descriptions of material and the various deliveries. There was a rumor this week that a sheet consumer had bid $80 for sheet bars for conversion, which shows that anxiety exists to secure sheets at not less than 2c premium, which it would be if the $80 price was negotiated.

The tin plate mills have not complained so much of car shortage as some other parts of the iron and steel trade, but it is known that considerable material has been piled up in warehouses, and if the car supply is not better next week there will be a curtailment of production. While not many of the makers seem to be suffering for lack of steel, none of them are getting as much raw material as they would desire, in view of the backlog of old business. There are heavy demands for tin plate, and sales at $20 to $30 a ton above the recognized base readily might be made to domestic consumers if makers were disposed to forget present obligations. While it is probable that some of the smaller makers are doing business at premiums, the most important producers are adhering to the old base of $7.00, Pittsburgh, and paying more attention to business already behind in fulfillment by reason of mill interruptions in the last three months of the old year. As regards export business, prices run from $8.50 to $9.50, Pittsburgh.

Shipments of sheets and supply of steel are being kept down by lack of cars, and very few of the tin plate producers are able to get to the point warranted by the volume of orders booked and the fact that there is no letup in demand.

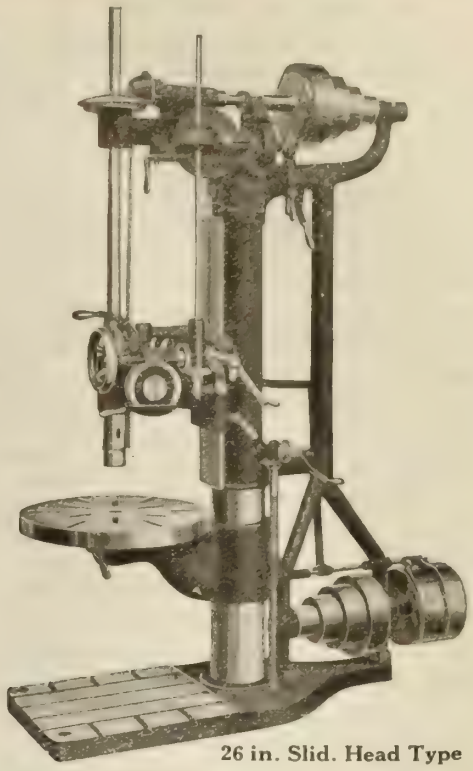
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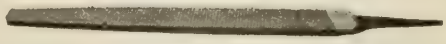
Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

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P H IMPERIAL

INGERSOLL

If interested tear out this page and place with letters to be answered.

There has been a heavy demand for spikes, but the makers are so well filled up with orders that they are turning down all inquiries for new business. The big railroad systems have given orders recently to the makers, especially for standard spikes, that will keep the mills going for several months to come, and makers will not sell further ahead on account of the uncertainty of supplies and prices of steel bars. Two of the largest makers here are out of the market, and refuse to quote prices. Standard spikes run from 3.75c to 3.85c, base, for carload lots, while small spikes are quotable from 4.25c to 4.50c, base, in lots of carload or more. It is not believed that less than 4c would be considered on large railroad spikes from irregular buyers, while small spikes are not available for buyers seeking supplies outside their regular sources much below 5c.

Bessemer and basic pig iron has not changed this week, both grades being quiet. The market stands as follows: Bessemer, $42; basic, $43; foundry, $42.00. This is unusual for basic to be above Bessemer, and was brought about a few days ago by basic demand having taken a spurt. A few pig iron producers are talking of $50 iron in the near future, and some profess to believe that it will reach $60.

There is little change in the coke market, which is well defined at the Government limits, $6.00 for furnace and $7.00 for foundry.

U.S. SCRAP METAL

The scrap market is softening considerably, and there is a downward trend to prices all over. Following are reports from various United States centres:

CHICAGO: — While quotations are practically nominal, the trend of business that has been done has been to lower prices. The steel making grades have gone back $1 per ton in most grades. The resumption of a buying movement would stiffen prices rapidly.

BOSTON:—There has not been much change in prices, though heavy melting has weakened a little more. The car situation has much to do with the market here. Thus cast grades have been short, and prices have stiffened.

PHILADELPHIA:—The market is generally weak, and there has been considerable liquidation by dealers which is still continuing on a smaller scale. Some grades such as railroad wrought, cupola cast, stove plate and fire bars have stiffened somewhat.

BUFFALO:—The market is not very active here, and car shortage and labor shortage are handicapping dealers in getting out tonnage already sold. Cast scrap stove plate and car wheels are in good demand. Stove plate is at $30 to $31.

BIRMINGHAM: — Quotations are somewhat higher on many grades, but heavy melting, which is not in much demand, has weakened slightly. Southern scrap cannot enter other markets on account of the high freights that have to be paid.

PIG IRON TRADE

The demand for pig iron has quietened down, after a fairly large buying movement. A feature of the situation is an embargo on New England points. Following are reports from various U.S. points:—

CHICAGO:—Enquiry for last half is in evidence here, prompt and second quarter demand being lighter. A sale of 35,000 tons foundry iron is reported for the Ford Co. Prices are about the same: $43 for Chicago iron; furnace for last half and southern iron $40, Birmingham.

PHILADELPHIA:—There has been a quieter week, most of the business being done in foundry iron, although there was a fair amount of off-iron sold for prompt shipment. Pennsylvania iron No. 2 plain is at $42 furnace in the central district, while Eastern Pennsylvania iron is $44 to $45 furnace for No. 2X.

NEW YORK:—Embargoes and severe weather have had the effect of curtailing foundry operations to some extent. Reports from the United Kingdom state that English and Scotch producers are sold up. This is expected to lead to more heavy buying here.

PITTSBURGH:—There is a distant lull in the market, due to a combination of circumstances including the quiet period after a heavy buying movement, the exchange situation, and the stock market. At the same time there are some heavy enquiries uncovered, chiefly for basic. Producers are quoting $45 for this grade.

IT'S EASY TO GET OUT AND SELL

(Continued from page 231)

The last question he remembered was about a tail stock. Chucks and the universe also lingered in the rear.

"The tail is made of good stock, I can assure you. We never had any of these break. (Swallows a lump). The chuck also goes with the machine, and as you said, it is known all over the universe. And as far as speed is concerned, say, Mr. E. X. Pert, she has some speed. We never had any complaints that she wasn't speedy enough."

"Mr. Prune, just a couple of other details. I mustn't take too much of your time."

Chapter four of "Big Business" had said, "Never appear in too great a hurry," so Mr. Prune assured Mr. E. X. Pert that it was his business to circulate and give the mechanical world the benefit of his expert knowledge.

"There's one point that is necessary for us to know," went on Mr. Screw, who had by this time wheeled around and taken an active interest in the onslaught. "What sort of bearings has the spindle got, and what is the ratio of the back gearing?"

"Don't worry about the spindle," broke in Prune, "it will be bearing all the load that's put on it, and as for the ratio—that also goes with the machine. Some firms regard them as extras, but we don't. We put on both the spindle and the ratio, but, of course, we charge for extra sets of back gearing. Now, gentlemen, how about the order? (Chapter five of "Big Business" had said to always keep in mind the closing of the contract), and Prune was already fumbling in his pocket for the yellow slip with the dotted line.

"Just one more detail," broke in E. X. Pert. "How do you convert the feed to the lead screw from the apron?"

"Just so—just so," sputtered Mr. Joseph Prune, "that is a matter about which one must use a great deal of discretion. You see, it depends altogether on the class of work and to who is operating the machine. Very few people wear aprons now, as they are apt to be caught in the belting. And as to converting the feed to the lead screw I can assure you that both the feed and the lead screw are quite convertible. Not only so . . . . ."

"You better do it," was all that Mr. John Screw stage-whispered to Mr. E. X. Pert, "I haven't got the heart, and I'm wearin' my best suit to-day."

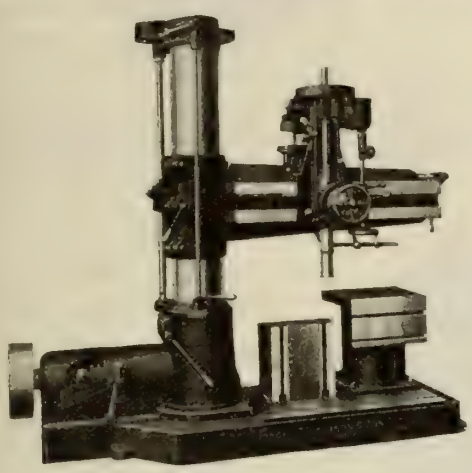
Whereupon Mr. E. X. Pert thumped the table so hard that Prune's yellow bag fell on the floor, and by the time he could untwist his leg from the friendly limb of the desk, the superintendent was laying a firm hand on his neck.

"Mr. Joseph Prune, you were head soda-water man in the shell shop—soda water's your line. Attend to it in future. Take your little yellow bag, your literature and your carcass. Remember those little murder charts in the papers, 'Dotted line indicates the direction taken by the body as it was hurled through the door.' Now, you've got a chance for one minute to spare that part of the chart. The door is in the same place as when you came in. Close it on the outside or there will be one grand universal chuck landed right on your face plate. Mr. Prune, pardon these words, but good-day and good-bye."

And that night in his hall bedroom, Prune sucked the butt end of a cigarette and wrote to the publishers of "Big Business," cancelling Vol. II, and also intimating that Vol. I was no darn good.

RYERSON

New Machines in Stock



4-Foot Plain Radial Drilling Machines

The Ryerson 4-Foot Plain Radial Drilling Machine is massive and of very rigid construction. The feed is of the positive all geared type and has four changes which can be varied by a conveniently located lever. The tapping, starting and stopping mechanism is operated by a horizontal lever.

Drilling cap. 3½″; Tapping Cap.; 4″ pipe tap; Travel of arm, 34½″; Travel of Head, 40¼″.

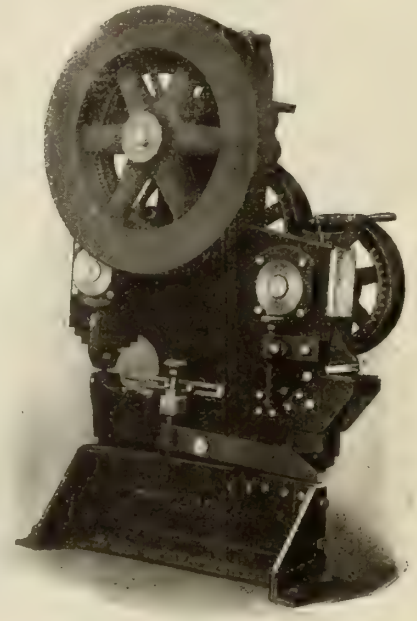
Quadruple Combination Punching and Shearing Machine

No. 4 SCAP- Power Driven

The Ryerson Quadruple Combination Punching and Shearing Machine embodies four single tools in one, handling punching, shearing of plates, round and square bars, cutting of angle, and tee iron as well as coping and notching work. All of this can be done without interchanging the attachments for the various operations or having to maintain a number of single machines for each operation.

We can furnish this machine arranged for either belt or motor drive. If direct electric drive is required, the machine is supplied with motor bracket, gear and rawhide pinion.

Punching Cap. ⅝ x ⅝″; Plate Shearing Cap. ½″; Coping Cap. 5″ Sections. Notching Cap. 3 x 3 x ¼″. Bar Shearing Cap. 1¼″ Round Bars, and 1″ Square Bars.



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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$33 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	35 00
Basic, Valley furnace	30 00
Toronto price:—	
Silicon, 2.25% to 2.75%	47 30
No. 2 Foundry, 1.75 to 2.25%	45 95

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 00
Steel bars, base, Toronto	5 00
Iron bars, base, Montreal	5 00
Steel bars, base, Montreal	5 00
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	8 00
Chequered floor plate, ¼ in.	7 50
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 25
Tank plates, Pittsburgh	3 50
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 50	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	71 00	60 00
Spelter	12 50	10 75
Lead	10 25	8 75
Antimony	14 00	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	6 50	7 25
Plates, ¼ up	$ 6 00	$ 6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

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Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	15 00	16 00
Boiler plate	15 00	11 00
Axles (wrought iron)	25 00	20 00
Rails (scrap)	16 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	26 00	25 00
Pipe, wrought	10 00	9 00
Car wheels	22 00	20 00
Steel Axles	21 00	20 00
Mach. shop turnings	9 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$43 00
Open-hearth billets	43 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	55 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

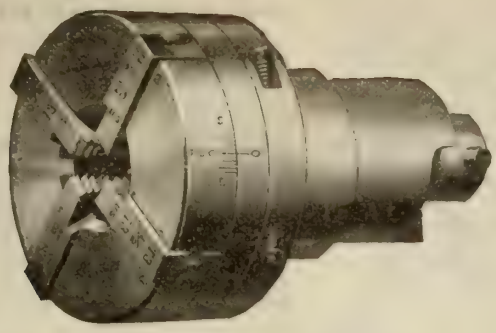
Wire nails	$4 95
Cut nails	5 00
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

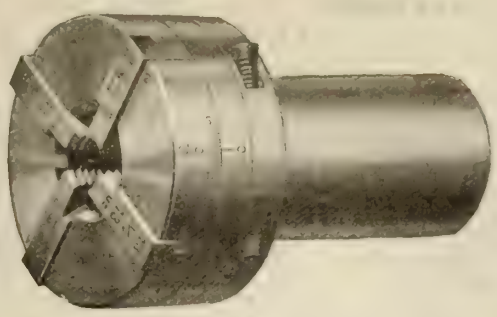
ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

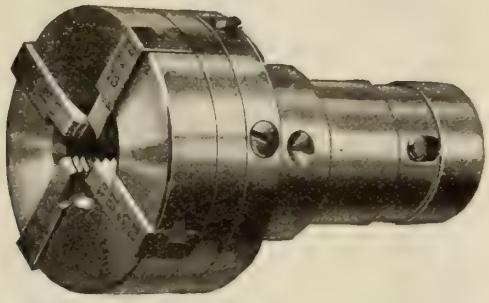
POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... net





Geometric Solid Adjustable Die Heads



When one uses the word "ONLY," he needs to be sure of what he is talking about. With confidence we use the word in saying that a Geometric Solid Adjustable Die Head, fitted with a set of milled dies, is the only solid die head that will back off without stripping the thread.

Geometric Solid Adjustable Die Heads may be fitted with either a releasing shank, plain shank, or with special shank for the Gridley Automatics. The releasing shank permits the head to disengage from the shank upon completion of the thread. The plain shank fits the head for use on the turret of a lathe or on a live spindle, such as a drill press.

Apart from the fact that it is not equipped with the self-opening feature or the roughing and finishing attachment, the Geometric Solid Adjustable Die Head is the same in principle and construction and will do equally as accurate work as the other styles of Geometric Die Heads.

Whatever the requirements, there is a type of Geometric Die Head best adapted to the work.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	40-10-5
Standard drills, all sizes	40-10-5
3-fluted drills, plus	10
Jobbers' and letter sizes	40-10-5
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	5% off
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Canadian high speed cutters, net to	10 off
American	plus 40

COLD ROLLED SHAFTING

At mill	list plus 5%
At warehouse	list plus 25%

Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 25	$ 8 50
Sheets, black, No. 10	7 75	8 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 50
Premier, 10¾ oz.	....	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08¼
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated

MORROW DRILLS

A mechanic takes a real pride in a Morrow High Speed Drill. He thins out the centre at the point and only has to regrind about half as often as with ordinary High Speed Drills—He *knows* the *Morrow* Tool will do its part if he does his.

The long life of the Morrow High Speed Drill and the wonderful dependability of it is what makes the demand.



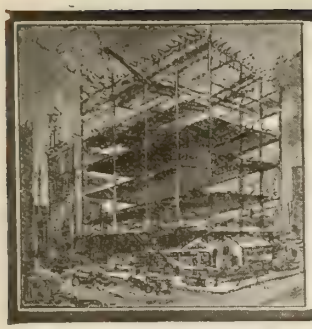
It's in the Steel!
It's in the Temper!
It's in Knowing How!

More holes with less re-grinding. Don't say *Drills,* Say *Morrow Drills.* There's a difference in your favor; order *now.*

JOHN MORROW SCREW & NUT CO.
LIMITED

INGERSOLL — — — — ONTARIO

Also Manufacturers of Cap Screws, Set Screws, Semi-Nuts.
Sole Distributors of P-H and Imperial Brand Files.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

W. A. McLean, deputy minister of public highways, is receiving tenders for four pumps capable of handling asphaltic road oils, receiving these up to March 15.

Ottawa.—The cabinet council are now considering the applications for the construction of a second-class floating dock at Sydney, N.S., under the provisions of the dry dock act. A decision will be reached very shortly.

Polson's Works to be Sold.—The official liquidator, Mr. G. T. Clarkson, has received permission from Mr. Justice Middleton to advertise the works of the Polson Iron Co. for sale. The contracts the firm had on hand were all completed.

Appointed Agents.—Elliott and Whitehall, Galt, Ont., manufacturers of milling cutters and small tools, recently placed with the Yates Machinery Co., Montreal, the exclusive agency for this line in the territory extending from Kingston east to the Maritime Provinces. The Yates people will carry a full stock of the Elliott & Whitehall line.

Group Insurance. — The Galt Brass Company has made a new departure. It has adopted a plan of group insurance, whereby every employee with the firm six months is insured for $1,000, increasing $100 a year up to $1,500, while the executive officers and superintendent are insured at $2,000, increasing at the same rate up to $2,500.

May Sell Polson's—G. T. Clarkson, liquidator, notified the courts that he has successfully completed the contracts the Polson Iron Works had on hand, and asked leave to advertise the company's property for sale, as a whole or en bloc. The matter came before Mr. Justice Middleton at Osgoode Hall and the required permission was given.

Kingston Co. Receives Orders.—The Canadian Locomotive Works at Kingston have received a large order for locomotives from the Canadian National Railway, and expect to be soon running at full capacity. The number of men employed at present is about 300, but by the summer this will be increased to around 1,000.

To Build Factory Buildings.—The Chamber of Commerce and the Business and Industrial Commitee of the city council of Niagara Falls are considering the erection of factory buildings in the town and will ask the city to back the bonds of a company to be formed for this purpose. Several factories would have located last year if suitable buildings had been available.

Montreal.—Capt. W. Gerrard, secretary of the Canadian Association of Shipbuilders and Engineers, is busy on the campaign of organization of that body, and is meeting with great success. The leading firms of the country are anxious to get such an organization built up, feeling that it will have a beneficial influence on the industry in many ways.

Electrical Men at Montreal.—The electrical interests of the Province of Quebec have been much in evidence at Montreal recently. At the weekly luncheon of the trade, Mr. W. L. Goodwin and S. A. Chase, of New York, were the speakers, the subject being "Co-operation in Business." Other events were a smoker in the Rose Room and a banquet, when several interesting addresses were delivered.

Plate Mill Starts.—The new plate mill of the Dominion Steel Company at Sydney, N.S., has been completed, and active operations have been started. The first plates turned out were in every particular equal to those made by American mills, and measured up to the highest requirements of Lloyds. The Deputy Minister of Marine, Alex. Johnston, was present when the mill was formally opened. He stated that he believed this undertaking was the beginning of big things for that section of Canada

Will Build New Bridge.—The members of the finance and public works committees of the city council of Guelph met recently to discuss the construction of a new bridge to replace the present Victoria bridge. The chief engineer, Mr. McArthur, presented three alternatives, two being cement construction and one steel. The cement bridges would cost $33,000 and $34,000 respectively, and the steel one to between $36,000 and $39,000. It was decided to call for tenders for the concrete bridge.

Spark Plug Factory Opens.—The first factory to be opened in Canada for the manufacture of spark plugs was started at Windsor, Ont., last week. The firm is the Champion Spark Plug Company of Canada, Ltd. The Mayor of Windsor started the first wheel turning. The factory, which is of steel and concrete construction, was started in June last. It has a frontage of 75 feet, and a depth of one hundred feet, and will have a capacity of about 40,000 plugs per day. The employees will number about 150 to begin with.

Canadian Locomotive Dividend.—The Canadian Locomotive Company, Ltd., have declared a 2 per cent. dividend on the common, and 1¾ per cent. on the preferred shares, payable April 1. The company is in a very strong position, and the increase in the dividend from 7 per cent. to 8 per cent. per annum, follows a similar increase in January, when it was increased from 6 per cent. to 7 per cent. They have secured orders which will keep them busy for several months.

Will Purchase Pumps.—The Administrative Commission of the City of Montreal have decided to purchase two electric pumps with capacity of thirty million gallons per day. While action of this character has been considered for some time, the need of installing more modern and adequate equipment was emphasized by the recent strike of waterworks employees. Some time ago a loan of $5,000,000 was authorized for aqueduct enlargement, and the abandonment of this scheme offers an excellent opportunity for diverting some of this money into new pumping equipment for the main station.

The E. I. C. at Regina.—The Saskatchewan branch of the Engineering Institute of Canada held a dinner at the Kitchener Hotel, Regina, recently, and were addressed by the Provincial Government town planning engineer, Mr. W. A. Biggs, A.M.I.E.C., on procedure to be followed under the Town Planning Act. During his talk he dealt extensively with the subject of rebuilding Europe and what was done in Canadian communities. Mr. W. T. Thompson, M.E.I.C., the oldest practising engineer and surveyor in Saskatchewan, gave some interesting remarks and personal observations in connection with the Hudson Bay Railway.

Locating in St. Kitts.—Two new concerns will shortly commence operations in St. Catharines, one for the manufacture of machine dies and the other for the manufacture of bicycle coaster brakes. The Kimber and Hillier Manufacturing Company, Ltd., have taken over the building of the old Woods Tannery and are putting in machinery and adapting the building to the manufacture of machine dies. The Regent Metal Goods Company, of Buffalo, have leased 7,500 square feet of the Lord and Burn-



Making Accuracy A Marketable Commodity

THERE'S a toolmaking shop in Detroit that refused to be stumped by any of the many problems our motor car builders present—the Michigan Tool Company.

This concern is fully equipped for any job—which means Dumore Grinders are there to do their bit.

In building jigs, standard bushings are used, the outer diameters running in an ascending series of sizes and calling for an arbitrary "constant" for the press-fit.

For grinding of this kind the Dumore is the ideal tool—high speed, dynamically balanced, non-vibrating, easy to move out of the way to permit the various holes to be indicated.

Write for information.

WISCONSIN ELECTRIC CO.

2920 Sixteenth Street Racine, Wisconsin

DUMORE HIGH SPEED GRINDERS

CANADIAN MEAD-MORRISON PLAN TO DO EXTENSIVE CANADIAN BUSINESS

THE Canadian Mead-Morrison Co., Ltd., has been organized under Canadian laws, and has purchased the manufacturing plant of M. Beatty & Sons at Welland, Ont., and has also purchased the Canadian business of the Mead-Morrison Manufacturing Co., of Boston, New York and Chicago. Steps have already been taken to enlarge and improve the Welland plant, and the new company will manufacture the extensive line of well-known Mead-Morrison products as well as the Beatty line of dredges, derricks, hoists, pumps, etc.

The new company has acquired from the United States Company the rights to use their engineering data, plans, patents, and past and future development work. This enables the Canadian Company to start under the most favorable auspices.

The Canadian Mead-Morrison Co., Ltd., has already a large specially-trained engineering staff and a well-organized contracting department, and is in a position to submit specifications, tenders, and to execute contracts for complete labor-saving plants.

In addition to covering the Dominion of Canada, the Canadian company will also manufacture for export to the British possessions.

Mead-Morrison installations are well known in Canada, and among the large plants in successful operation might be mentioned those built for the Canadian Pacific Railway, Canadian Northern Railway, Canadian Government Railways, Grand Trunk Railway, Canada Cement Company, Steel Company of Canada, Nova Scotia Steel & Coal Company, Montreal Light, Heat & Power Company, St. Lawrence Stevedoring Company, Canada Sugar Refineries, St. Lawrence Bridge Company, Canadian Rolling Mills, George Hall Coal Company, Ogdensburg Coal & Towing Company, Farquhar Robertson Coal Company, Canadian Furnace Company. The company has also furnished installations in England, Australia, Chili, Brazil, Norway, Sweden and Cuba.

The new company will have a very strong local board of directors, and its general officers will be: Messrs. W. S. Martin, managing director; D. W. Coe, general sales manager; J. R. Story, chief engineer, and J. A. Johnson, secretary.

The general sales offices of the company are located in the Guarantee Building, 285 Beaver Hall Hill, Montreal. This office will have entire control of the sales of "Mead-Morrison" products in the Dominion of Canada and British Possessions. The sales are divided into two classes — engineering contracting, which covers the installation of coal, ore and material handling plants, and merchandise sales, under which heading are included the standard lines of steam and electric hoists, contractors' equipment, grab buckets, derricks, winches, etc.

The engineering contracting department is under the direction of Mr. R. C. Smith, of Montreal.

Mr. D. W. Coe, general sales manager of the Canadian Mead-Morrison Company, Limited, has been connected with the Mead-Morrison Manufacturing Company for a number of years and is well known in Canada, as the many large "Mead-Morrison" installations in Canada were made under his direction as manager of the Boston contract department of the Mead-Morrison Manufacturing Company.



D. W. COE,
Sales Manager Mead-Morrison.

Mr. Coe is very enthusiastic on the subject of Canadian prosperity, and thoroughly believes in the future of Canada as a manufacturing country. He is building up a strong organization of Canadians, and sees a great future for "Mead-Morrison" products "manufactured in Canada."

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ham factory and will manufacture coaster brakes for bicycles. This company will employ 30 men at the start.

Locating in London.—Despite the fact that the majority of the directors are Sarnia men, London will get the Canadian branch of the Detroit Gartley, Weston Company, of Detroit, manufacturers of metal plating, which will employ about 500 men when their Forest City plant opens in the near future. The officers of the company will be as follows: Robert I. Towers, of the legal firm of Cowan & Towers, Sarnia, president; P. C. Gartley, Detroit, vice-president and director of Sales and Advertising; Malcolm Mackenzie, formerly of Mackenzie, Milne & Co., of Sarnia, vice-president and treasurer; Frank J. Weston, Detroit secretary, and James F. Perkins, of Detroit, production engineer.

Collingwood Plant Sold.—The sale has been completed of the Northern Iron & Steel Company's plant, at Collingwood, to steel interests from the United States represented in the negotiations by M. J. Shaw, a Toronto broker, and R. J. Courtney, of Buffalo. The price is said to be $200,000. Informal discussions have taken place between the purchaser and town officials, and it is understood the plant will be continued as an active concern. The Northern Iron & Steel Company was originally promoted by Col. J. A. Currie, M.P. It was bought during the war by Wm. Kennedy & Sons, Ltd., of Owen Sound, and D. J. Kennedy acted as manager. Munitions and billets were made, but the plant has been closed for the past few months. Subsequently the Western Canada Steel Corporation, which has plants at Calgary, Medicine Hat and other points, with headquarters in Calgary, took it over, and by them the sale was made to the American interests.

Trade Commissioner.—Capt. Evan J. Edwards has been appointed to the position of Senior Trade Commissioner for Great Britain, with headquarters in Montreal, vice Mr. G. T. Milne, O.B.E., who was appointed several months ago as commercial secretary to the British Legation in Cuba. Capt. Edwards has had business experience in various parts of the British Empire, including the post of managing of sales (home and export) for a large manufacturing firm in the United Kingdom. During the war he served in the Royal Naval Volunteer Reserve and home and foreign waters, and later was appointed Admiralty Overseer in an airship works in the North of England. Capt. Edwards will arrive in Montreal in the very near future to take up his new duties.

Dominion Steel Corporation.—At a meeting of the board of the Dominion Steel Corporation, Mr. J. W. Norcross, president and managing director of Canada S. S. Lines, Ltd., was elected a director to fill the vacancy caused by the retirement of Mr. J. K. L. Ross, some weeks ago. Major-Gen. Sir Newton Moore and Col. Grant Morden, two of the members of the recently appointed London Advisory Committee, were present at the meeting and discussed with Canadian members of the executive plans for the extension of export business. Sir Wm. Mackenzie and Senator Frederick Nicholls, of Toronto, and Hector McInnes, K.C., Halifax, were also present. It was announced at the conclusion of the meeting that the regular dividend of 1½ per cent. on the common stock of the company, and 1¾ per cent. on Dominion Iron and Steel preferred, had been declared. The former is payable on April 1 next, to shareholders of record March 5, and the latter on the same date to shareholders of record March 13.

PERSONALS

J. B. Smythe, formerly superintendent of A. O. Norton, Ltd., Coaticook, Que., is now with Foss Machinery as general manager of their new office and show rooms, 174 Lafayette Street, New York City.

Mr. Percival Cort, late of the British Corporation, has joined the firm of William C. Wilson, Toronto, and will take charge of the marine engineering department of that firm. Mr. Cort was with the British Corporation for twelve years, the most of this period being spent in Glasgow. He has been their representative in Toronto for several years and is well known to the shipping fraternity.

The death occurred at London, Ont., of Arthur E. McClary, the second largest shareholder in the McClary Manufacturing Company. He was the son of the late Oliver McClary, a brother of John McClary, the aged president of the company which bears his name. He had been ill for some time with heart disease. He was fifty-six years of age, and was largely interested in London and outside financial and industrial institutions. He is survived by his wife, who was Miss Ellen Whetter, daughter of the late Squire Frank Whetter; one daughter, Mrs. Clifford Gray, of this city, and one son, Oliver, at home.

NO BENEFIT FROM THE EXCHANGE RATE

Hamilton Firms Have to Secure Raw Materials in United States Markets

Hamilton.—Local industries are not benefiting to any great extent through the rate of exchange. On the other hand, many of the manufacturers of steel goods are compelled to get raw materials from across the border and pay a high exchange rate.

"It is a very costly thing for us, as for most manufacturers," said Cyrus A. Birge, vice-president of the Steel Company of Canada. "We have to get our ore and coal from the States, while the revenue derived from exports is very small."

Lieut.-Col. Arthur Hatch, of the Canada Steel Goods Company, remarked that the exchange situation was a very peculiar one. "Some manufacturers are finding it a great encouragement. It is a question whether or not it will work out to the detriment of Canada. The immigration authorities are becoming alarmed in the States because it is driving many of their farmers to our West.

"As for this company, we do very little importing, as we can secure most of our raw materials in Canada. We also dispose of our product here. There is a certain obligation to encourage the people of this country to build their own homes and prevent a shortage of anything in the home market."



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MERIT AND DEMERIT MARKS GIVEN ON C.P.R.

Following is the C. P. R. bulletin for Algoma district, issued Feb. 1, showing merit and demerit marks there:

John Corbett, conductor; H. M. Davis, conductor; J. O. Milks, engineer; A. J. Pracht, trainman—10 merit marks. Valuable services rendered in assisting to extinguish fire in car at Bremner before any damage done.

H. Newman, conductor; E. Holden, conductor.—10 merit marks. Prompt action taken, after discovering broken rail on main line, to have same protected and replaced.

Ursen McFadden, conductor.—5 merit marks. Prompt action in reporting broken wire near Verner.

T. McGuirk, fireman.—10 merit marks. Assisting with repairs to furnace in boarding house, Mactier—saving having to send to Toronto for repair men.

Nap. Landriau, section-foreman.—10 merit marks. Repaired telegraph wires near Walford.

F. B. Bones, trainman; Samuel Fourna, trainman.—5 merit marks. Discovered broken arch bars on cars.

W. H. Jessup, trainman.—5 merit merks.—Fired engine on freight train over subdivision, when fireman took suddenly sick.

Engineer.—10 demerit marks. Allowed driving tyres on engine to skid.

Engineer.—5 demerit marks. Allowed valves and cylinders on engine to get dry, causing delay to passenger train and cutting valve bushings.

Engineer.—10 demerit marks. Improper inspection of engine resulting in failure.

Engineer.—20 demerit marks. Improper handling of engine resulting in breaking stand pipe.

Engineer.—10 demerit marks. Careless switching.

Five operators.—5 demerit marks. Issued unstamped tickets.

Six trainmen.—20 demerit marks. Careless switching.

Sectionman.—Dismissed. Not going out proper distance to flag extra freight, as instructed by his foreman, when latter was changing frog.

SERIOUS TRYING TO KEEP PLANT OPEN

Coal Problems Are Facing the Steel Co. of Hamilton

Hamilton Times: — A serious coal shortage faces the Steel Company of Canada, said H. H. Champ, of the big steel corporation. Just how long the plant can run on present supplies is a matter of conjecture.

Unfavorable weather conditions for shipping and the non-production at the mines is ascribed as the chief factors making for the present shortage.

"There are many firms in Buffalo in a similar position," said Mr. Champ, "although those nearest the lines have a chance to receive supplies sooner than we."

At the present time there is a big shortage of coal in the United States. The situation is looked upon as serious. The Steel Company of Canada will operate as usual until present supplies are exhausted.

The company depends entirely on rail shipments throughout the year for its supplies.

"When the Welland Canal is opened up we will probably ship by water," said Mr. Champ.

Although the big firm has mines of its own, it is in no more favorable position than others in the present shipping and non-productive period.

A new rust-proofing for electrical or other machines is an application to the surface of the iron or steel of iron phosphates, which are insoluble and not corroded under ordinary conditions, which is referred to by a writer in CANADIAN MACHINERY. After thorough cleansing, a bath containing ferric and ferrous phosphates is prepared and the articles immersed therein, and then a little manganese dioxide is added at boiling water temperature. The articles are left in the bath until hydrogen is no longer given off. The articles are then air-dried, when they may be treated with mineral oil or painted, japanned or otherwise finished. As the phosphate surface is attached chemically to the metal, no rust forms even in cracks to the paint.

According to a leading Norwegian newspaper, Engineer Hermod Peterson has recently patented a device for the production of electrical current for radio telegraphy. The electricity is received by an accumulator, which releases it at certain intervals. The system is sparkless, and the sounds are clearer than in the older inventions. The clearness of sound depends upon the regularity of the current, and with this system the current is released with a mathematical exactness. The device has further advantages in that it is cheaper, simpler, and more durable than those now in use. If the claims for this invention prove well founded, it is thought that it will mark a distinct step in advance of what has so far been accomplished in this line, and hence its possibilities are creating considerable interest in the radio world.

According to "Scientific American," ethylene is a good substitute for acetylene in cutting and welding operations. As far as heat of combustion is concerned, ethylene has a slightly higher coefficient. Moreover, in the working of copper it has been found impossible to make a satisfactory weld with acetylene because of the formation of carbon and the consequent blistering in the weld. This is not the case with ethylene. Perfect copper welds have been made by using it. In addition to its availability for welding copper, the ethylene process of aluminum welding and lead burning makes for much better results than does the use of acetylene. Finally, ethylene has been found to possess considerable value for heating and lighting.

The city of St. Thomas, Ont., will receive tenders until February 26th, 1920, for approximately 40,000 gallons of road oil. Particulars can be obtained at the office of the City Engineer, St. Thomas.

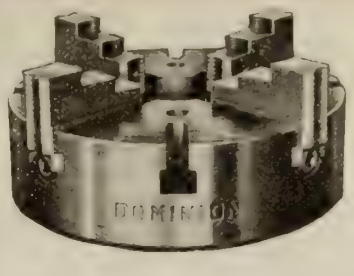
The Toronto and York Roads Commission are open to receive tenders up till February 27 for the construction of six bridges. Plans and specifications can be obtained at the office of the Chief Engineer E. A. James, 57 Adelaide St. East, Toronto.

The city of Saskatoon has for sale a 750 kw. direct-connected generator set. The engine is a 26-in. by 48-in. by 30-in. Robb, Armstrong vertical cross compound, and the generator a 2,300-volt, 60-cycle General Electric. Surface condensor, air pump, etc., are included. Tenders will be received till February 26.

Canada Metal Buys Building.—The building of the United Brass and Lead Co., at 284 St. Helens Avenue, has been purchased by the Canada Metal Co., Ltd., who will use it as a subsidiary to their main plant on Fraser Avenue. The building was erected for a munition plant and is exceptionally well built. It is single-storey, concrete, fronting on St. Helens Avenue, and running back 300 feet to a Grand Trunk siding. The building contains 30,000 square feet floor space. The 1920 assessment on the building is $40,000 and on the land $10,500.

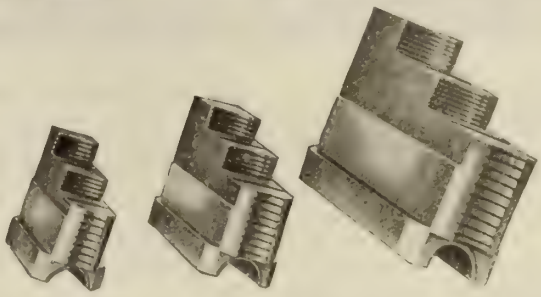
Tube Plant for Toronto.—The Tube Company of Canada, Ltd., have obtained premises at 233 Dufferin Street, Toronto, and will engage in the manufacture of welded steel tubing. The stock will be made in sizes ranging from ⅜ inch to 2 inches outside diameter, and thicknesses of 14 to 20 gauge. The capacity of the plant will be 30,000 feet per day, hot or cold finish, and the equipment will consist entirely of automatic welding machines. The president of the company is W. W. Carter; sec. treas., P. Sorely; J. F. Lawson, vice-president and general manager.

Trade Commissioner.—J. Vernon McKenzie, who has recently left the MacLean Pub. Co. to accept the position of Canadian Trade Commissioner for Scotland, with headquarters at Glasgow, will make a brief tour of the Dominion, between Winnipeg and the Maritime Provinces, during the next six or seven weeks. Any manufacturers or others interested in exporting to Scotland who may wish to get in touch with Mr. McKenzie, or who may wish to have him make inquiries for them in Scotland, may address communications to the editor of this journal, who will see that they are forwarded. Or communications may be addressed direct to the Secretary of the Canadian Manufacturers' Association, Montreal. Mr. McKenzie will make his headquarters there until early in March, and after that communications will be forwarded.



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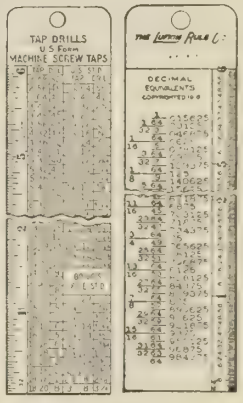
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WANTED—SECOND-HAND 24", 30" OR 36" Bullard Vertical Turret Lathe, or equal, with Turret Head and Side Head. Preston Woodworking Machinery Co., Ltd., Preston, Ont. (c8m)

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FOR SALE—1100 POUNDS OF STEEL STRIPS, 2 inches wide, .056 thick, soft stock for punching or forming, about 6 ft. lengths. This stock can be shipped immediately. Bright stock. Apply Box 655, Canadian Machinery. (c9m)

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The "want ad." gets work for workers and workers for work.

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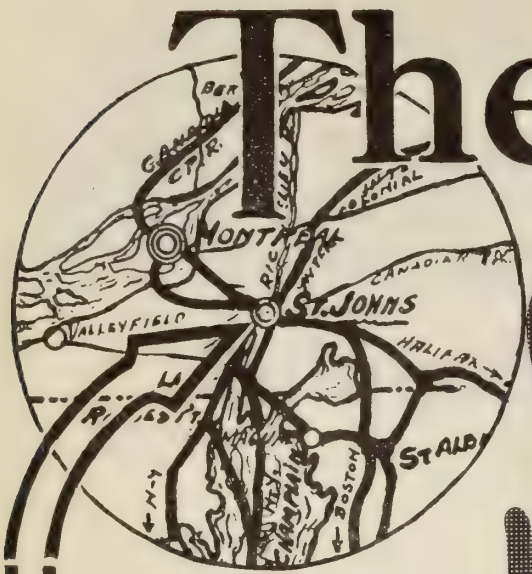
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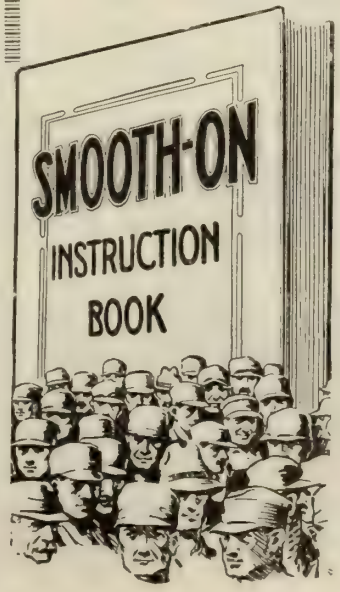
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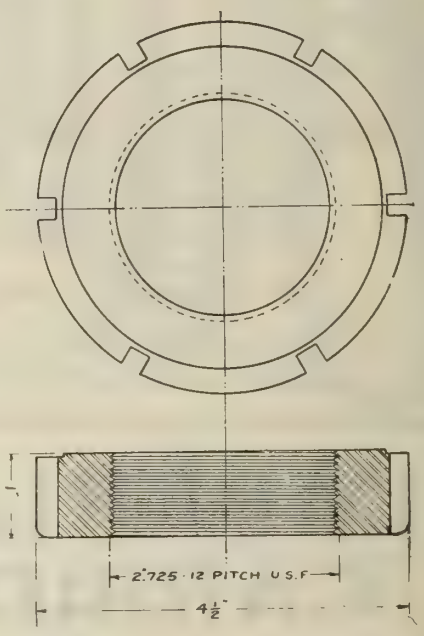
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MATERIAL—Soft Steel.
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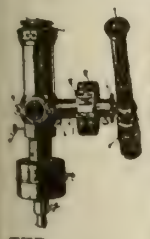
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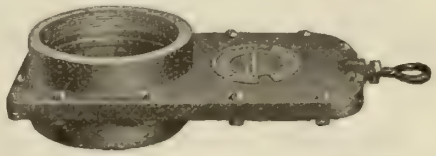
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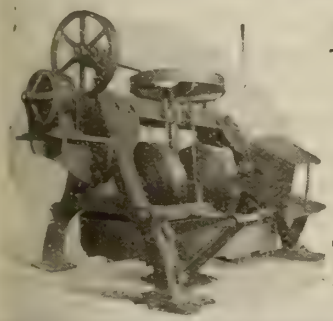
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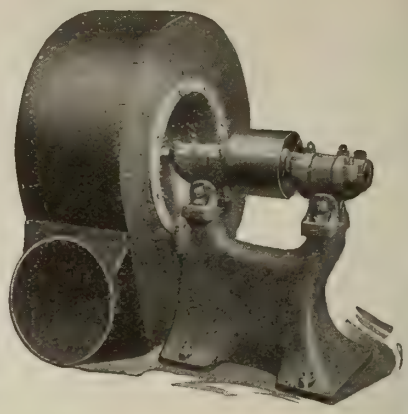
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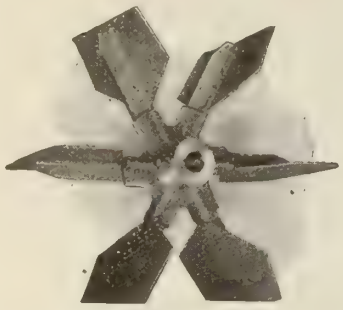
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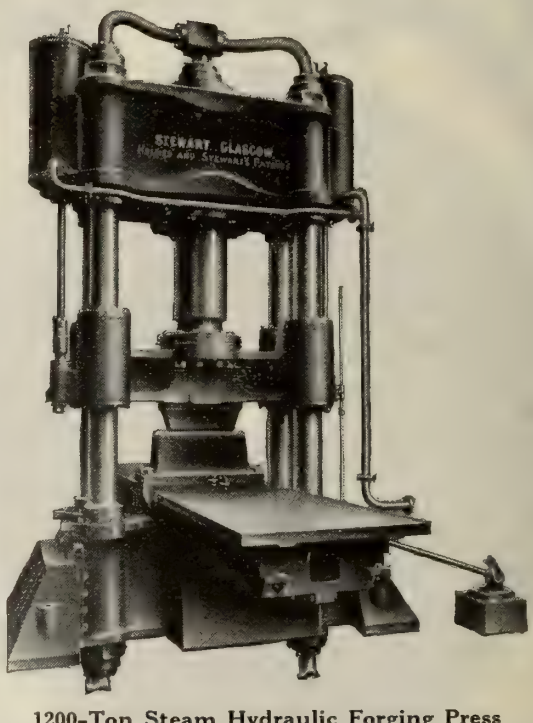
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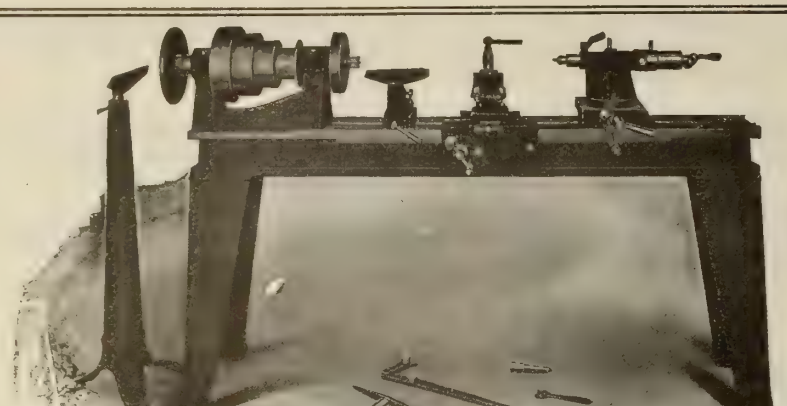
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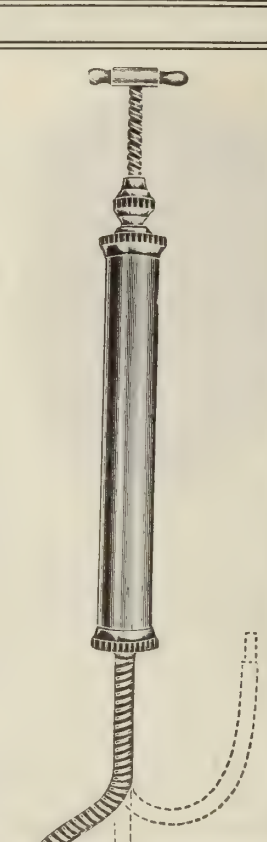
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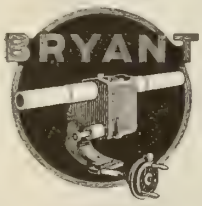
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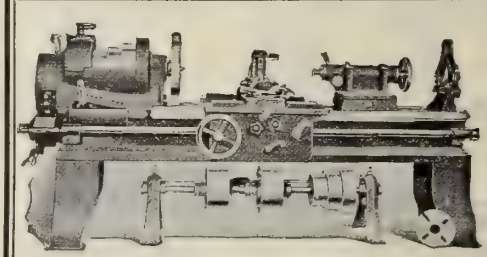
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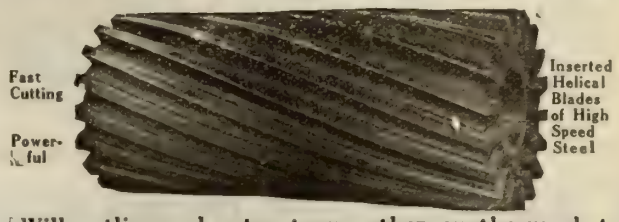
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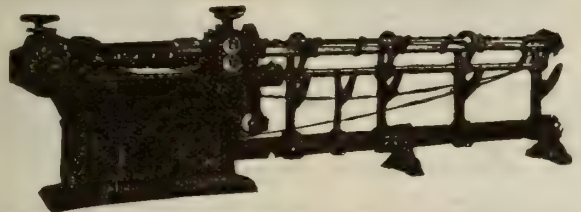
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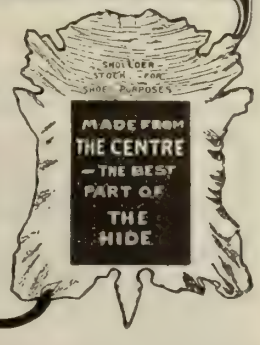
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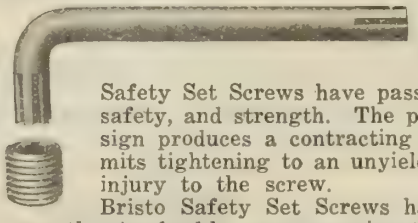
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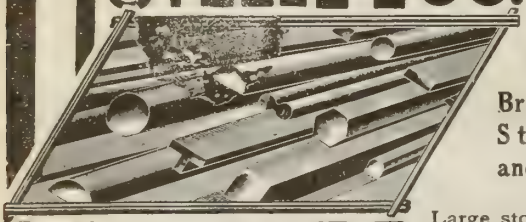
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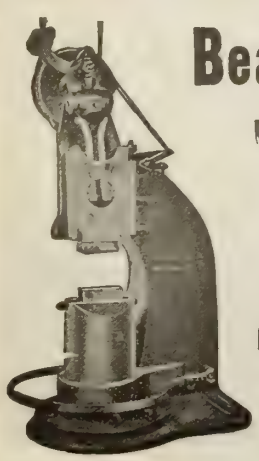
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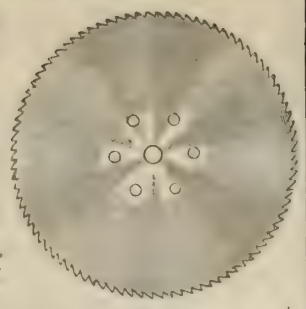
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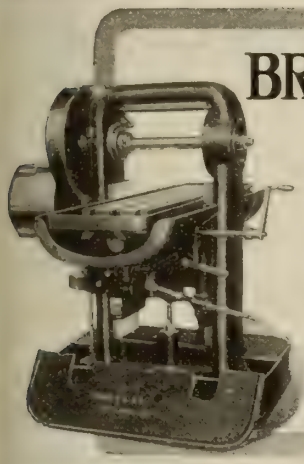


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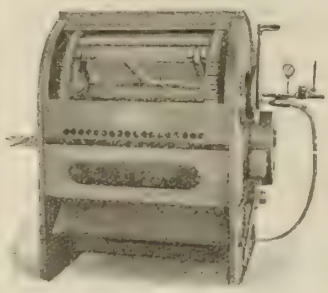
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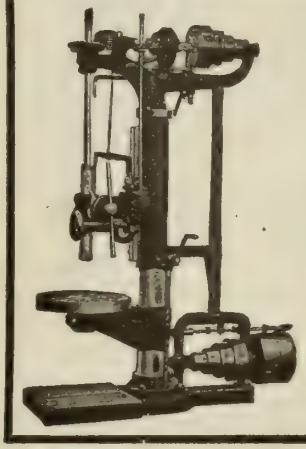
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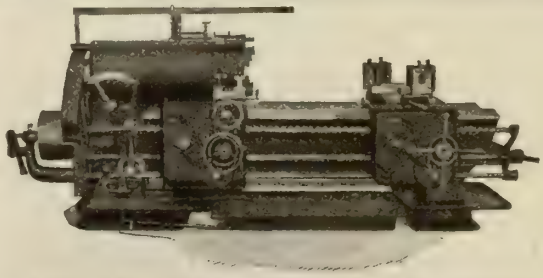
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Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
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COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

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Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

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Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son. Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

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Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Lyman Tube & Supply Co., Montreal, Que.
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Petrie, Ltd., H. W., Toronto.
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CHAINS, POWER TRANSMISSION
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Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

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Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

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Toronto Testing Lab'tory, Ltd., Toronto

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Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
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Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
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Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

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Oakley Chemical Co., New York.

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Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

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Crane, Ltd., Montreal, Que.

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Wright Mfg. Co., Lisbon, Ohio.

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Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
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Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
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Williams & Co., J. H., Brooklyn, N.Y.

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Sturtevant Co., B. F., Galt, Ont.

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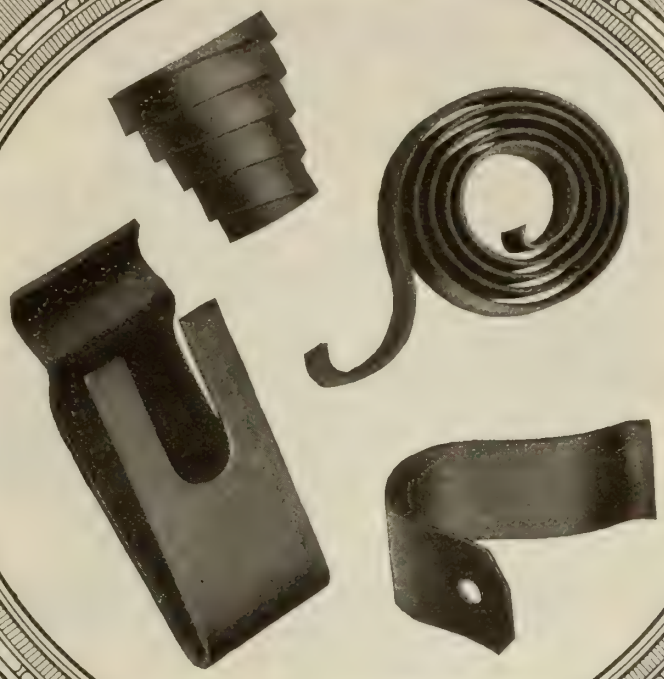
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Pratt & Whitney Co., Dundas, Ont.
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Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
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Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Int. Machinery & Supply Co., Ltd., Montreal, Que.

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Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

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Northern Crane Works, Walkerville.

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Volta Manufacturing Co., Welland, Ont.

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Northern Crane Works, Walkerville.

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MacKinnon Steel Co., Sherbrooke, Que.

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MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
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Williams & Co., J. H., Brooklyn, N.Y.

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Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
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Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
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Petrie, Ltd., H. W., Toronto.

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See Bolt Cutters.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
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Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
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Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
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Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
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Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
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Bertram & Sons Co., John, Dundas.
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Garvin Machine Co., New York.
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Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
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B. F. Sturtevant Co, Galt, Ont.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
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Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Stoll Co., D. H., Buffalo, N.Y.

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Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
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Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
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Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

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Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

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Kayser-Ellison & Co., Ltd., Montreal.
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Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Bilton Mach. Tool Co., Bridgeport, Conn.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
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Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
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Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

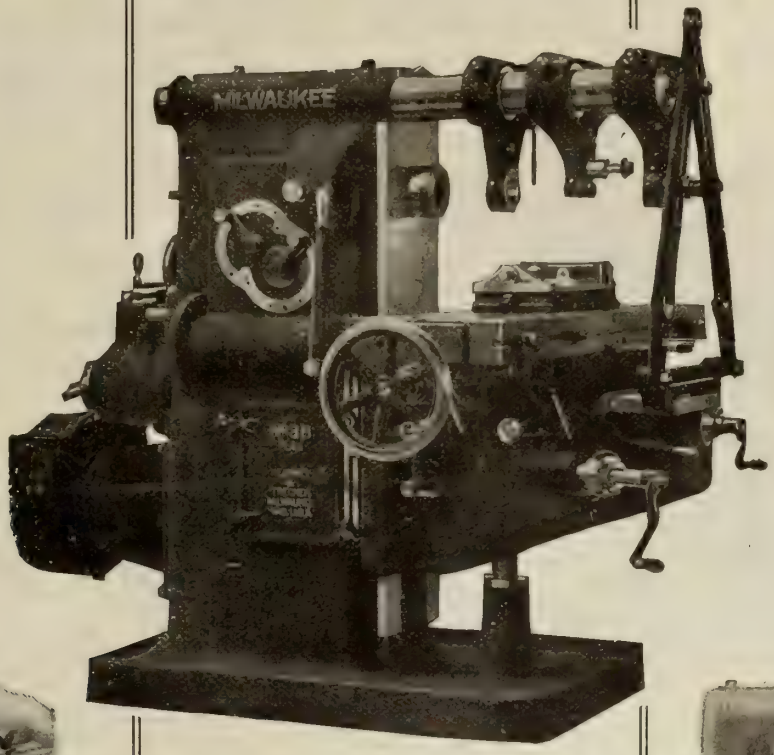
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Canadian Fairbanks-Morse Co., Montreal.
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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

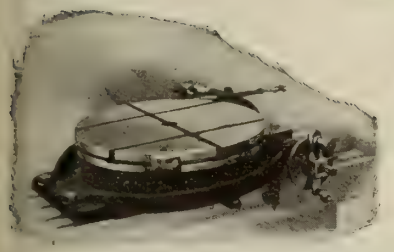
DRILLING MACHINES, SPECIAL
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Milwaukee

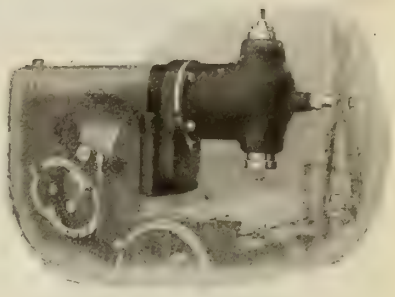
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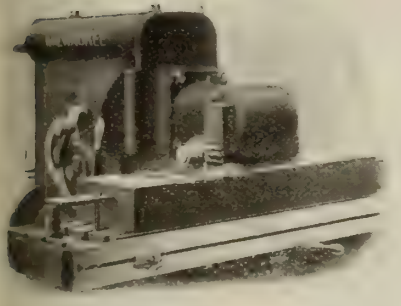
Milling Machines



ROTARY TABLE



VERTICAL SPINDLE ATTACHMENT



RACK CUTTING ATTACHMENT



DIVIDING CENTERS



UNIVERSAL MILLING ATTACHMENT



SLOTTING ATTACHMENT

Readily Equipped
WITH
MILWAUKEE
ATTACHMENTS

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GAUGES, THREAD
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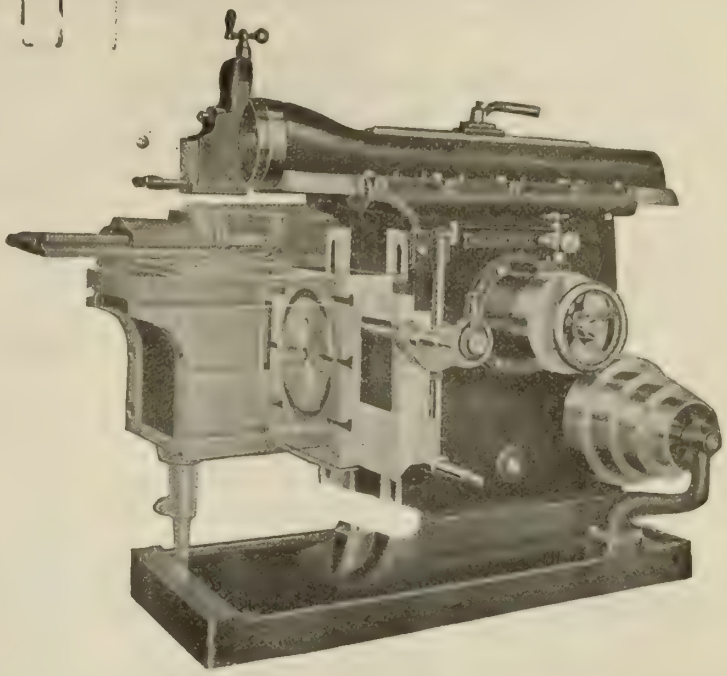
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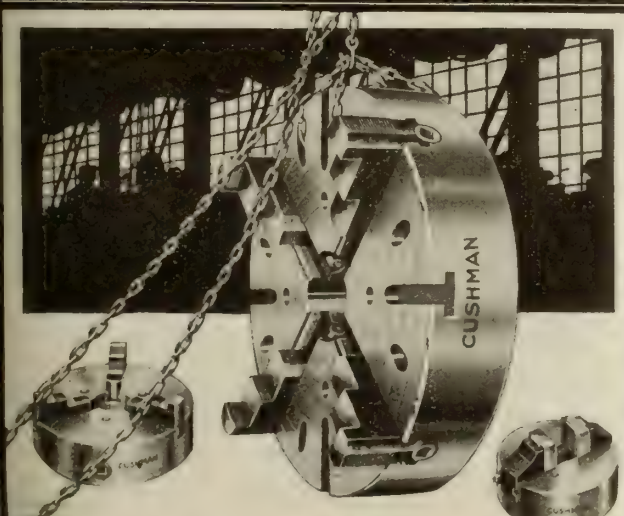
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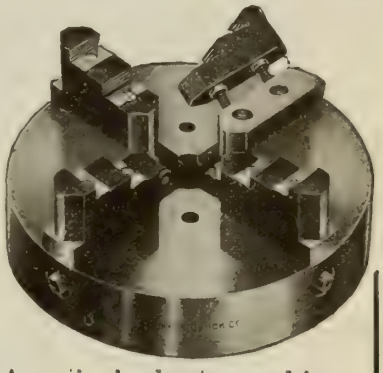
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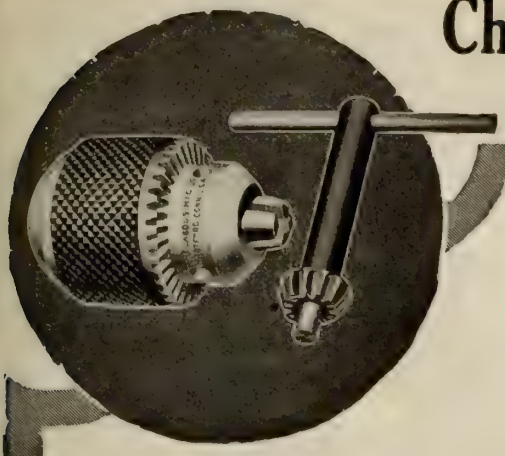
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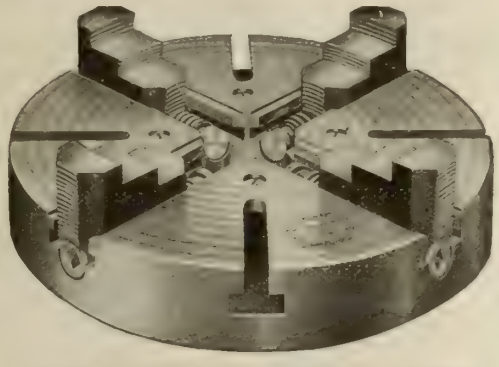
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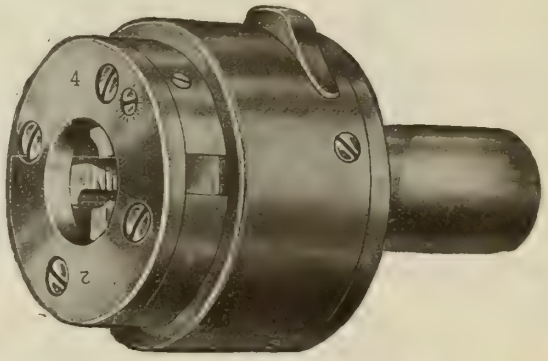
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Williams Machy. Co., A. R., Toronto.

KEYS, MACHINE
Whitney Mfg. Co., Hartford, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

KILNS
Can. Blower & Forge Co., Kitchener, Ont.
General Combustion Co., Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

KNIVES, MACHINE
Atkins & Co., E. C., Hamilton, Ont.

KNIFE GRINDERS
Gray Ball Bearing Co., Ltd., Toronto.

LABELS AND TAGS
Matthews & Co., Jas. H., Pittsburgh, Pa.

LABORATORIES, INSPECTION AND TESTING (see Chemists)

LADLES, FOUNDRY
Northern Crane Works, Walkerville.

LACING MACHINES
Clipper Belt Lacer Co., Grand Rapids, M.

LAG SCREW GIMLET POINTERS
National Machy. Co., Tiffin, Ohio.

LATH
Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING
Acme Machine Tool Co., Cincinnati, Ohio.
Petrie, Ltd., H. W., Toronto.
Wood Turret Machine Co., Brazil, Ind.

LATHE CHUCKS (See Chucks)

LATHE DOGS AND ATTACHMENTS
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
Williams & Co., J. H., Brooklyn, N.Y.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
Wood Turret Machine Co., Brazil, Ind.

LATHES, AXLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Betts Mach. Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHES, BORING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bridgeford Mach. Tool Works, Rochester.
Canada Machinery Corp., Galt, Ont.
Lodge & Shipley, Cincinnati, O.
Petrie, Ltd., H. W., Toronto.

LATHES, PRECISION, BENCH
W. F. & John Barnes Co., Rockford.
J. G. Blount & Co., Everett, Mass.
Canadian Fairbanks-Morse Co., Montreal.
Geo. F. Foss Machy. & Supply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Dundas, Ont.
Seneca Falls Mfg Co., Seneca Falls, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, BRASS
Acme Machine Tool Co., Cincinnati, Ohio.
Hardinge Bros., Chicago, Ill.
Wood Turret Machine Co., Brazil, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

LATHES, ENGINE
Acme Machine Tool Co., Cincinnati, Ohio.
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canada Mach'y Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cisco Machine Tool Co., Cincinnati, Ohio.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis
Kennedy & Sons, Wm., Owen Sound, Ont.
Lehman Mach. Co., St. Louis, Mo.
R. Mc'Dougall Co., Galt.
Niles-Bement-Pond Co., New York.
Perfect Machine Co., Galt, Ont.
Rae Mach. Tool Co., Ramilton.
Smalley-General Co., Inc., Bay City, Mich.
Standard Equipment & Tool Wks. (Montreal, P.Q.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Sidney Tool Co., Sidney, Ohio.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
A. R. Williams Machy. Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Worcester Lathe Co., Worcester, Mass.

LATHES, FOOT POWER
Seneca Falls Mfg. Co., Seneca Falls, N.Y.

LATHES, HORIZONTAL
Intern'l. Mchy. Supplies Ltd., Montreal.
Wood Turret Machine Co., Brazil, Ind.

LATHES, JOURNAL TRUEING
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.

LATHE MANDRELS, HARDENED AND GROUND
Elliott & Whitehall, Galt, Ont.

LATHES, PATTERNMAKERS'
J. G. Blount Co., Everett, Mass.
Can. Machinery Corp., Galt.
Wood Turret Machine Co., Brazil, Ind.
G. F. Foss Mchy. & S'ply Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

LATHES, POLISHING
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

LATHES, SCREW CUTTING
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Cisco Machine Tool Co., Cincinnati, O.
Foss Mchy. & S'ply Co., G. F., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Hepburn Ltd., John T., Toronto, Ont.
Lehman Machine Co., St. Louis, Mo.
Niles-Bement-Pond Co., New York.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
U. S. Ordnance, Toronto, Ont.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

LATHES, SPINNING
Bliss Co., E. W., Brooklyn, N.Y.

LATHES, TOOL ROOM
Barber Mchy. Co., Ltd., Toronto, Ont.
Cisco Machine & Tool Co., Cincinnati, O.
Canada Machinery Corporation, Galt, Ont.
Knight Metal Products, Toronto.
Lehman Machine Co., St. Louis, Mo.
Rae Mach. Tool Co., Ramilton.
Seneca Falls Mfg. Co., Seneca Falls, N.Y.
Worcester Lathe Co., Worcester, Mass.

LATHES, QUICK CHANGE
Lehman Machine Co., St. Louis, Mo.

LATHE SAWS
Atkins & Co., E. C., Hamilton, Ont.

LATHES, TURRET
Hardinge Bros., Chicago, Ill.
Acme Machine Tool Co., Cincinnati, Ohio

LEAD, PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

LEAD BURNING
St. Lawrence Welding Co., Montreal.

LEAD BURNING OUTFITS
Turner Brass Works, Sycamore, Ill.

LEATHER STRAPPING
Graton & Knight Mfg. Co., Worcester, M.

LENSES FOR GOGGLES
Standard Optical Co., Geneva, N.Y.

LETTERS AND FIGURES, METAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

LEVELS
Hughes, Owens Co., Ltd., Montreal, Que.

LIDS, SCREW TOP AND HINGE
Can. Winkley Co., Ltd., Windsor, Ont.

LINK BELTING
See Belting, Chain.

LIFT TRUCKS
Can. Kron Scale Co., Montreal.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LOCKERS, STEEL WARDROBE AND STEEL MATERIAL
Canada Wire & Iron Gds. Co., Hamilton
Dennis Wire & Iron Works, London, Ont.

LUBRICANTS
Cataract Refining & Mfg. Co., Toronto.
Swan & Finch, Inc., New York.

LUBRICANTS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

LUBRICATING, OIL FILTERING AND CIRCULATING SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.

LUBRICATORS
Trahern Pump Co., Rockford, Ill.

LUMBERMEN'S TOOLS
Thos. Pink Co., Ltd., Pembroke, Ont.

MACHINE COUNTER WEIGHTS
Katie Foundry, Galt, Ont.

MACHINE TOOLS
Barber Mach. Co., F. F., Toronto, Ont.
Knight Metal Products, Toronto.
Rae Mach. Tool Co., Ramilton.

MACHINERY, CORNER AND BENDING
Peck, Stow & Wilcox Scurhington, Conn.

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Archibald & Co., Chas. P., Montreal.
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall, Galt, Ont.
Williams Machy. Co., A. R., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.

MACHINERY GUARDS (See Guards)

MACHINERY SUPPLIES
Crescent Machine Co., Ltd., Montreal.
Globe Engineering Wks., Hamilton, Ont.
Knight Metal Products, Toronto.

MACHINERY, SPECIAL
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MACHINISTS' TOOLS
Atkins & Co., E. C., Hamilton, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
Volta Mfg. Co., Welland, Ont.

MANDRELS
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

MARKING DEVICES
Pritchard-Andrews Co. of Can., Ottawa.
Matthews & Co., Jas. H., Pittsburgh, Pa.

MARKING MACHINERY
Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

MASKS, WELDING, SMOKE, FUME, GAS, ETC.
Strong, Kennard & Nutt Co., Cleveland.

MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

MEASURING MACHINES
Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

MEASURING TAPES AND RULES
Chesterman & Co., Jas., Sheffield, Eng.

MERCHANTS, IRON AND STEEL
Samuel Osborne (Can.), Ltd., Montreal.

METALLURGISTS
See Chemists.

METAL CLEANERS
Oakley Chemical Co., New York, N.Y.

METAL CUTTING MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.

METAL SAWS
See Saws.

METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

METAL SAWS, POWER
E. C. Atkins & Co., Inc., Indianapolis.
Hoefer Mfg. Co., Freeport, Ill.
Lyman Tube & Supply Co., Montreal, Que.

METALS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper & Brass Rolling Mills, New Toronto, Ont.
Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

METAL, STAMPINGS, SMALL
Can. Winkley Co., Ltd., Windsor, Ont.

METERS, OIL, GASOLINE, KEROSENE, ETC.
Bowser Co., Ltd., S. F., Toronto, Ont.
General Combustion Co., Ltd., Montreal, Que.

MICROMETERS
Almond Mfg. Co., Ashburnham, Mass.
Taylor, J. A. M., 31st Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

MILLS, BRACE AND TUBE
Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
Atkins & Co., E. C., Hamilton, Ont.

MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

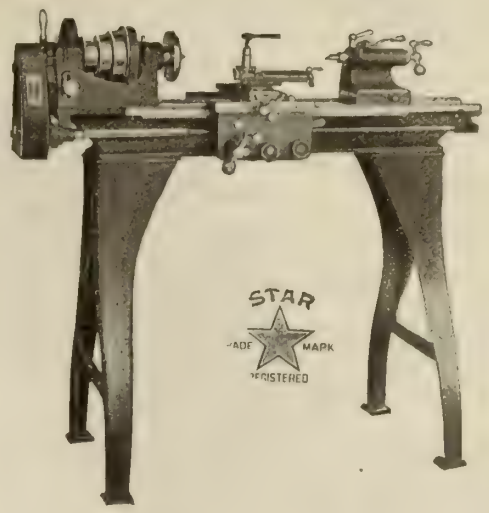
MILL MACHINERY
Alexander Fleck, Ltd., Ottawa.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

MILLING ARBORS
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.

MILLING ATTACHMENTS
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass.
Bertram & Sons Co., John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Mach. Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Wis.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Taft-Peirce Mfg. Co., Woonsocket, R.I.



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Boost Production, Cut Costs

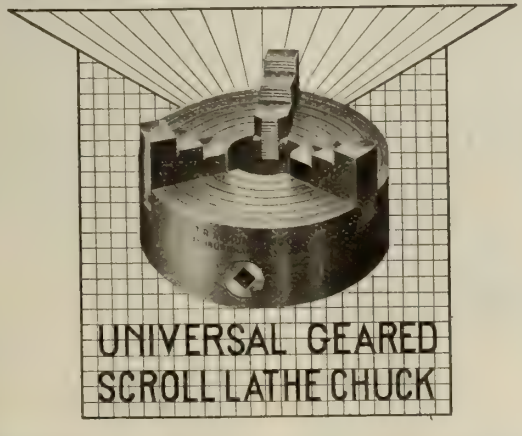
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ELEVATING TRANSMITTING CONVEYING BELTING

LEVIATHAN ANACONDA

"The Lines for Service"

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Betts Machine Co., Rochester, N.Y.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Milling Machine Co., Cleveland.
Delore Smelting & Refining Co., Ltd, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Marshall, Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Wilt Twist Drill Co., Walkerville, Ont.

MILLING MACHINES, HAND
Bristol Machine Tool Co., Bristol, Conn.

MILLING MACHINES, THREAD
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.
Gray Ball Bearing Co., Ltd., Toronto.
United States Mach. Tool Co., Cincinnati.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Smalley Gen. Co., Inc., Bay City, U.S.A.
Standard Equipment & Tool Wks., Montreal, P.Q.

MILLING MACHINES, HORIZONTAL AND VERTICAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co., Boston, Mass
Bristol Machine Tool Co., Bristol, Conn.
Brown & Sharpe Mfg. Co., Providence.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gooley & Edlund, Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Kearney & Trecker Co., Milwaukee, Wis
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rockford Milling Mach. Co., Rockford, Ill
United States Mach. Tool Co., Cincinnati.
U. S. Ordnance, Toronto, Ont.
Whitney Mfg. Co., Hartford, Conn.
Williams Machy. Co., A. R., Toronto.

MILLING MACHINES, PLAIN, BENCH AND UNIVERSAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Becker Milling Machine Co, Boston, Mass.
Bilton Mach. Tool Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Canada Machinery Corp., Galt, Ont.
Cleveland Milling Machine Co., Cleveland.
Cincinnati Milling Machine Co., Cincinnati
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, Ohio.
Gooley & Edlund, Inc., Cortland, N.Y.
Hardinge Bros., Inc., Chicago, Ill.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal, P.Q.
U.S. Ordnance, Toronto, Ont.

MILLING MACHINES, PROFILE
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Ford-Smith Mach. Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MINE CARS
Can. Fairbanks-Morse Co., Montreal.
Dominion Bridge Co., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

MINING MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Elec. Steel & Metals, Welland, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

MIXERS, SAND
Frost Mfg. Co., Chicago, Ill.

MORTISING MACHINES
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
Gray Ball Bearing Co., Ltd., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machy. Co., Toronto, Ont.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Elec. Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Williams Mach'y Co., A. R., Toronto.

MOTOR SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

MOTORCYCLE FRAME AND FORK
The Dunbar Brothers Co., Bristol, Conn.

MOTORS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

MOULDS, RUBBER
Hoggson & Pettis Mfg. Co., New Haven, Conn.

MULTIPLE INDEX CENTRES
Garvin Machine Co., New York.
Graton & Knight Mfg. Co., Worcester, M

MULTI-DRILLING, MULTI-BORING, MULTI-TAPPING MACHINERY,
Nat. Automatic Tool Co., Richmond, Ind

MUNICIPALITIES
City of St. John, Quebec.

NAIL SETS
Morrow Screw & Nut Co., J., Ingersoll, Ont

NAME PLATES, BRONZE, ETCHED AND STAMPED
Matthews & Co., Jas. H., Pittsburgh, Pa
Turner Brass Works, Sycamore, Ill.

NICHROME CASTINGS
Can. Driver-Harris Co., Ltd., Walkerville.

NICKEL
Baker & Co., Inc., H., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.

NICKEL STEEL
See Steel.

NICKEL SILVER—SHEETS, ROLLS, PLATES and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

NIPPLE THREADING MACHINES
Hall & Sons, Ltd., John H., Brantford.
Landis Machine Co., Waynesboro, Pa.

NITROGEN
Carter Welding Co., Toronto, Ont.

NUTS, STEEL, CASTELLATED AND COLD PRESSED
Galt Machine Screw Co., Ltd., Galt, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Williams & Co., J. H., Brooklyn, N.Y.

NUTS, SEMI-FINISH AND FINISHED
Galt Machine Screw Co., Galt, Ont.
National-Acme Co., Cleveland, Ohio.
Wilkinson & Kompass, Hamilton.

NUT LOCKS
Edw. W. Robinson Co., Ltd., Montreal.

NUT BURRING AND NUT MACHINES (HOT)
National Machy. Co., Tiffin, Ohio.

NUT FACING AND BOLT SHAVING MACHINES
Garvin Machine Co., New York.
National Machinery Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Victor Tool Co., Waynesboro, Pa.

NUT TAPPERS
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co. Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.

OILERS
All-Way Oiler Mfg. Co., Toronto, Ont.

OIL SEPARATORS
Can. Fairbanks-Morse Co., Montreal.
St Lawrence Welding Co, Ltd., Montreal

OIL STONES
Aikenhead Hardware Co., Toronto, Ont.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

OIL STONE GRINDERS
Oliver Machy. Co., Grand Rapids, Mich.

OIL STORAGE SYSTEMS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal.

OPENING DIE HEADS
Greenfield Tap & Die Corp, Greenfield.
Wells Bros. of Canada, Galt, Ont.

OPTICAL SUPPLIES
Consolidated Optical Co., Toronto, Ont.

OSCILLATING VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co. of Canada, Toronto

OVENS FOR BAKING, BLUING, DRYING, ENAMELING, JAPANNING AND LACQUERING
Brantford Oven & Rack Co., Brantford

OVEN TRUCKS, STEEL
Brantford Oven & Rack Co., Brantford.
MacKinnon Steel Co., Sherbrooke, Que.

OVENS FOR DRYING, TEMPER AND OXYGEN, ELECTROLYTIC CELLS UNDER TRUCKS
Welding & Supplies Co., Montreal, Que.
Brantford Oven & Rack Co., Brantford

OXY-ACETYLENE WELDING AND CUTTING AND OUTFITS
Carter Welding Co., Toronto, Ont.
Prest-o-Lite Co., Inc. Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.
Welding & Supplies Co., Montreal, Que.

OXYGEN
Nat. Electro Products Ltd., Toronto, Ont.

OXYGEN PLANTS (ELECTROLYTIC)
Davis-Bournonville Co., Toronto, Ont.

PACKINGS, ASBESTOS
Cleveland Wire Spring Co., Cleveland.

PACKING, ROD AND SHEET
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., Can., Ltd., Toronto
Gutta Percha & Rubber, Ltd., Toronto.
International Mach. Spls., Ltd., Montreal
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co., Philadelphia, Pa

PANS, WET AND DRY
Frost Mfg. Co., Chicago, Ill

PAPER MILL CONVEYORS AND DRIVES
Bertrams, Ltd., Edinburgh, Scotland.
Can. Link-Belt Co., Toronto, Ont.
Gutta Percha & Rubber, Ltd., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PARTITIONS, WIRE
See Guards

PAPER MILL MACHINERY
Garlock-Walker Machinery Co., Toronto.
MacKinnon Steel Co., Sherbrooke, Que.

PATTERN SHOP EQUIPMENT
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Oliver Machy. Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto.

PATTERN MAKERS' LATHES
See Lathes.

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Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

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Can. Link-Belt Co., Toronto, Ont.

PENSTOCKS
William Hamilton Co., Peterboro, Ont.

PERFORATED METALS AND ORNAMENTAL IRON GOODS
Canada Wire & Iron Goods Co., Hamilton

PHOSPHOR TIN, COPPER AND BRONZE
British Smelting & Refining Co., Ltd., Montreal, Que.

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Commercial Camera Co., Providence, R.I.

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Hanna & Co., M. A., Cleveland, O.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Morrow Screw & Nut Co., J., Ingersoll, Ont

PINS, BELT-LACING
Clipper Belt Lacer Co., Grand Rapids.

PIPE, BLACK & GALVANIZED
Crane, Ltd., Montreal, Que.

PIPE FITTINGS, MALLEABLE AND CAST IRON
International Malleable Iron Co., Guelph.

PIPE CUTTING AND THREADING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal.
Curtis & Curtis Co., Bridgeport, Conn.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, John H., Brantford.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
McDougall Co., R., Galt.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
Williams Tool Co., Erie, Pa.
Williams Machy. Co., A. R., Toronto.

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Crane, Ltd., Montreal, Que.

PIPE RIVETED STEEL
Toronto Iron Works, Ltd., Toronto.
William Hamilton Co., Peterboro, Ont.

PIERCING
Oliver Machy. Co., Grand Rapids, Mich.

PIPE CUTTERS, ROLLING
Curtis & Curtis Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield.
Hall & Sons, Ltd., John H., Brantford.
Wells Bros. Co. of Canada, Galt, Ont.

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

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Petrie, Ltd., H. W., Toronto.

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Quickwork Co., St. Marys, Ohio.

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MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

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Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
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Cleveland P'matic Tool Co., Can., Toronto.
Curtis Pneumatic Machy. Co., St. Louis.
Garlock-Walker Machy. Co., Toronto.
Int. Mach. & Supply Co., Ltd., Montreal.
Independent Pneumatic Tool Co., Chicago.

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MacKinnon Steel Co., Sherbrooke, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

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Petrie, Ltd., H. W., Toronto.
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Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
Williams Mchy Co., Ltd., A. R., Montreal

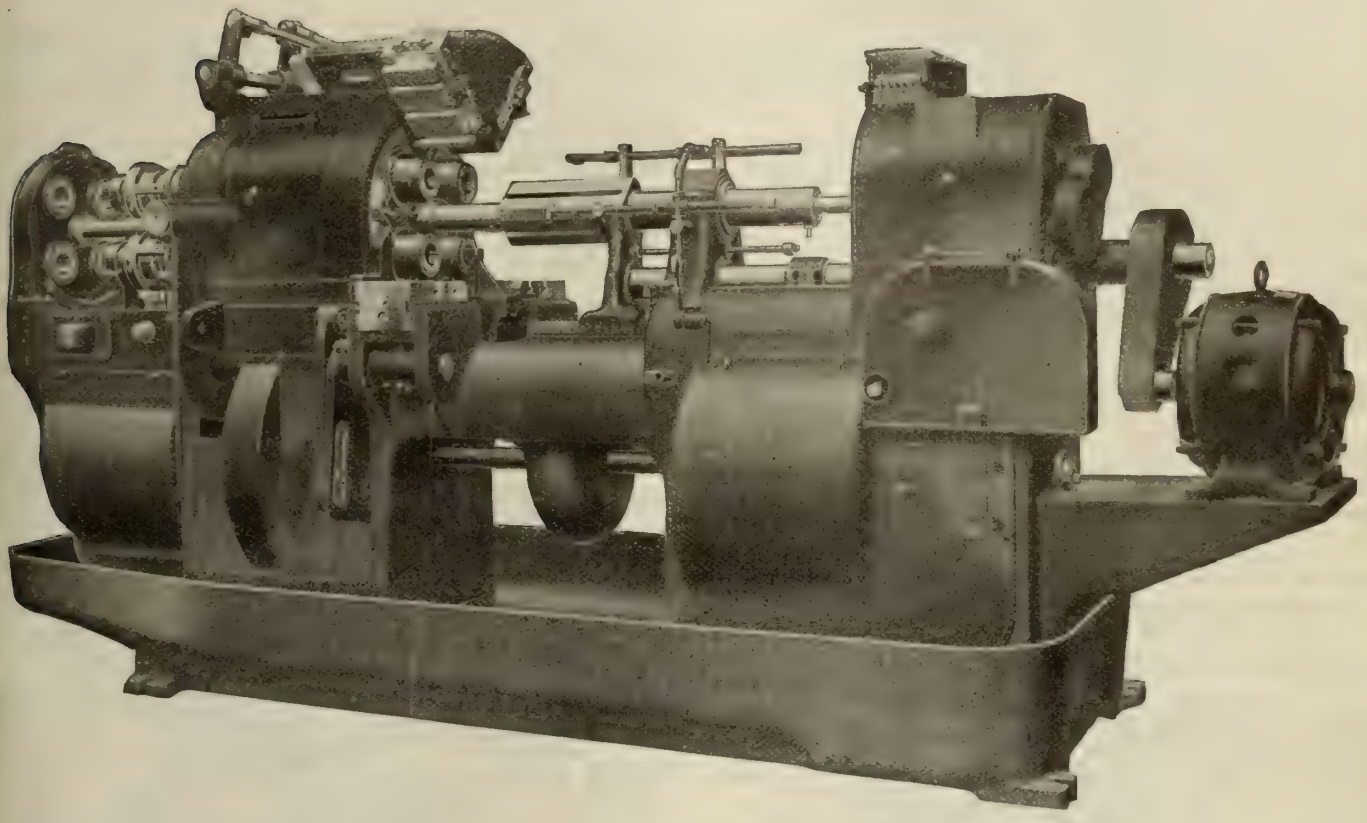
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Stoll Co., D. H., Buffalo, N.Y.
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Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
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Garlock-Walker Machinery Co., Toronto.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
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Manhattan Machine & Tool Co., Grand Rapids, Mich.
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Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
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Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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PULLEYS, FRICTION, CLUTCH
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Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glasco, Montreal.
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Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Fraser & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

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Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
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PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.

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Darling Bros., Ltd., Montreal, Que.
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Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks Morse Co., Montreal
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Gaume & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blumney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

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Bertrams & Sons, John, Dundas, Ont.
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E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
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Williams Mchy Co., A. R., Toronto, Ont.

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Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

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Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

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Algoma Steel Corp. Sault Ste. Marie, Ont.

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Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
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Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

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REAMERS, ADJUSTABLE
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Cleveland Twist Drill Co, Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
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Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
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Wells Bros. of Can., Galt, Ont

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Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
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Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Bristol Co., Waterbury, Conn.
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American Pulley Co., Philadelphia, Pa.

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REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
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St Lawrence Welding Co, Ltd., Montreal

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Independent Pneumatic Tool Co., Chicago.
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ROOF COOLERS
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ROLL LATHES
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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Elliott & Whitehall, Galt, Ont.

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Can. Link-Belt Co., Toronto.

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Dom. Steel Products Co., Ltd., Brantford.

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GARVIN MACHINE TOOLS

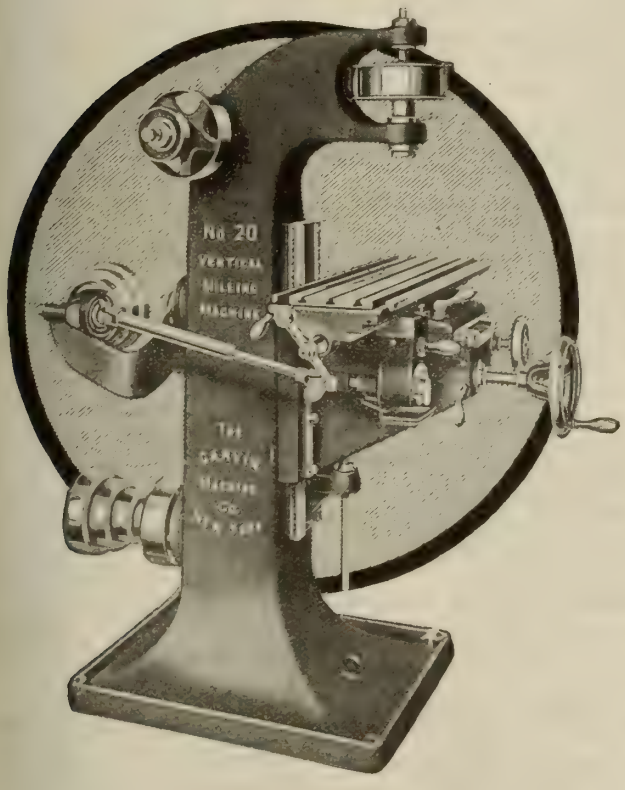
GARVIN MACHINE TOOLS

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  - Die Slotters
  - Screw Slotters
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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co., The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
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Williams & Co., J. H., Brooklyn, N.Y.

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Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
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TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

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Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
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A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son Toronto, Ont.

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Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

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Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O

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Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

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Sturtevant Co., B. F., Galt, Ont.
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Becker Milling Machine Co., Boston, Mass.
Foss Machy. & Spls. Co., G. F., Montreal.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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Marshall, Son & Bunney, Toronto.
Wells Bros. Co. of Canada, Galt, Ont.
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U. S. Ordnance, Toronto, Ont.

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VISES, PLANER AND SHAPER
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Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.

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WASHER MACHINES
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes, Wallace, Co., Bristol, Conn.
Graton & Knight Mfg. Co., Worcester.
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London Bolt & Hinge Wks., London, Ont.
Marshall, Son & Bunney, Toronto.
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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Wood Turret Machine Co., Brazil, Ind.

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Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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WELDERS, ELECTRIC ARC
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

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Welding & Supplies Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

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Strong, Kennard & Nutt Co., Cleveland.

WELDING GOGGLES
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Willson Goggles Inc., Reading, Pa.

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Page Steel & Wire Co., Adrian, Mich.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Welding & Supplies Co., Montreal, Que.

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Lincoln Electric Co. of Canada, Limited, Toronto, Ont.
Nat. Electro Products Ltd., Toronto, Ont.
St Lawrence Welding Co, Ltd., Montreal
Union Carbide Co., Toronto, Ont.

WELDLESS BOILER TUBES
Furniss, Clarke & Co., Montreal, Que.

WHEELS, BALL BEARING
Lyman Tube & Supply Co., Montreal, Que

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Petrie, Ltd., H. W., Toronto.

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Elec. Steel & Metals, Welland, Ont.

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Hall & Sons, John H., Brantford.
Kennedy & Son, Wm., Owen Sound, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

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Kayser-Ellison & Co., Ltd., Montreal.
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WIRE COILING AND POINTING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Shuster Co., F. B., New Haven, Conn.

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WRENCHES, PIPE, POWER
Peck, Stow & Wilcox Co., Southington.

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WIRE, COPPER, CLAD STEEL WIRE, LINK FABRIC
Page Steel & Wire Co., Adrian, Mich.

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Page Steel & Wire Co., New York, N.Y.
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National Machy. Co., Tiffin, Ohio.
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Can. Driver-Harris Co., Ltd., Walkerville.

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Williams Mchy Co., Ltd., A. R., Montreal

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Cowan Truck Co., of Galt, Galt, Ont.
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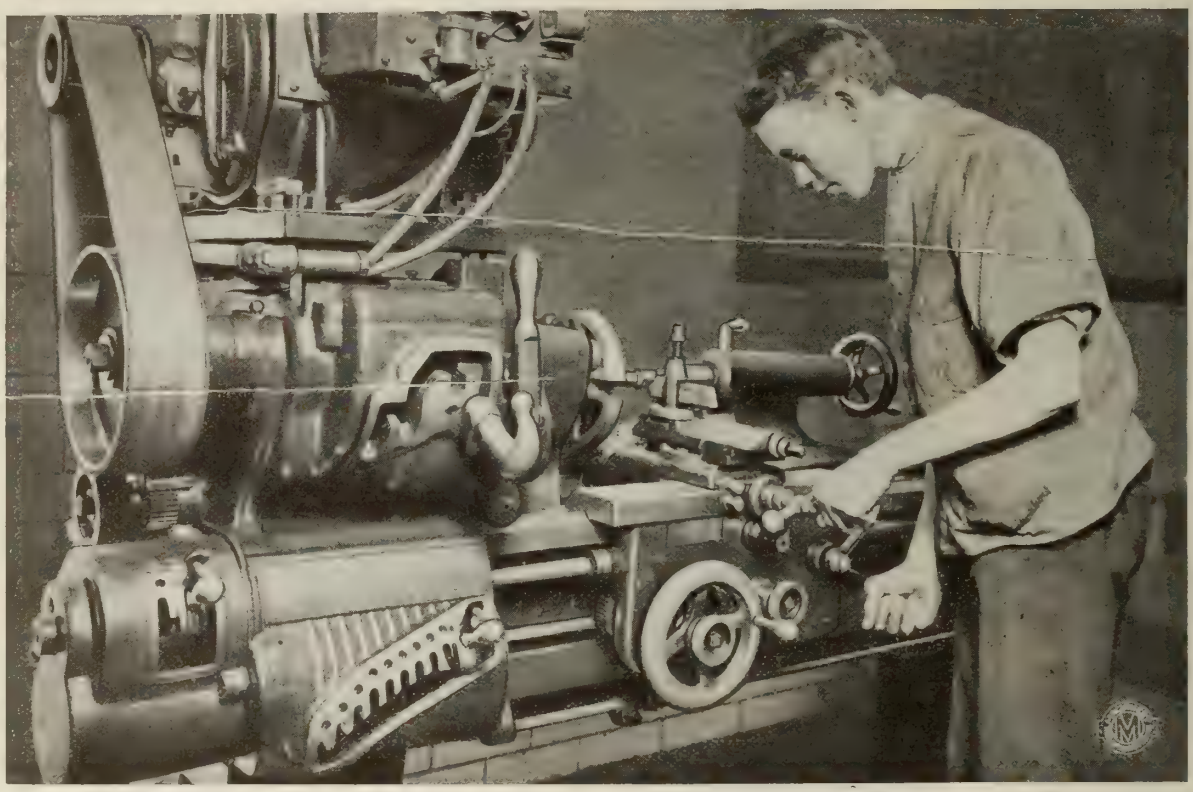
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HENDEY

GEARED HEAD MANUFACTURING LATHE



Used in the Technical Department of the William L. Dickinson High School, at Jersey City

What Better Testimony of *Worth* Than This!

When a technical school installs machine tool equipment it invariably installs the best, and it is the rule to thoroughly investigate the merits of the equipment first. When Technical Department of the William L. Dickinson High School, at Jersey City, installed the Hendey Lathe shown in the above illustration it did so only after rigid tests. It was proven that the Hendey possesses all the essentials of a high-class lathe, a lathe appropriate for engineers-in-the-making to gain experience. Hendey represents standard equipment. It is the lathe that experts recommend for rapid, accurate work—they know Hendey is a safe choice!

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The momentous question of rate of exchange on American goods that is proving such a handicap to Canadian merchants can be satisfactorily solved, as will be seen by extracts from letters received from several American firms, reproduced below:—

Lancaster, Pa., U. S. A.
1-27-20

The Geo. F. Foss Machinery & Supply Co.,
Montreal, Canada.

Gentlemen:—

In view of the present excessive rate of exchange which exists between Canada and the United States, which might have the effect of decreasing our business with our Canadian customers, we have concluded to accept checks on Canadian banks for any purchases you may make, until such time as the rate of exchange becomes normal.

Yours truly,

CHAMPION BLOWER & FORGE COMPANY.

Meriden, Conn.
January 9-1920.
Ref. W.R.B.

The Geo. F. Foss Machinery & Supply Co., Ltd.,
Montreal, Can.

Gentlemen:—

We are in receipt of your favor of December 11th in reference to the settlement of account and the high rate of exchange now existing between the United States and Canada We have held this communication up as we were undecided which would be the best way to handle the existing condition.

We are pleased to report that in the future we will accept the Canadian checks and will absorb the exchange charges ourselves.

Trusting this will be satisfactory, we are

Yours very truly,

THE CHARLES PARKER COMPANY.

Athol, Mass.
Dec. 23-1919.

To Canadian Dealers in Starrett Tools:

On account of the exorbitant rates of exchange charged by the banks for the collection of Canadian checks, which is a matter of considerable expense to you and no little annoyance and bother to us—as well, we fear, as loss of business to both of us,—we have decided to open an account with a Canadian bank where checks received from our Canadian friends will be deposited by us for collection.

You will please note, therefore, that until further notice your checks will be received by us and credited at their face value.

We wish each of you a most happy and prosperous New Year, and remain,

Yours respectfully,

THE L. S. STARRETT COMPANY.

Providence, R.I.,U.S.A.
January 3-1920.

Geo F. Foss Machinery & Supply Co., Ltd.,
305 St. James St.,
Montreal, Canada.

Gentlemen:—

In view of the continued high rate of exchange prevailing between Canada and the United States, we are notifying you that hereafter we will accept Canadian funds at par on Montreal in future settlements of your accounts with us, until further notice.

We propose for the present to absorb the entire cost of exchange ourselves, by maintaining a bank account in Canada which will handle all of our Canadian collections, and the funds to be transferred to the United States as exchange conditions and our needs may warrant.

Yours respectfully,

BROWN & SHARPE MFG. COMPANY.

Another alternative, equally effective, is the purchase of Canadian Victory Bonds with the money due from Canadian Creditors, which saves the Canadian the exchange rate, and also proves a good investment to the American who can afford to hold such securities until the rate of exchange becomes normal once more, when he can realize on these securities, without loss. In fact he will be in pocket, through the interest he can earn on such gilt-edge securities.

THE GEO. F. FOSS MACHINERY AND SUPPLY COMPANY, LIMITED

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ADVERTISING INDEX—PAGE 179. BUYERS' DIRECTORY—PAGE 161. EDITORIAL INDEX—PAGE 258

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
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Vol. XXIII., No. 10 Publication Office: Toronto, March 4, 1920 $3.00 per year. Subscription Price




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OF PROVEN QUALITY
Stamina, speed, assured satisfaction—by these our Small Tools are judged. We rest upon the verdict of the men who use them.
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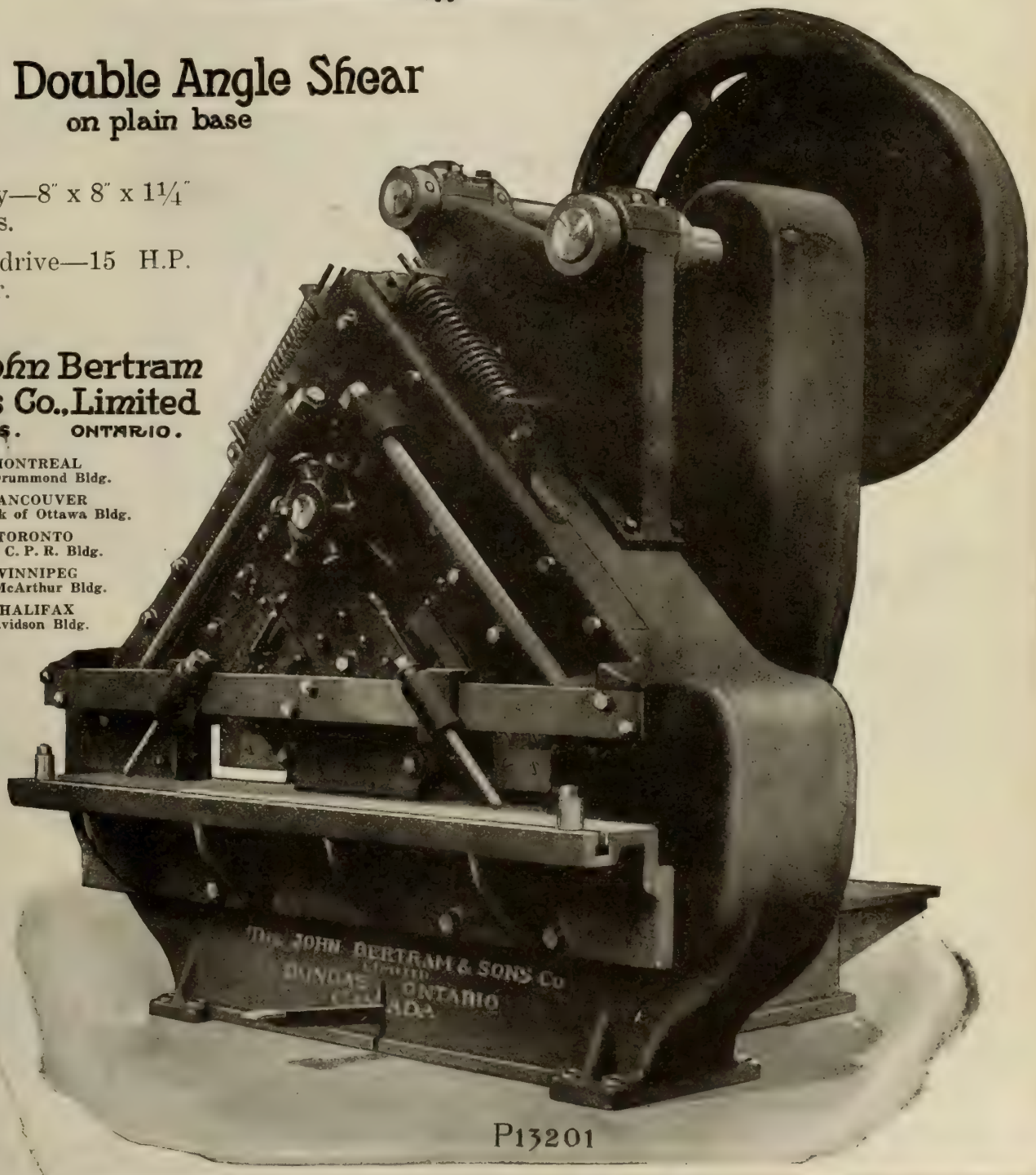
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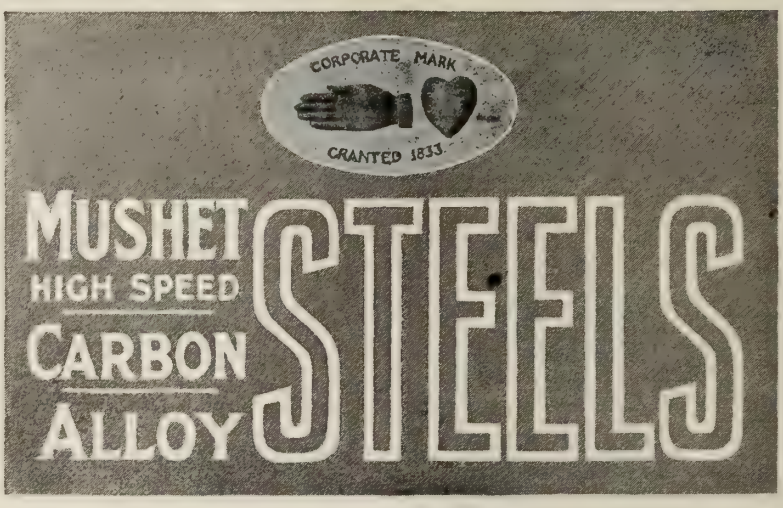
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Canadian Machinery and Manufacturing News, March 4th, 1920. Vol. 23, No. 6. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

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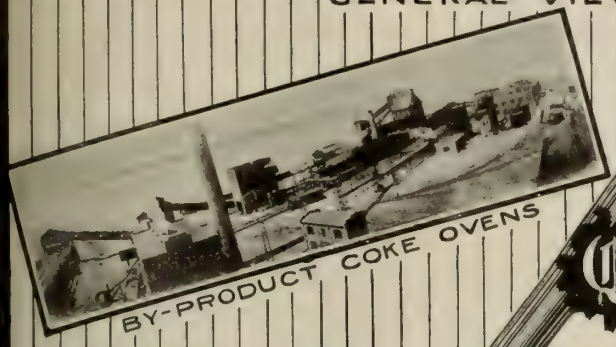
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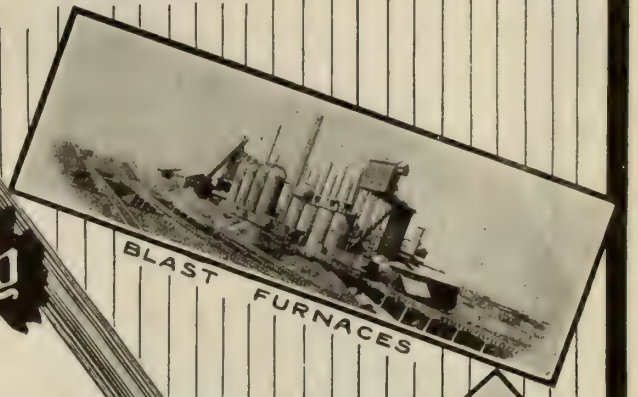
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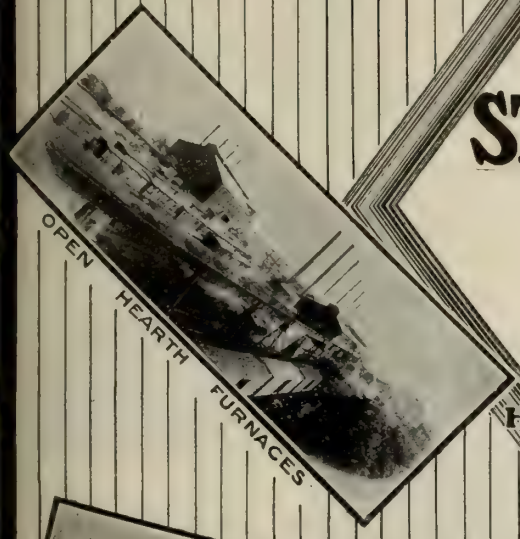
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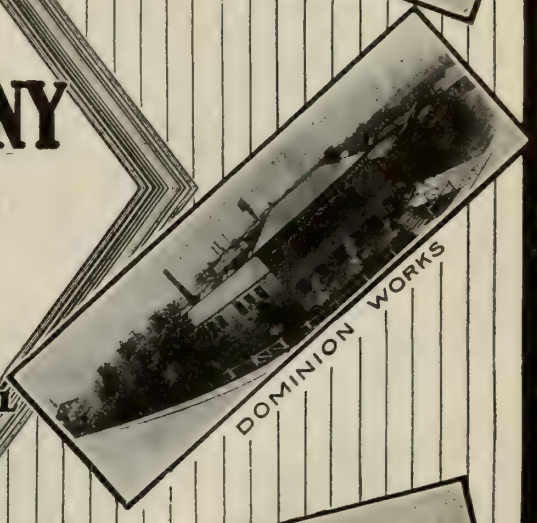
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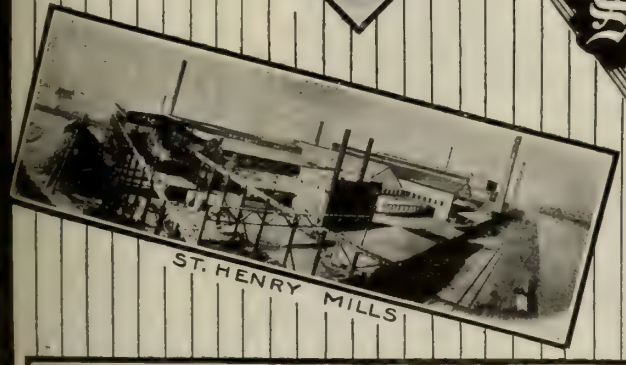
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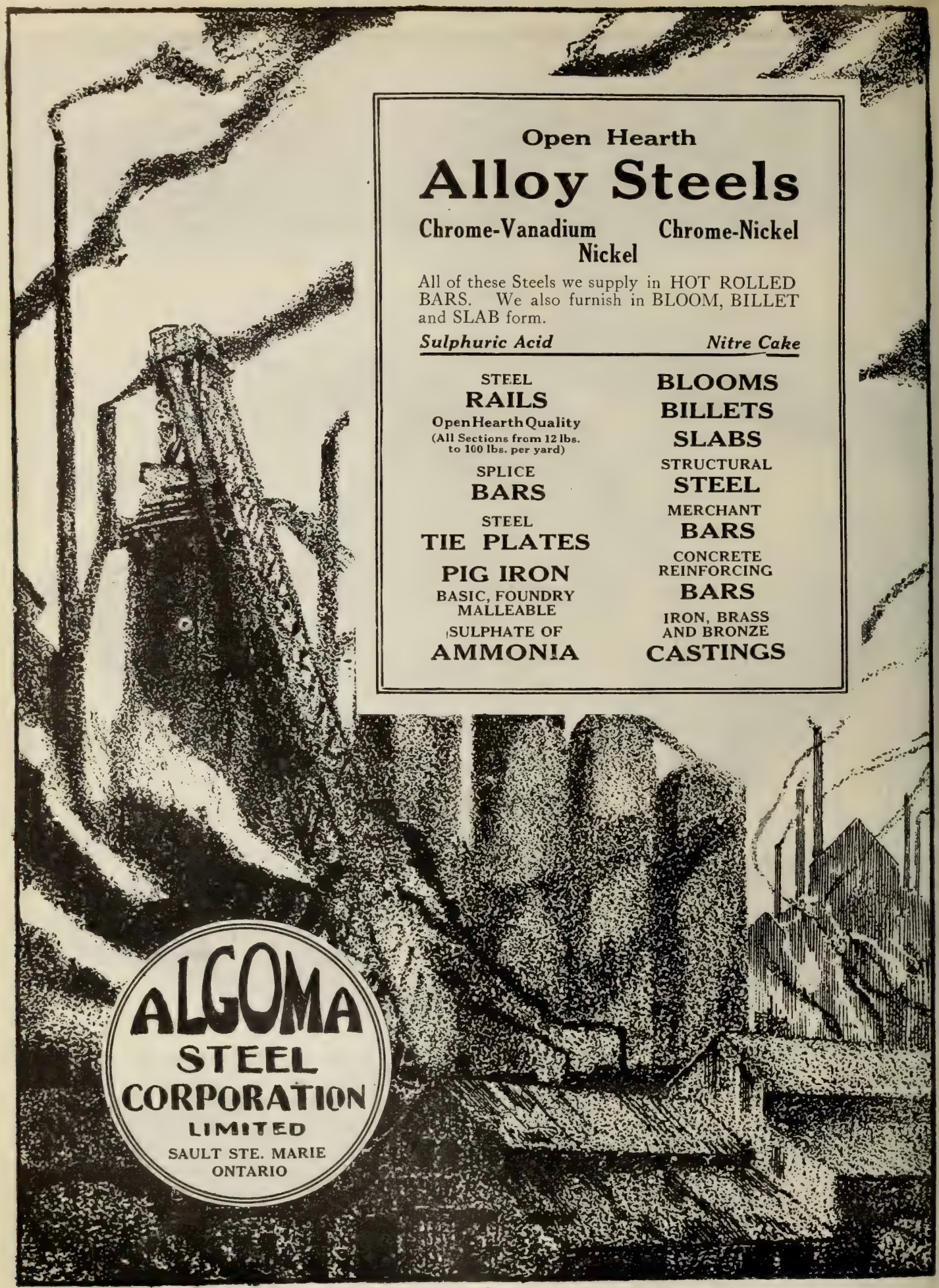


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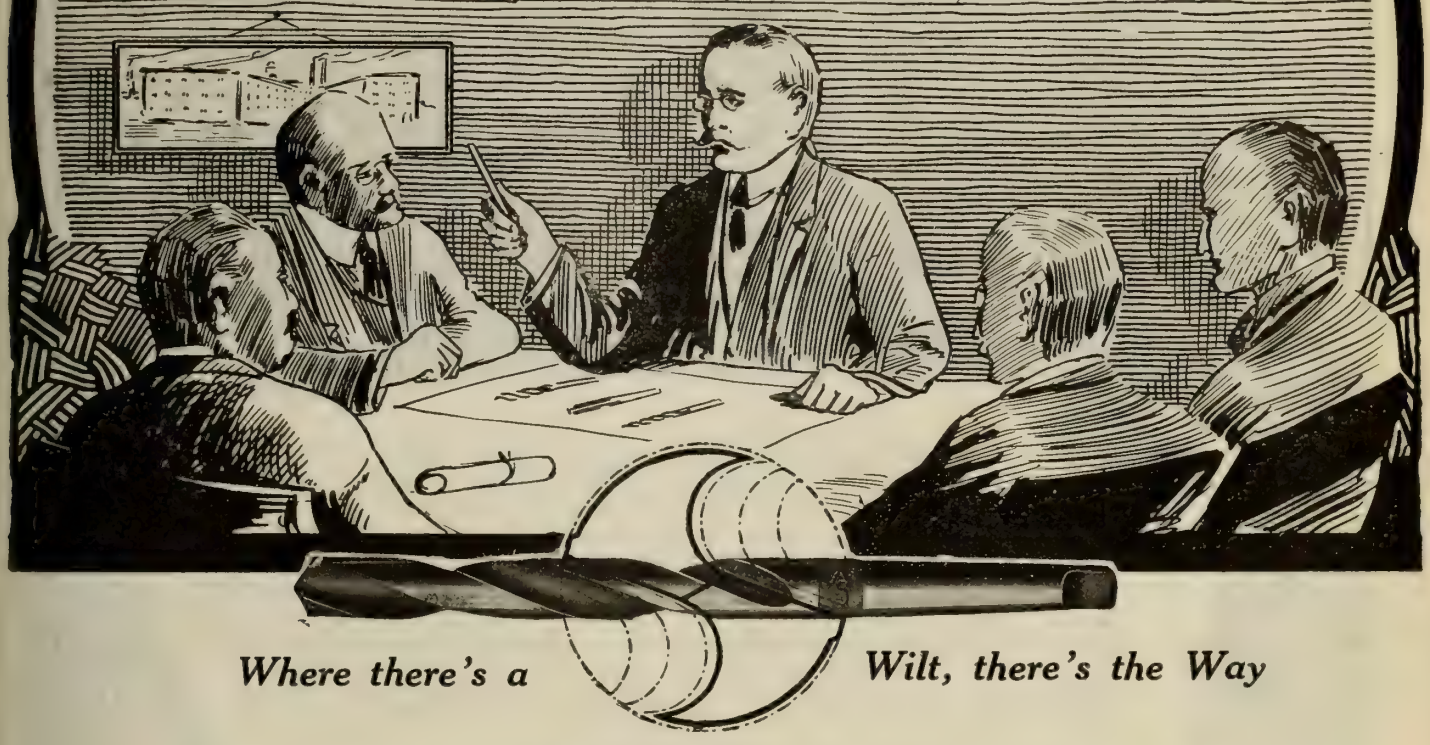
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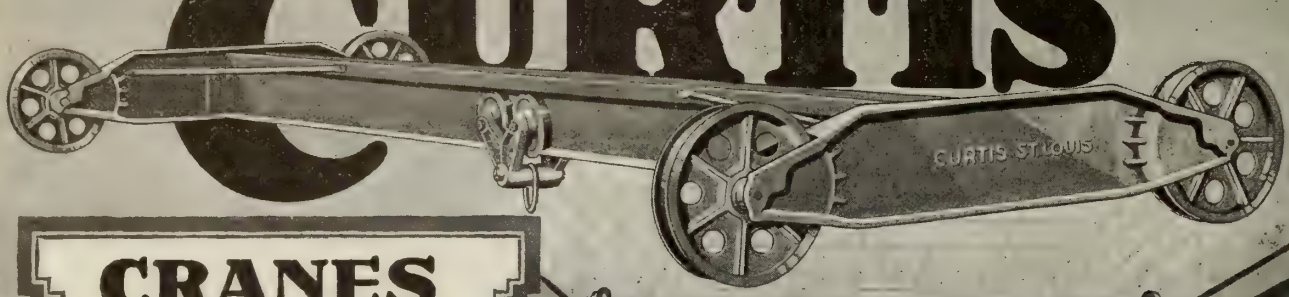
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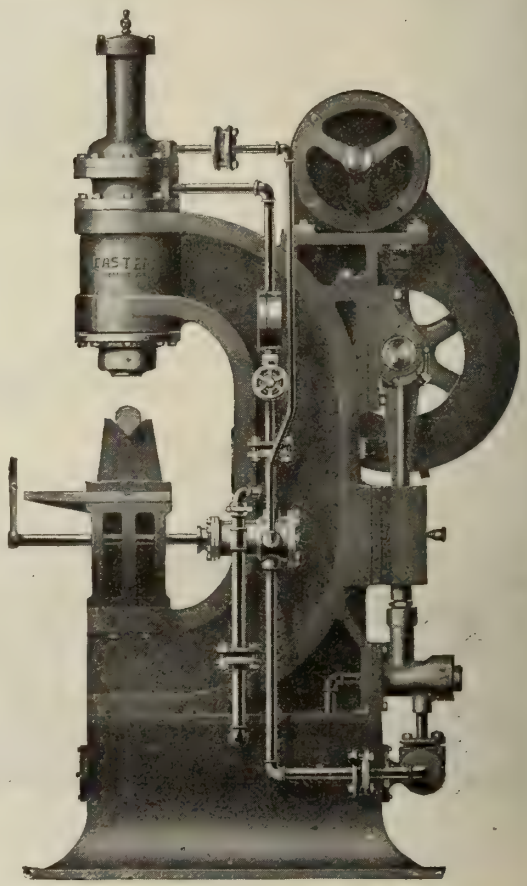
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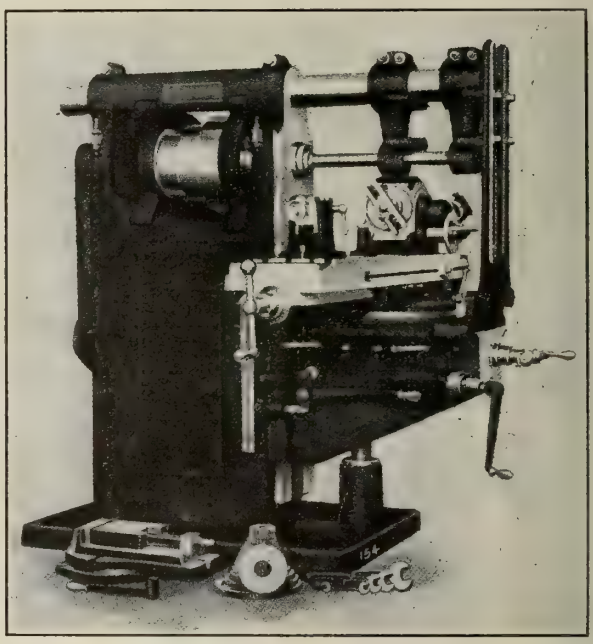
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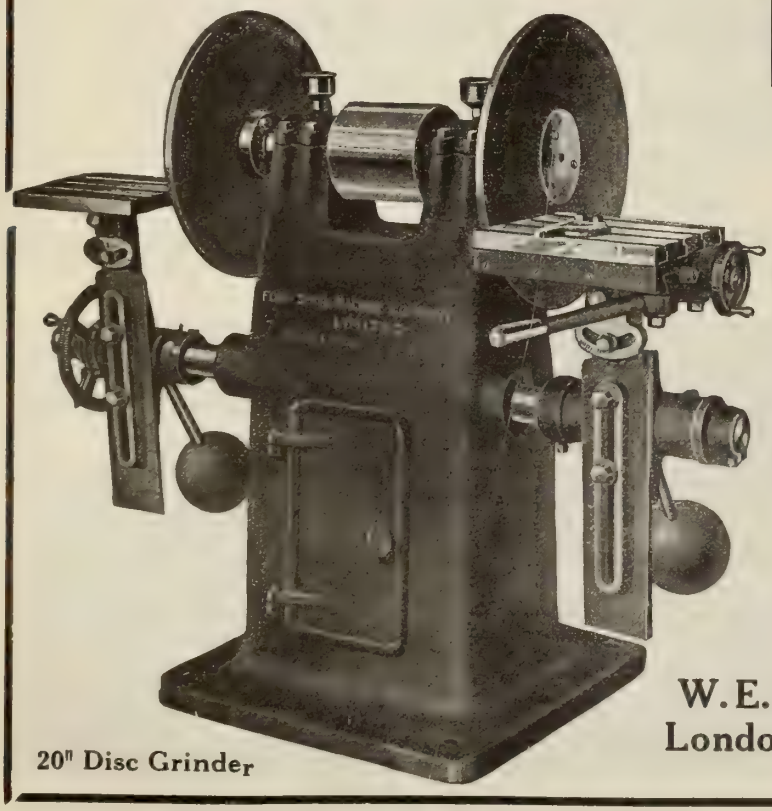
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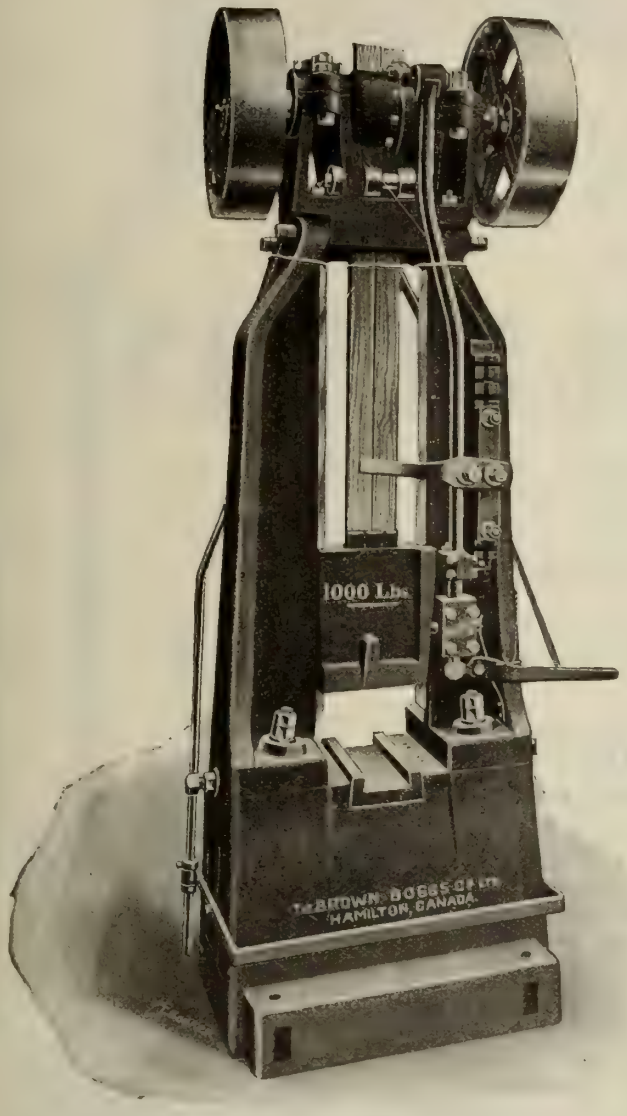
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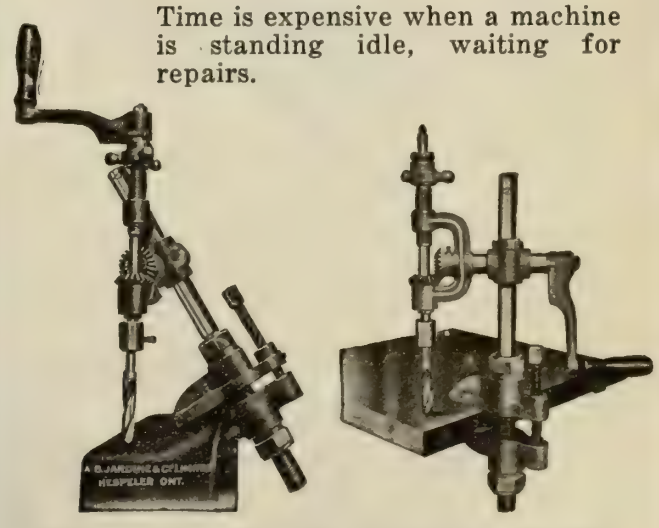
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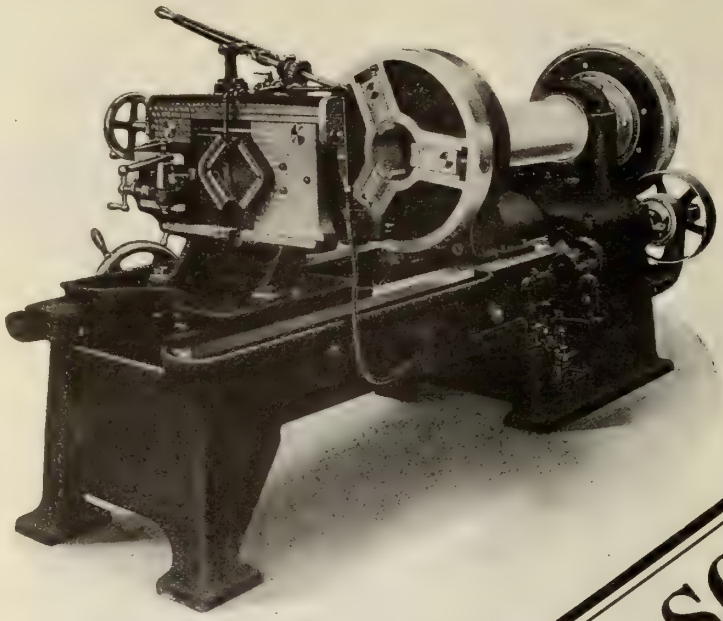
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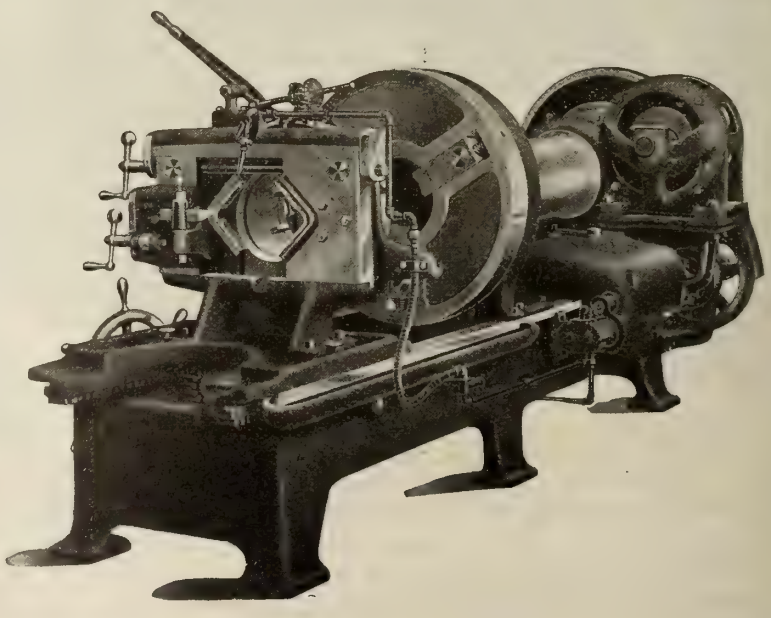
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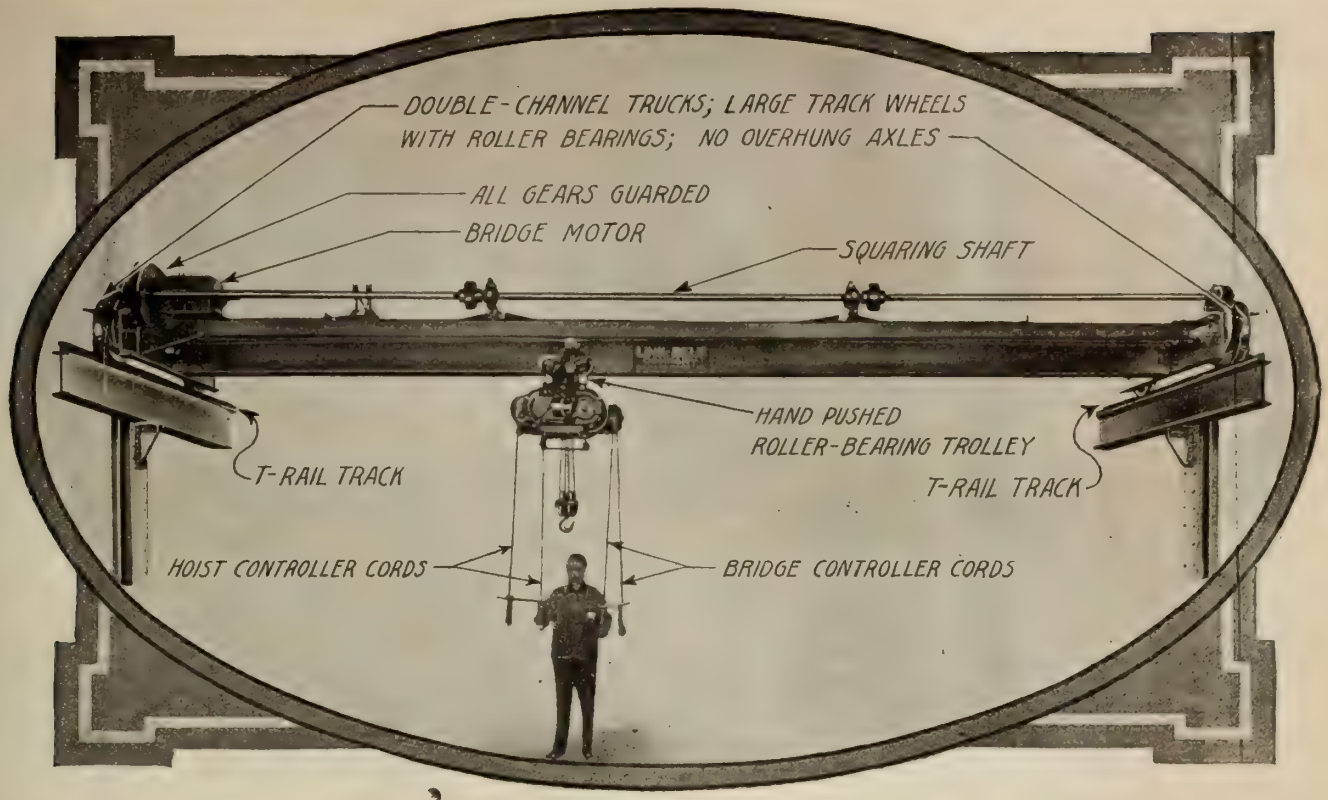
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5. Like our mono-rail electric hoist and other Link-Belt products, this crane embodies Quality, Reliability, Accessibility, and High-Efficiency.

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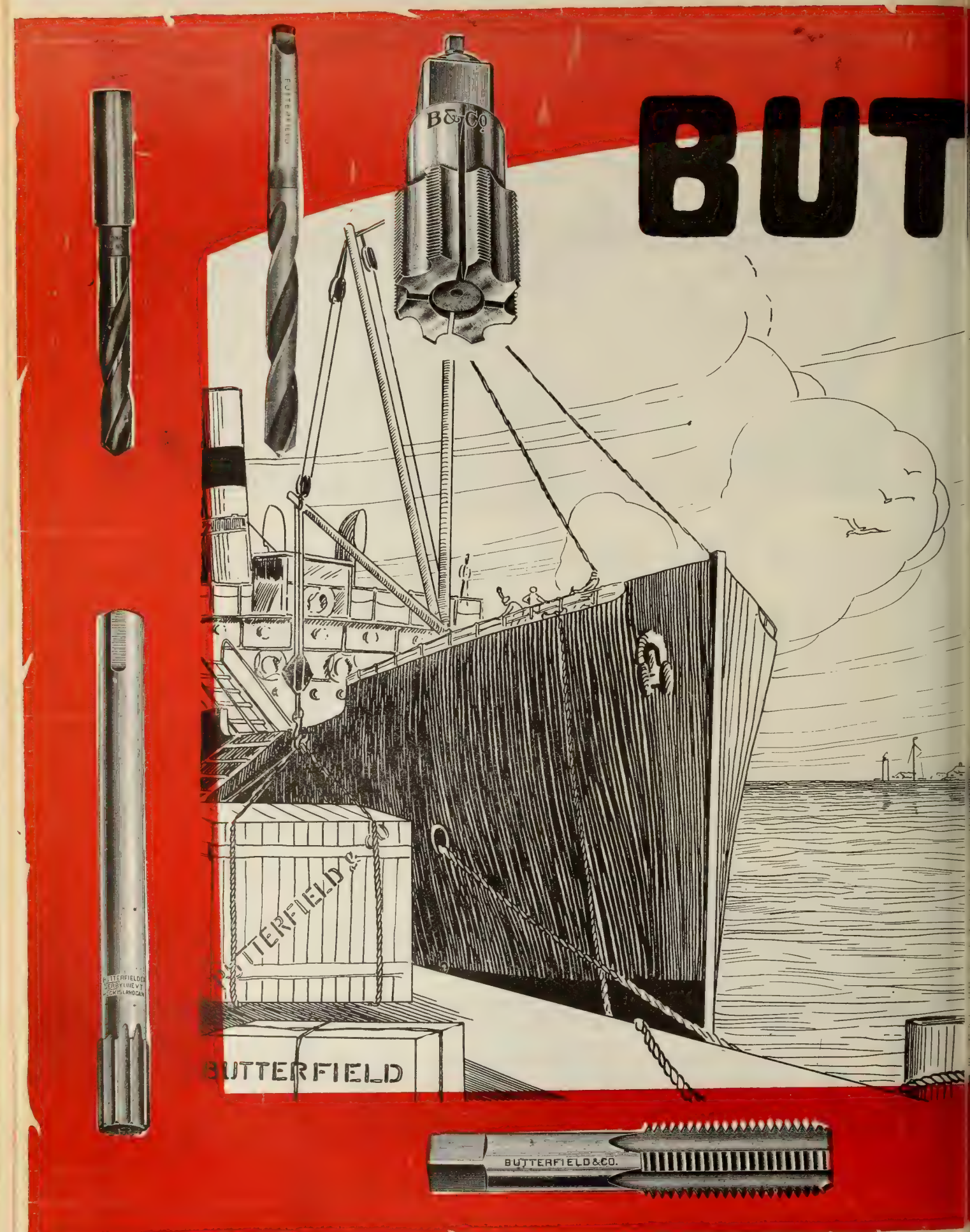
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TERFIELD

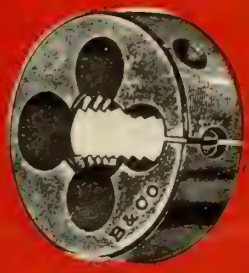
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with a sympathetic understanding of your needs puts the tried and proven Butterfield high speed and carbon twist drills, reamers, milling cutters, taps, dies and other celebrated, efficient Butterfield products within ready reach of all the world.

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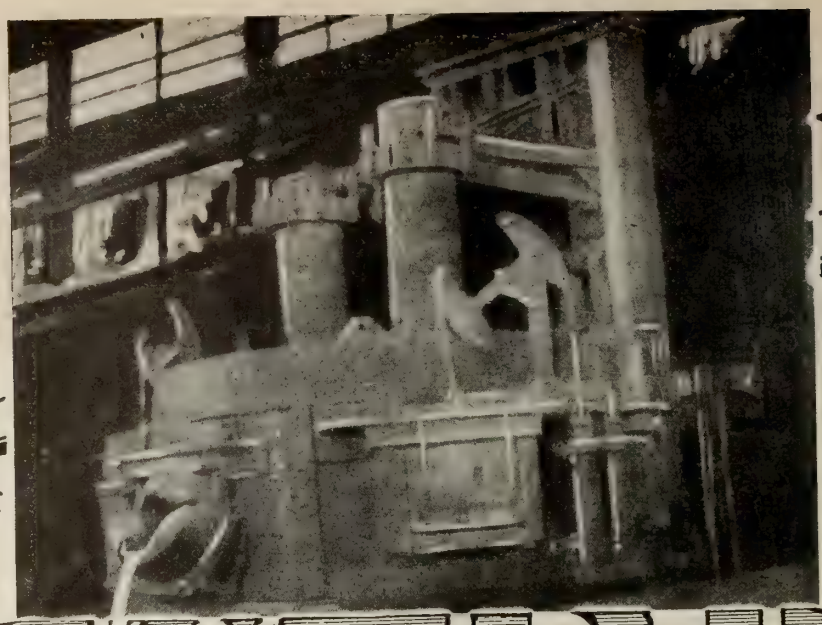












ELECTRITE

High Speed Steel

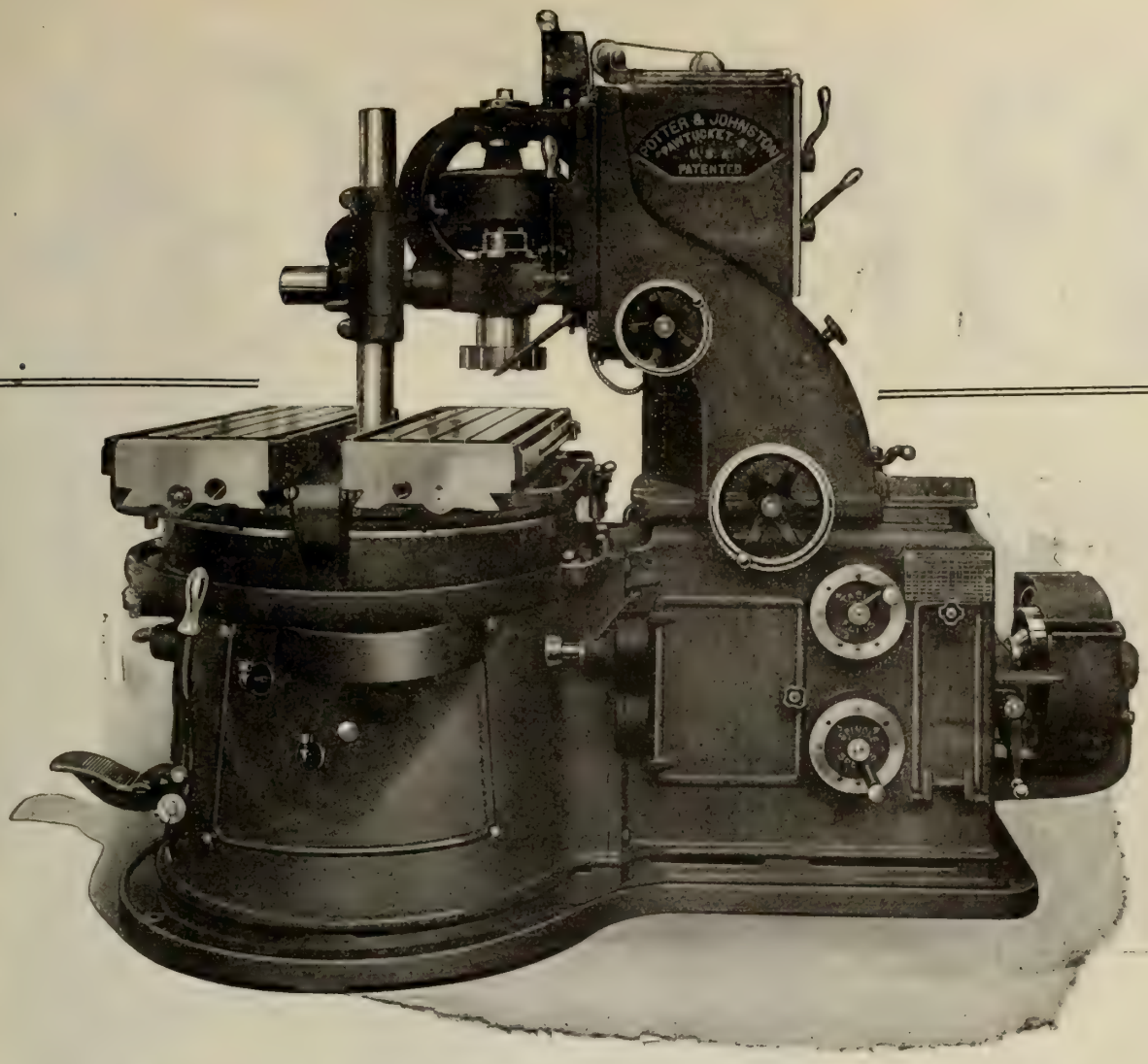
SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.
LATROBE, PENN.

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No Delay on a P & J

Absolutely no waste time. This P & J Automatic Milling Machine was made expressly to eliminate machine idleness between cuts. No lost time returning table by hand and removing finished work from vise or fixture. No delay brushing chips out of vise and inserting new pieces.

Keep two tables going at a time. Load up on one while the cutter is milling work mounted on the other. With the exception of 10 seconds for indexing table direct, bringing work into alignment with cutter, and advancing table — automatically — to cutting point—there's no lost time—no waste of power—big production—practically continuous milling.

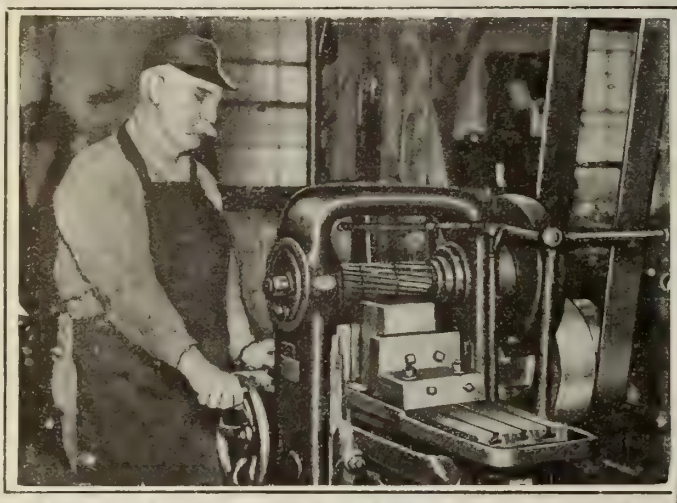
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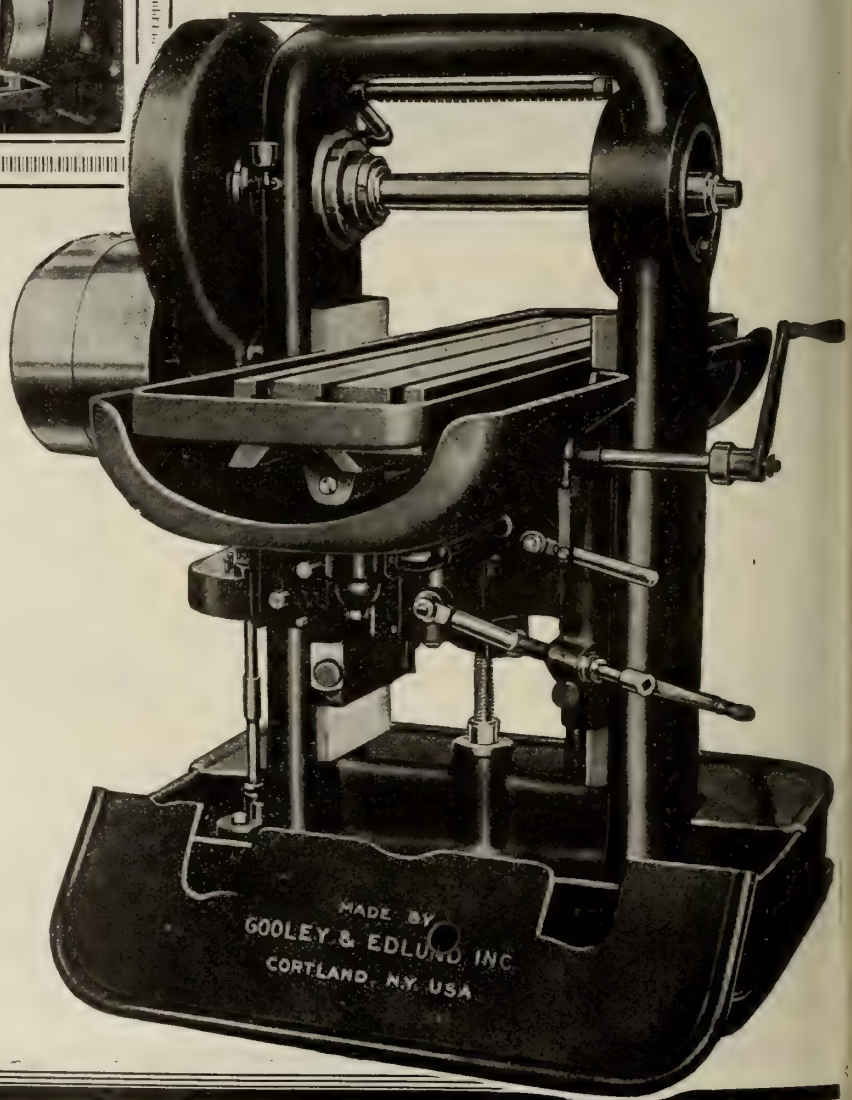
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BRIGGS MILLER

Keeps Five Die Sinkers Going





HERE you see the Briggs Miller Squaring Die Blocks, and it is working so fast it keeps five die sinkers going.

Some are new, squared from the rough; some are old, annealed, cut down and made over; some are oblong, some square, in sizes up to 9 inches. This Briggs Miller has been squaring blocks for four years; has never given any trouble. When cutters get dull the operator has another gang ready to go on with the work. Unusual rigidity accounts for Briggs' higher efficiency. Don't you think you could use this tool to advantage in your shop? Write for the details.

Gooley & Edlund, Inc.
Cortland, N.Y., U.S.A.

Garlock Walker Machinery Co., Ltd.
Toronto, Ont.

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LANDIS THREADS

Are True to Gauge



Varied Work—

High Speed—

And Every Thread Is Accurate

To cut accurate, finely finished threads of different pitch on varying diameters is simple—with a Landis Threading Machine and a Landis Die Head. The Noe-Wadlow Co., Philadelphia, Pa., investigated Landis claims a little over two and one-half years ago—and a Landis installation followed forthwith. This machine has worked steadily 9¾ hours a day, every day, ever since. It is used for threading pipe, bolts, truss rods and similar work. It cuts clean, accurate threads—cuts them fast, and cuts them at remarkably low cost. On the word of the company it has proved satisfactory in ever respect.

Landis machines are rigid, quick-acting, cost-saving threading machines—machines capable of standing continued hard service. Exceptionally long life, interchangeability of chasers, high-cutting speed, variable rake angle and absence of the need for annealing, hobbing and retempering, are a few advantages of the Landis chasers. If you are not satisfied with present cost and output, write us.

Catalog sent on request.

Landis Machine Company, *Inc.*, Waynesboro, Pa.

"WACO"

THE HIGH SPEED STEEL

MARSHALL, SON & BUNNEY
39 Richmond Street East TORONTO, ONT.

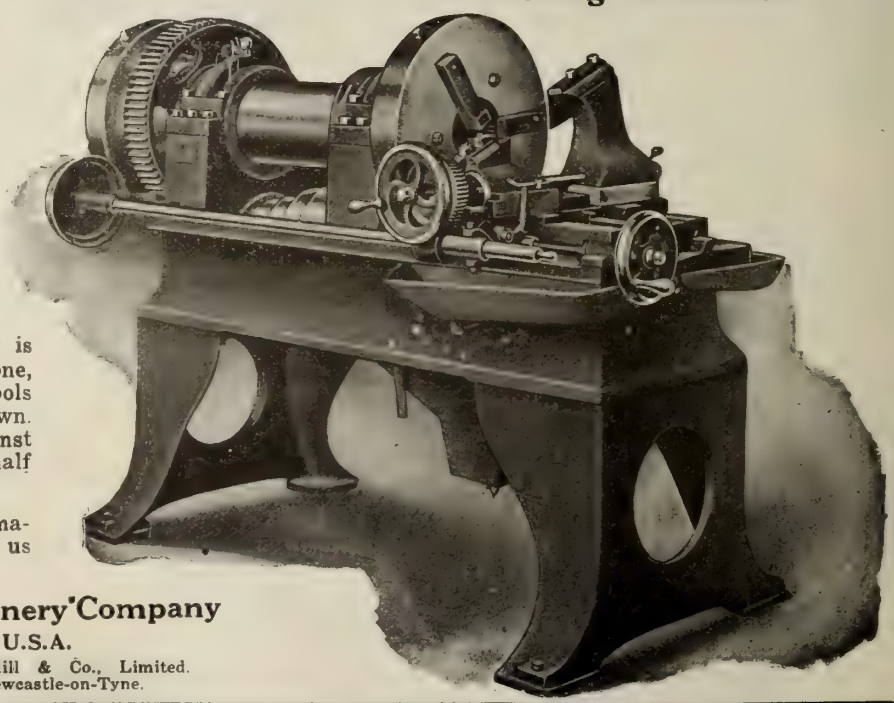
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IN STOCK

Cut Your Cutting-off Costs in HALF

HURLBUT'S

Patent Cutting-off and Centering Machines



TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.

Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and do twice the work.

You can't afford to be without this machine. It saves real money. Let us tell you more about it. Write!

The Hurlbut, Rogers Machinery Company
South Sudbury, Mass., U.S.A.
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The Babbitt Metal that's at the Front in Efficiency and Economy



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Manufactured by

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TORONTO - CANADA
HAMILTON WINNIPEG
MONTREAL VANCOUVER

You may not buy your machine tools on a beauty basis

But you're pretty certain to be suspicious of a machine which is ugly to the mechanic's eye.

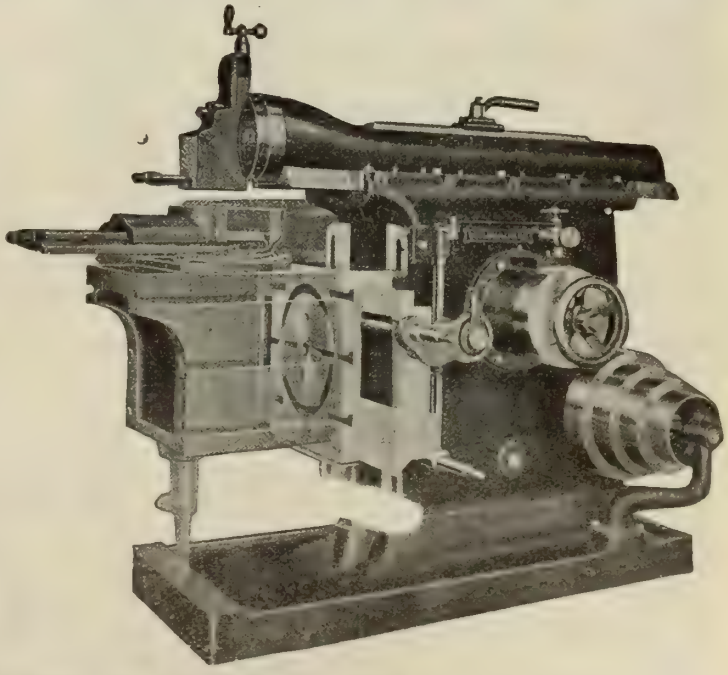
"When a machine is wholly right it is pretty sure to look right."—Professor Sweet.

The trained eye of the mechanic or the engineer rarely fails in its judgment. Heavy parts look awkward; light parts look weak; incorrect proportions look ugly; unnecessary parts look cheap.

"To be good, a design must be consistent."—Professor Sweet.

Designed by specialists in machine tool design, the Milwaukee Shaper is proportioned to be wholly right for its work. The machine is a beauty and we are proud of it. It's an indication of the quality of the design.

Literature describing this machine in detail, and any other information we can supply, is yours on request.



MILWAUKEE SHAPER CO.

1029 Coldspring Ave. **Milwaukee, Wis.**

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Greenfield



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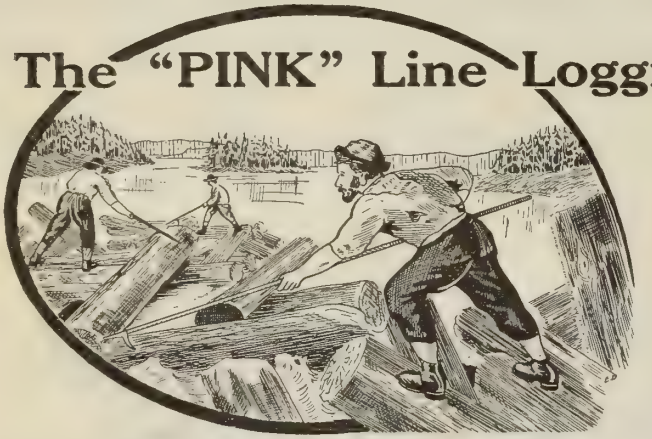
UNIVERSAL AND TOOL GRINDER

The Greenfield is equipped with all attachments for the grinding of milling cutters, reamers, taps, lathe centres, etc., and capable of handling all this work with the accuracy and convenience essential in the modern tool room.

The Greenfield is a simple necessity in the tool room for routine grinding work, but has a versatility outside this line that is astonishing. It is truly universal and handles all varieties of cylindrical, internal and surface grinding within its capacity with a consistent accuracy and finish that adapts it to the making of intricate jigs and gauges.

Greenfield Machine Co.
GREENFIELD, MASS., U. S. A.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
PEMBROKE, ONT., CANADA

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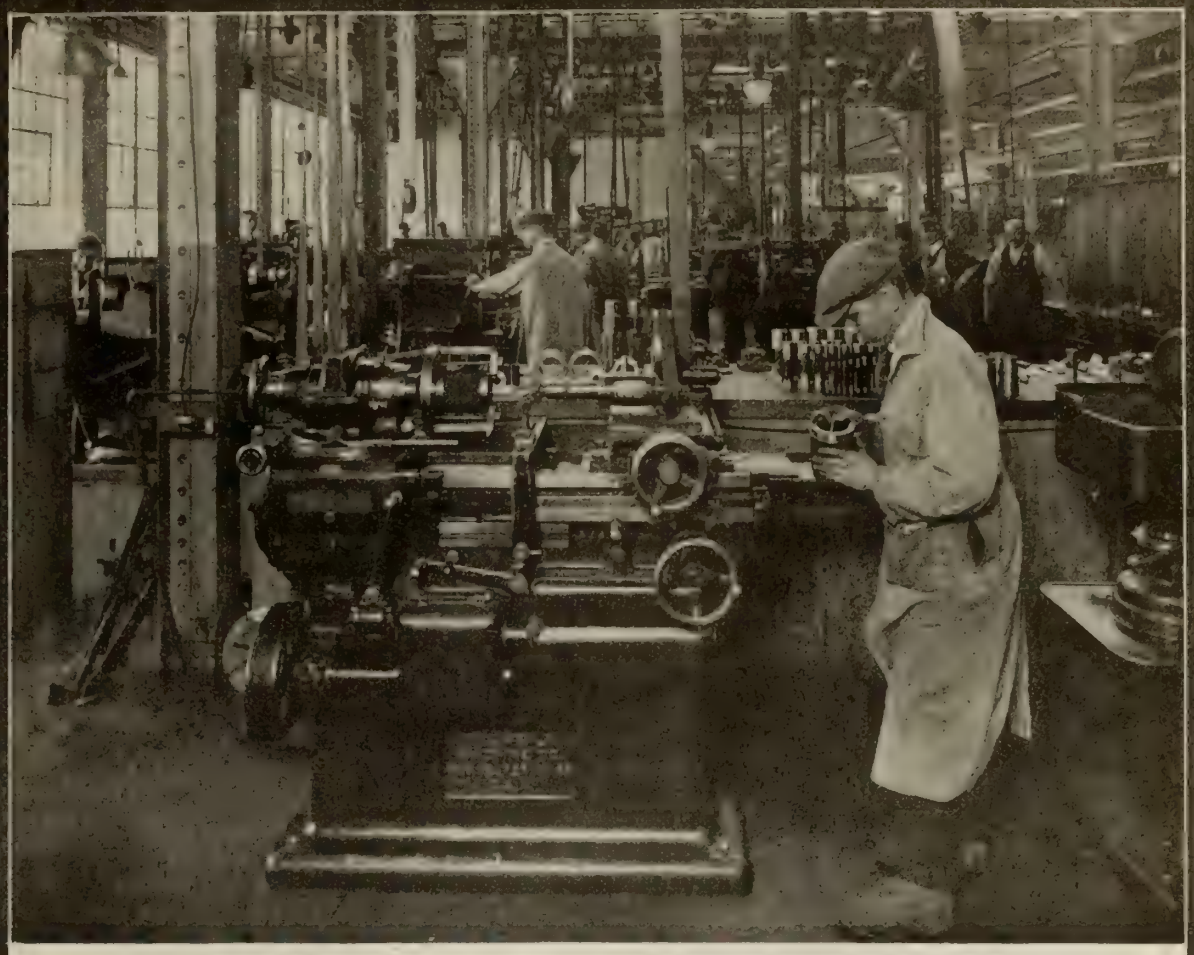
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All Tool Room Work Centers on a Heald No. 70 Internal Grinder

The foreman said, "We could not build tools, especially gages, without that grinder. It is practically indispensable. For instance, nearly all tools are hardened and require extreme accuracy, that's where the Heald comes into play. It is built stiff and rigid, will grind work that other internals fall down on. Not a chatter mark shows and you get a mirror-like finish to any desired correctness. Then, again, it is so convenient to change wheel-heads without bothering about adjustments or speeds, and the punishment we give them would ruin the ordinary head. If you want an INTERNAL GRINDING MACHINE, not a 'temporary polisher,' get a Heald."

Heald No. 70 Internal Grinder has not only been found to be an absolute necessity in this tool room, but is acknowledged the most useful and used of any machines in the department.

The work head can be swiveled to 45 deg. either side of the centre. This is particularly advantageous for taper gages.

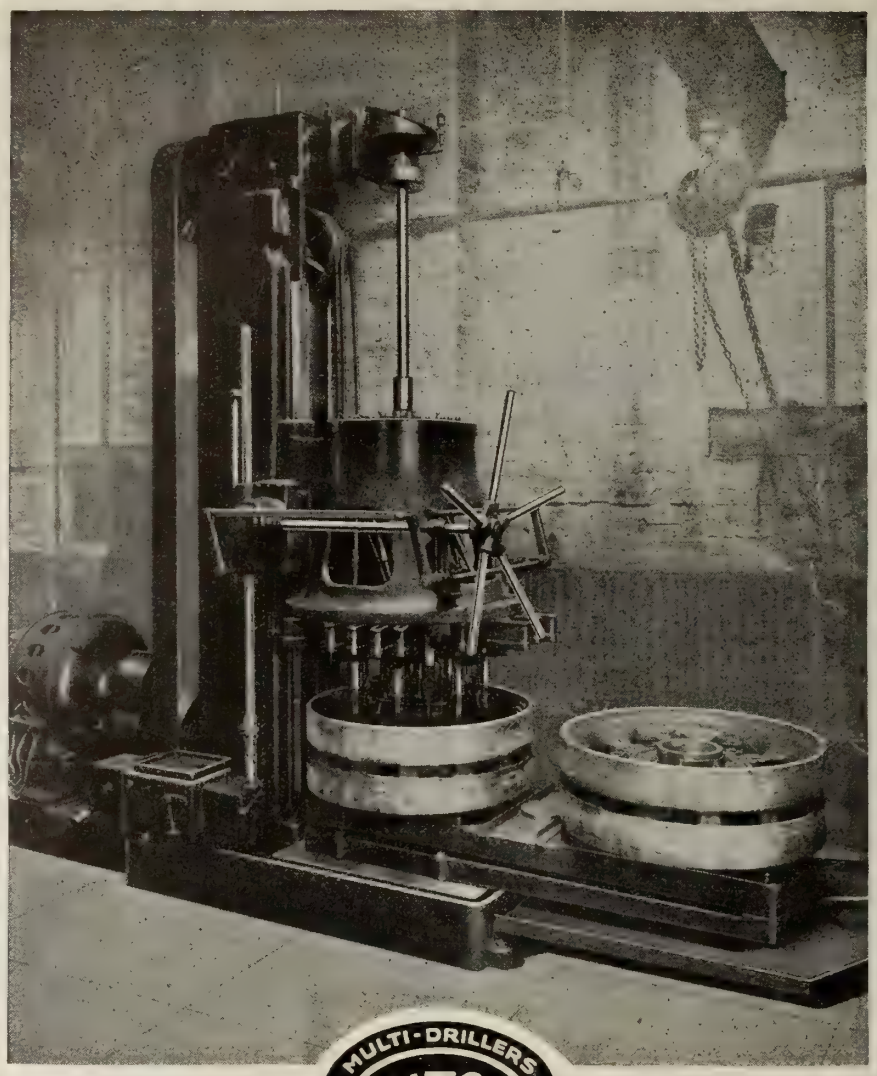
A radius truing device can be secured for this machine which will either convex or concave the wheel, as desired for curved surfaces.

Every machine is equipped for either wet or dry grinding and has an 8-in. draw-in collet chuck.

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WORCESTER, MASS.



MULTI-DRILLERS
NATCO
MULTI-TAPPERS

The "Hole" Story in one word

26 Holes in Each Wheel—50 Sets of Wheels in 24 Hours

LET Mr. Klinger, Chief Engineer of the Dayton Steel Foundry Company, tell you about it, for it was done in their plant. "On Rear Truck Wheels, we drilled at one setting seven 9-16 in. holes through the spokes and twelve 33-64 in. holes in the hub flange. Then, without any change in the drills or jigs, the wheel was turned over and seven 9-16 in. holes were put through the spokes from the opposite side. The drill was kept practically in continuous operation, turning out 50 complete sets of wheels in 24 hours."

The machine doing the work is the Natco No. 30 High-Speed Multiple Drill, with motor drive and turn table. This machine has a constant speed drive, six changes of gear feeds, six changes of speeds, centralized front control, and our patented Independent Change of Drill Speeds—all very important factors in getting maximum production.

NATCOS are built in 11 sizes ranging from 2 to 72 spindles.

We also design and build jigs and fixtures for use in connection with NATCO Multi-Drillers.

The National Automatic Tool Company

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WHEREVER men work metal to the finer limits of precision, machinists know and favor Starrett Tools.
Their reputation for accuracy, utility and quality has grown through forty years of service in the interests of better, truer work.

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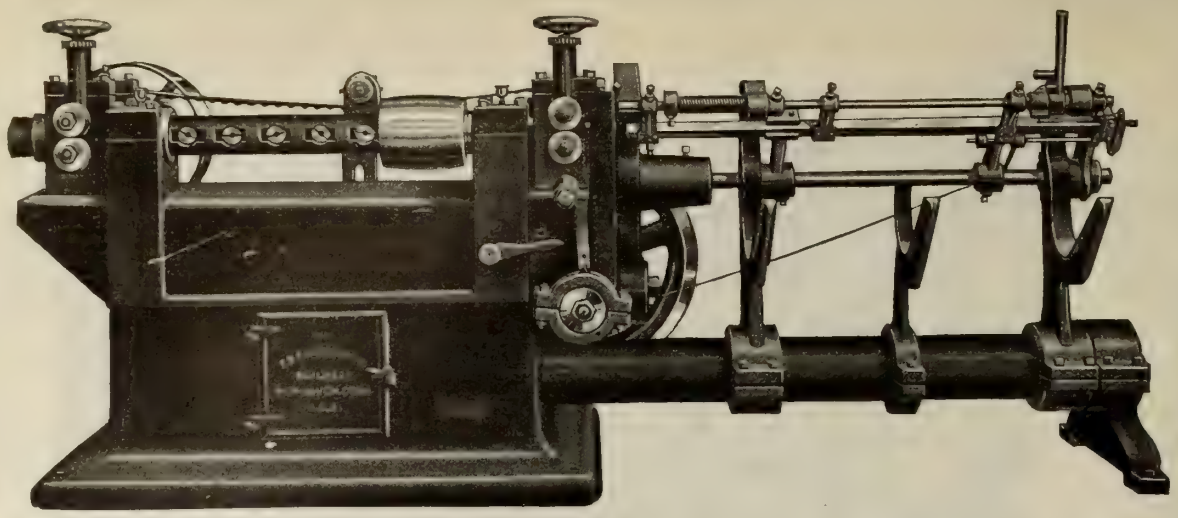
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The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
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STARRETT TOOLS

Starrett Tools

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Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

Catalogue tells more about them, and we will be glad to send you a copy.

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ALSO MAKERS OF STRAIGHTENERS FOR SQUARES, HEXAGONS, FLATS, ETC.

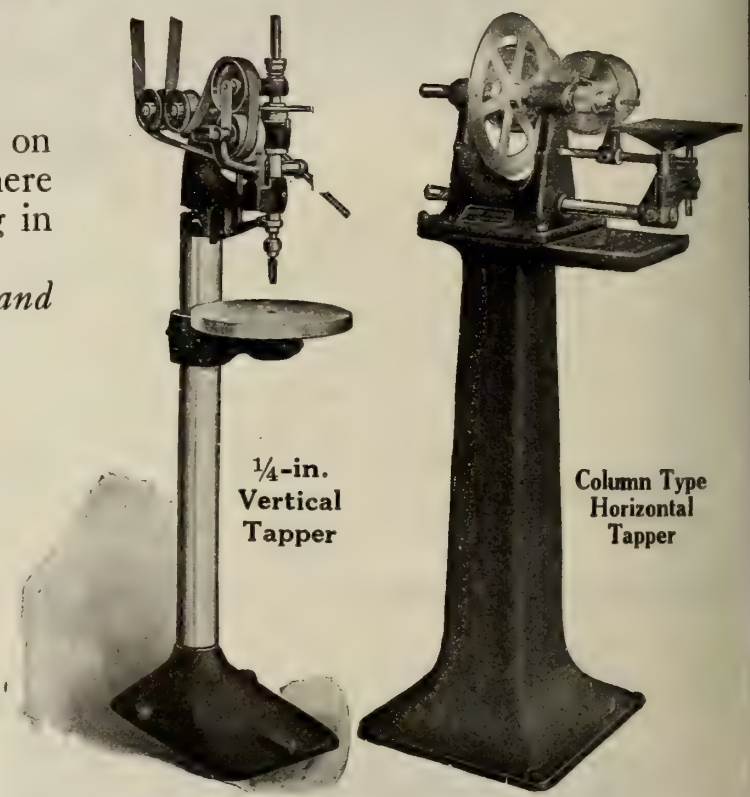
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Save Tap Breakage

The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on 5/8-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.



¼-in. Vertical Tapper

Column Type Horizontal Tapper

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EVERY skilled workman looks with pride upon his best tools. Skilled mechanics of today ask for tools made of "Red Cut"

Each passing year sees Red Cut more firmly entrenched in the hearts of the men in the shops.

Red Cut is true to its name—superior in service—the best for all machine work.

"Red Cut Superior"

The Nationally Known---First Quality

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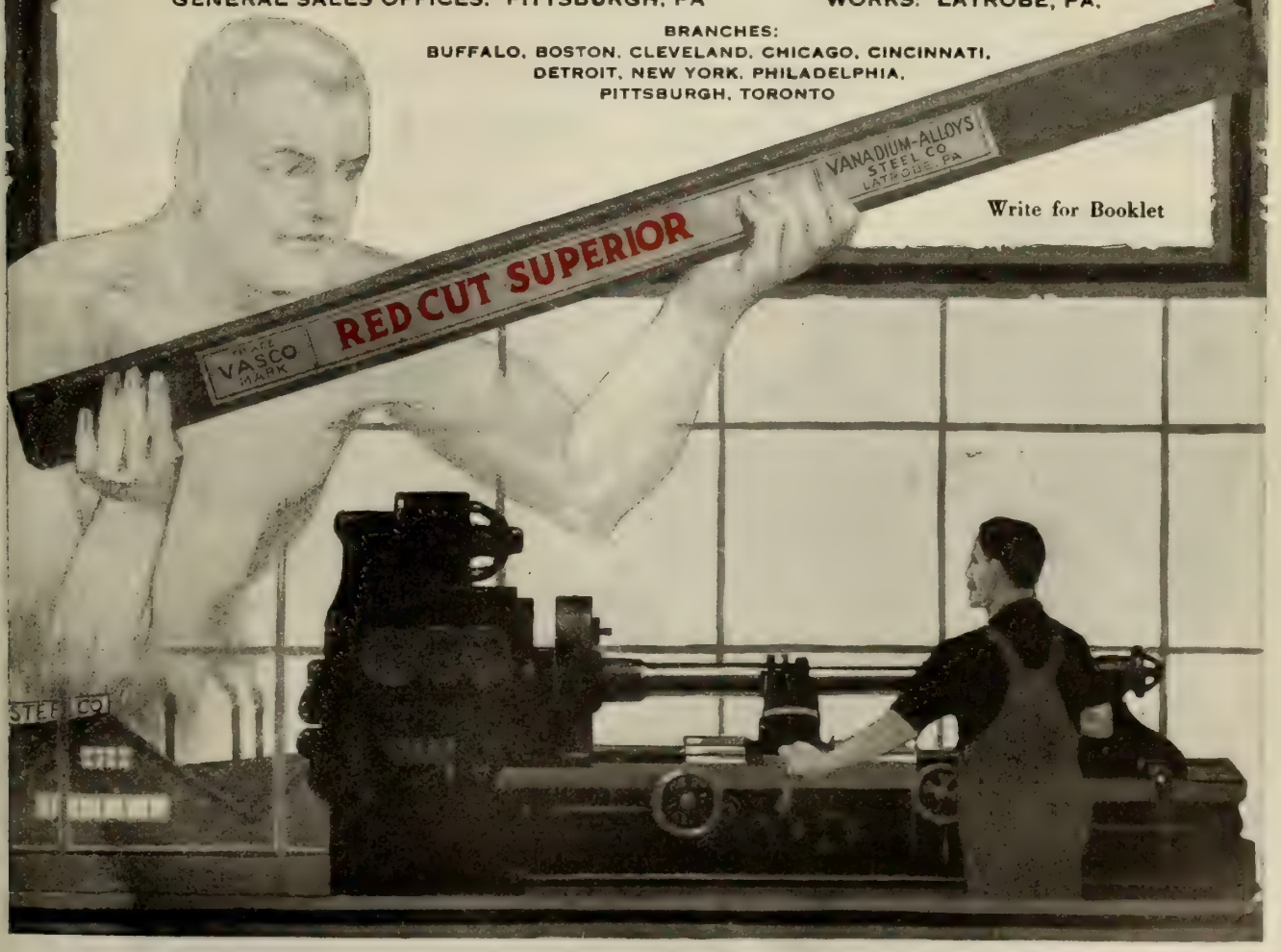
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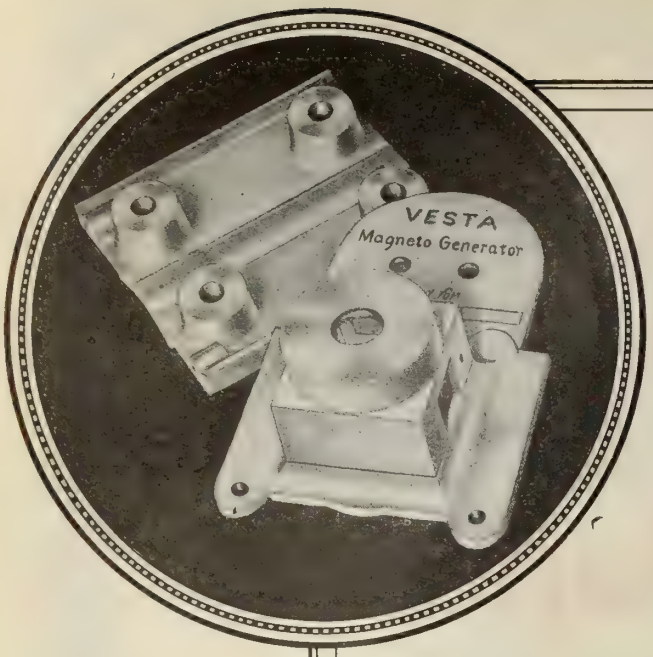
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Even the simplest and most insignificant machined part, if made in appreciable quantities, is worth while to die-cast. And the complicated shape, which needs accurate finishing on many faces and is often impossible to machine in one piece, can be die-cast as a unit with a great saving in time, labor, and equipment.

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Drive your sawing machines to the limit. They'll stand it if you fit them with



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The design of this inserted tooth saw gives the greatest possible number of teeth, with the result that material can be cut with greater speed, as the rigid construction withstands heavier feeds.

For fast cutting and long life specify Hunter "Duplex."

Hot Saws, Friction Discs, Solid Blades made from Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines, Inserted Tooth Grinders. Hardened Steel Specialties, etc. Write for prices.

Hunter Saw & Machine Co., Pittsburgh, Pa.

THE MASTER METAL THE MASTER METAL

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Not a steel—but its master

There is no iron in Stellite—nothing to burn or crumble under high speeds and heavy cuts.

Stellite lathe tools will take deeper cuts at a higher speed, and will go longer without regrinding than the best high speed steel ever made.

Stellite has revolutionized the art of cutting metals. It speeds production and cuts costs. It is a vital factor in manufacturing.

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We will send a demonstrator on request.

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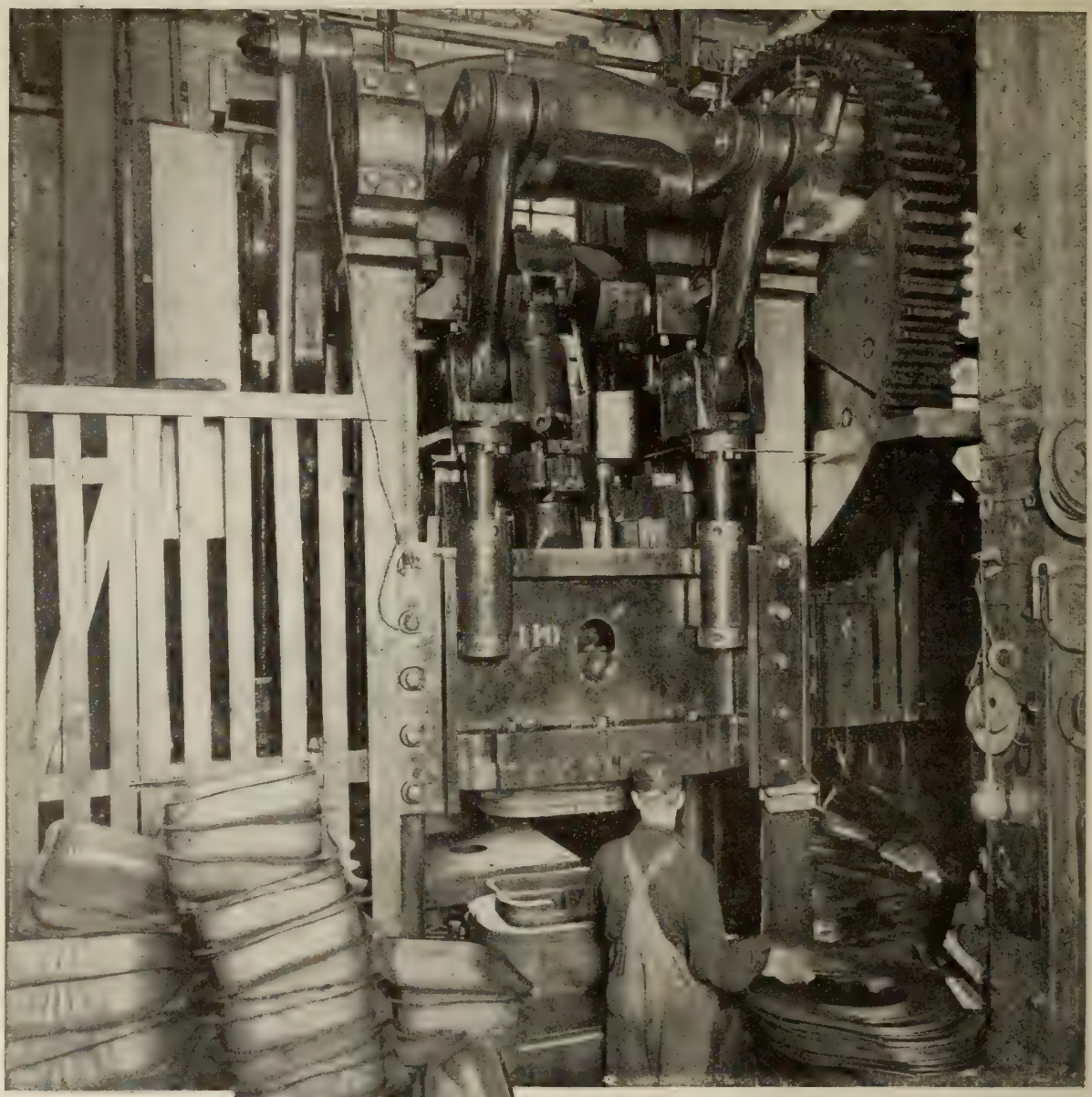
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THE MASTER METAL THE MASTER METAL

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Roasters 18 x 12 x 4½ deep from 24 gauge pickeled and annealed steel at 350 per hour.

Sold in 1898

A "Bliss" No. 14 Toggle Drawing Press. It is here being run at 7 strokes per minute, the operator catching 85 per cent. of the strokes.

The owners bought their first "Bliss" Press in 1871, and to-day our records show the purchase of 66 "Bliss" presses of various kinds. It is neither our longest nor greatest record for a single customer, but it has been maintained with characteristically mutual respect and satisfaction.

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E. W. BLISS COMPANY

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No. 54

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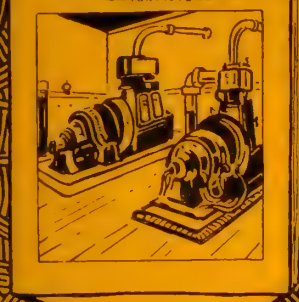
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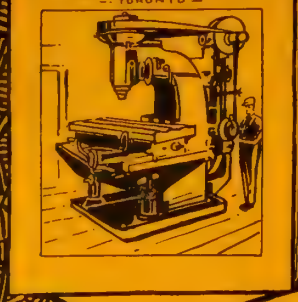
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10 to 24 inches
Steel or Cast-Iron Bodies

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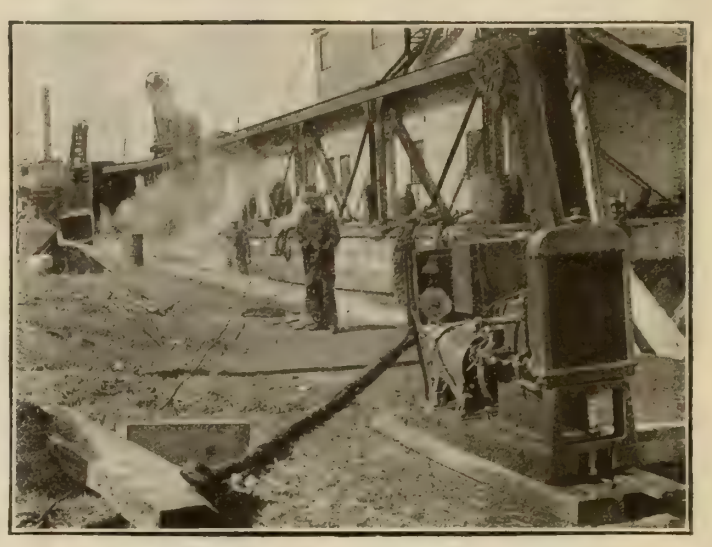
Let us be Your Salvage Department

THERE is one sure way to find out whether or not the Lincoln Arc Welder will pay for itself in your establishment.

The next time a casting becomes broken, a forging defective or any stamped piece of equipment worn, get in touch with us.

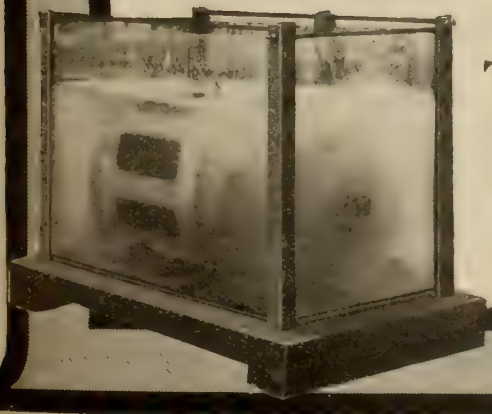
Just put it up to us to show you whether or not it can be saved from the scrap-heap!

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Outfit on welding job—Dominion Dredging Co., Port Dalhousie; 150-ampere machine, direct-connected, gasoline-driven

Our Welding Plant at the foot of Jarvis St. is perfectly equipped to handle all welding jobs with exceptional care and promptness of delivery. 'Phone or write us your requirements to-day.



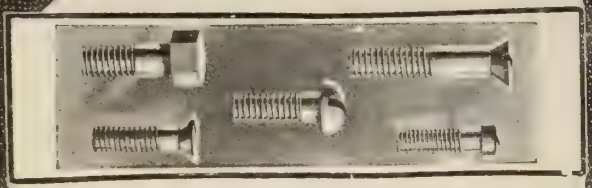
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of Canada, Limited

1110 Temple Building, Toronto
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Wood Screw Making Machinery

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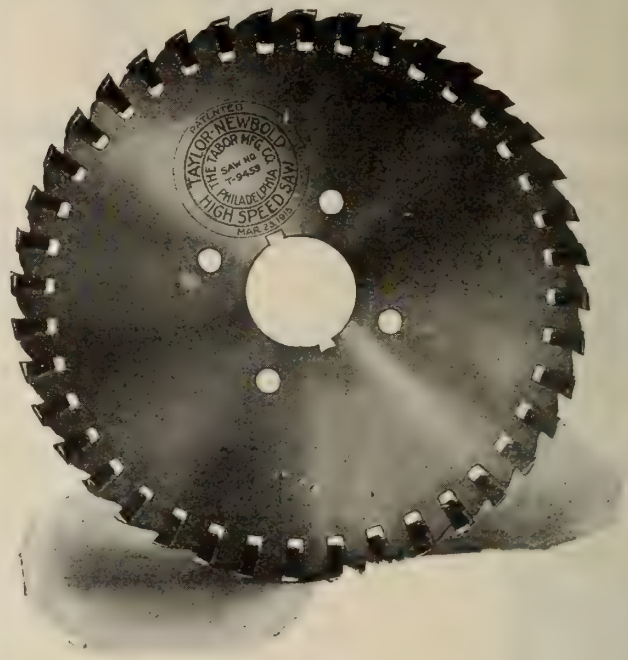
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Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25%; a different method of molding them might double your production at no increase in molding cost. *We can advise you* and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

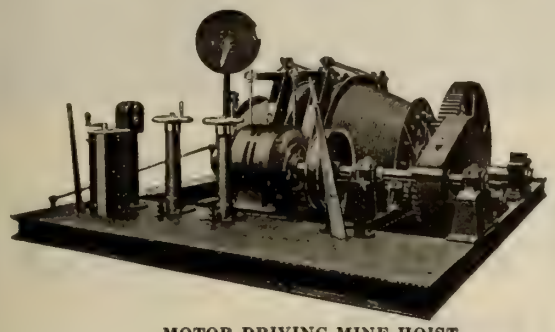
We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us.

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"Bending Machines"



BEND PIPE COLD

ELIMINATE FRICTION

2 New Models

"Wonder" Pipe and Tube Bending Machines (pat.) electrically operated to bend from 1" to 8".

We also manufacture
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Hand operated to bend from ⅛" to 6".

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Bars, Angles, Channels, Beams, Shafting, Screw Stock, Cold Drawn Flats, Squares, Hexagons, Black and Galvanized Sheets, Plates, Box Strapping, Bolts, Nuts, Washers, etc. Wire Rope, Guy Wire.

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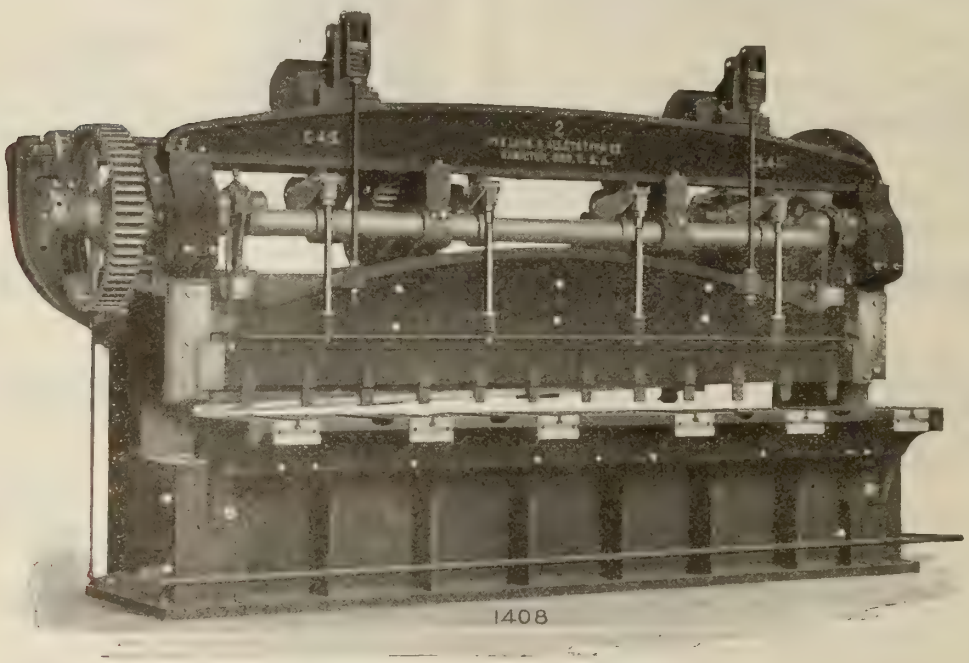
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PUNCHING and SHEARING MACHINERY

means a big saving to your plant in time and labor



Size No. 2, Gate Shear

(144 inches wide between the housings, 5-inch throat, motor-driven)

The L & A Quality Line includes Alligator Shears, Angle Iron Shears, Bar Iron Shears, Billet Shears, Squaring Shears, Beam Punching Machinery, Boiler Punches, Disc Punches, Horizontal Punches, Multiple Punches, Structural Punches, etc.

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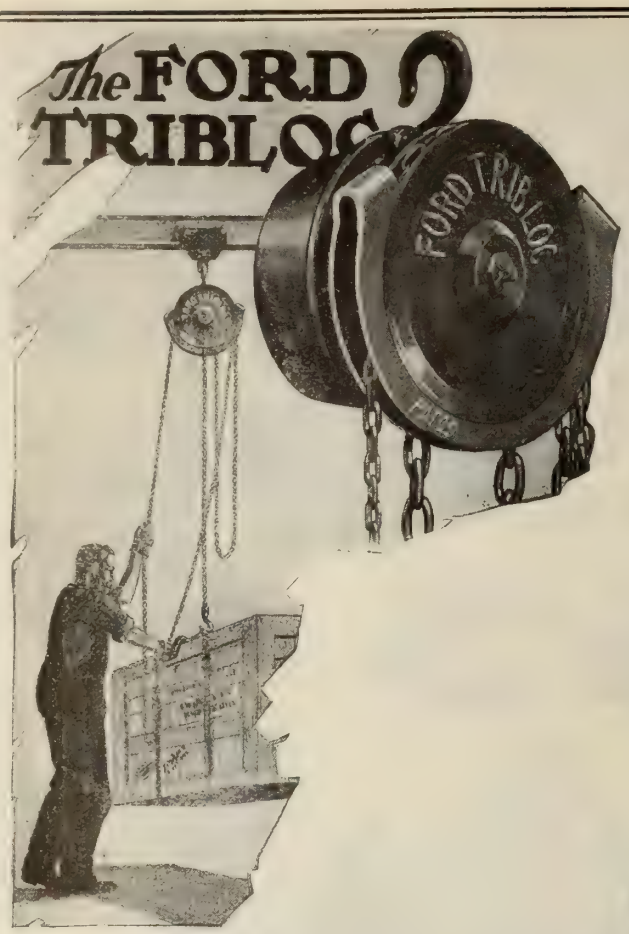


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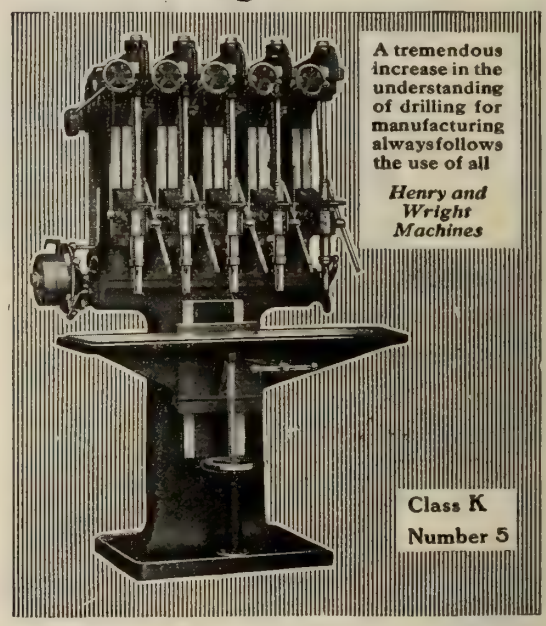
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17 Black Degrees 6B softest to 9H hardest and hard and medium Copying All perfect

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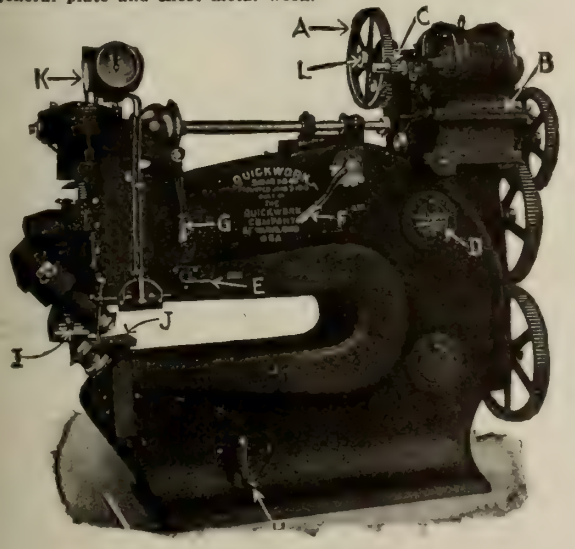
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MADE IN 7 SIZES.

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



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SAVES 50% TO 90%

Eliminates Oxyacetylene Cutting and Plate Planing.
Write for Catalogue No. 60.

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A small machine takes up less space, requires less power, is easier to operate and is more accurate.
The Paramount Miller of its size. Drop us a line for full details.

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We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

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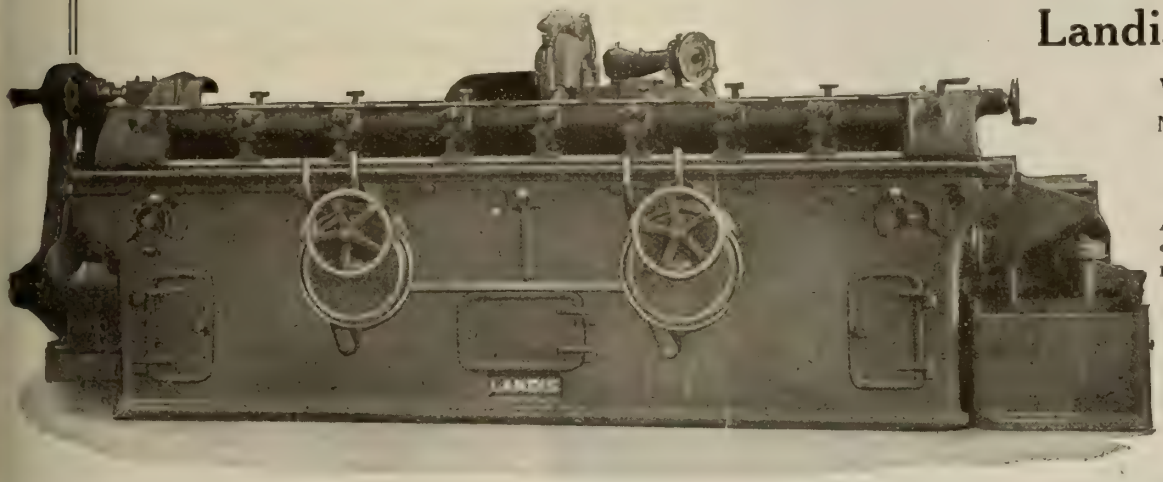
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The Landis Heavy Duty Plain Grinding Machine

A tool backed by a well-earned reputation for sturdy accuracy and big production.

Submit your prints and let our engineers tell you what this machine can do, and where you can see it in operation.



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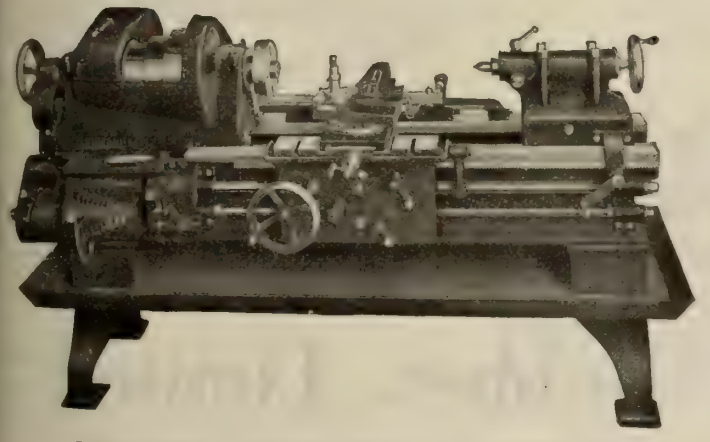
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Will Put the Same Degree of Efficiency Into *Your* Shops as They Have in Many Others



TWO SIZES—16", Swing 18¼" and 18", Swing 20¼"

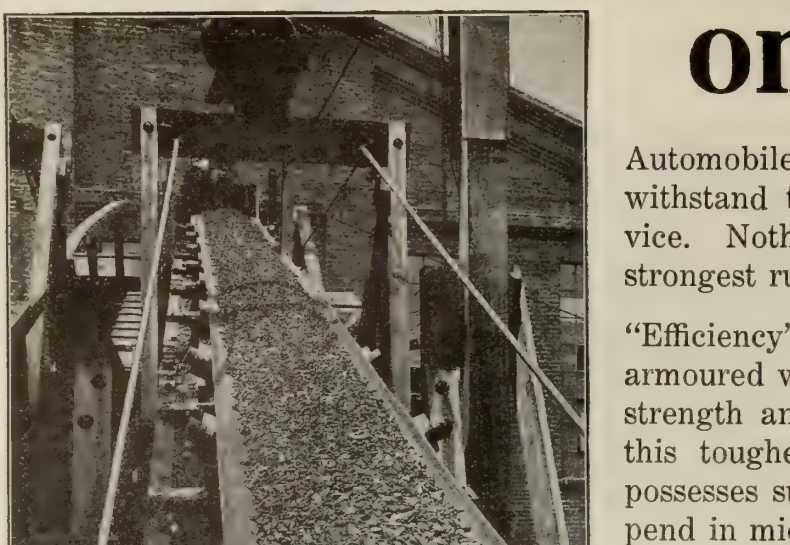
Because they are constructed "right" of the best material, workmanship and design, and therefore are adaptable to all conditions, whether it be work requiring accuracy to the highest standards or for the heavy duty where power, strength and rigidity are required.

Convince yourself of these facts! Let us send you complete specifications of this superior lathe and the names of some of the larger concerns who are using "LEHMANN LATHES" for better results.

We know you are interested, so don't put off writing us. Do it to-day. Now!

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Automobile Tire Treads encounter and must withstand the most abusive, abrasive service. Nothing but the very toughest and strongest rubber stock will stand it long.

"Efficiency" Conveyor Belts are heavily armoured with Tire Tread Rubber of great strength and elasticity. A single cord of this toughened rubber, one inch square, possesses sufficient strength to readily suspend in mid air a big load of hay and will stretch several times its original length without breaking.

"Efficiency" Conveyors, like highest grade Auto Tires, are made for the most exacting service.

Though of immense strength they trough perfectly, and, of their own weight, automatically conform to the idlers.

Other very important features in their construction we are unable to detail here, but they represent economy in operating cost for you. When in need of Conveyor Belting let us send a representative to demonstrate them.

Rubber Belting for Every Purpose.

Rubber Goods of all kinds for Every Mechanical Service

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Clipper Belt Lacer Co.
REGISTERED TRADE MARK

SAVE TIME

Machinery cannot be permitted to rest. The demand for manufacturers is just as insistent in Canada now as at any time in past capacity taxing years.

The Clipper Belt Lacer
Laces a Belt in Three Minutes

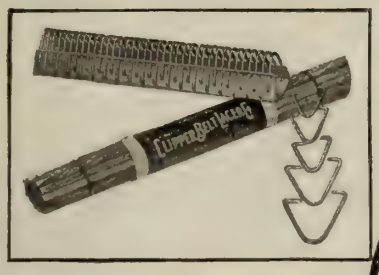
The Clipper Belt Lacer not only performs the operation with lightning speed, but it does the job well. It makes a joint that is smooth, flush on **both** sides, hugs the pulley and is durable. It is so simple that any factory workman can use it. Shop men everywhere favor "Clipper" belt lacing because the joint is safe.

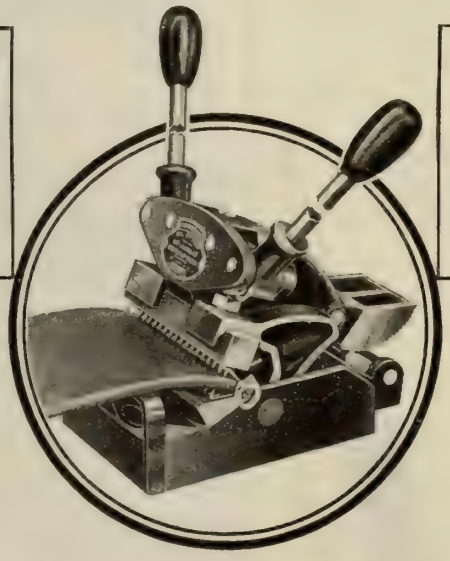
The cost of "Clipper" lacing is a mere trifle, its saving in efficiency and continuous production great.

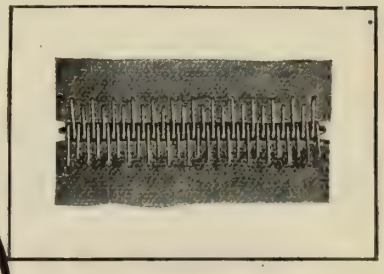
The "Clipper" is placed in any plant for a 30-day trial at our expense. It is permanently guaranteed.

"Clipper" tools and hooks are now sold by mill supply houses everywhere. We have a good proposition to offer dealers at points where we are not now represented.

"The Connecting Link Between Power and Production"







"Clipper" hooks are made from steel wire of great tensile strength. Actual tests have proved that each hook will stand a pulling strain of 60 pounds, equal to over 400 pounds per inch of belt. There are five sizes.

"Clipper" hooks are pressed into the belt as shown by the joint here illustrated. No material is cut away — no big holes are punched and, in the case of fibre belts, no strands are cut to fray later on.

Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U.S.A.

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Only workmen recover with a rest; tired files must be discarded.

Better buy new files than "botch" a job and waste expensive labor-time with files that have ceased to be efficient.

Famous Five Files do not "tire out" till they have given you your money's worth in efficient service. Special steel, accurate cutting and thorough hardening prolong their "endurance."

They are:

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Give Your Time to the Development of a Safer Plant

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For chippers, grinders, welders and others.

ADJUSTOGLASS GOGGLES with Protexal reinforced lenses will not shatter; will keep your indispensable men on the job; the most popular goggle made; no assorted sizes required.

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Made of rubber, leather and asbestos.

Fire, water and acid-proofed duck material.

A garment for every worker —leggings, gloves, aprons, suits.

Every article guaranteed.

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If it's for Safety, we sell it.





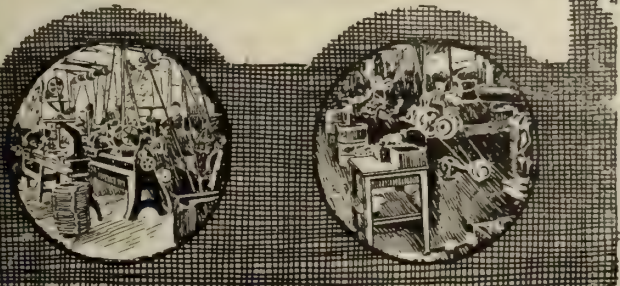
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Genuine Arctic Metal

will give satisfactory results in the most troublesome bearings. Will last longer and save many times its cost in repairs. Will reduce your overhead expense.

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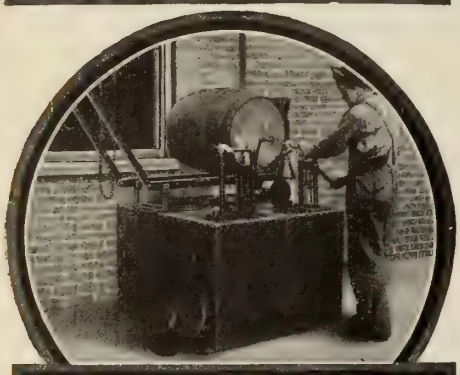
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Pittsburgh, Pa. U. S. A.

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With Bowser Equipment One Man Does the Work with Less Time and Effort —and Without Loss

STOP WASTING LABOR IN HANDLING OILS

Do away with the back-breaking, disagreeable labor in storing and handling oils.

With Bowser Storage Equipment the heavy work is done mechanically—there is no wasted energy—all oils are easily and quickly put into storage by gravity.

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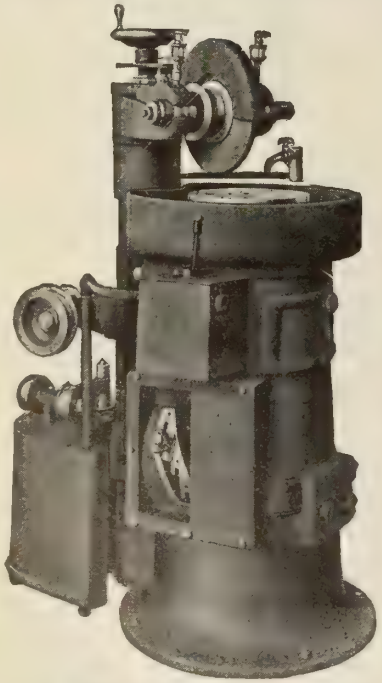
Distribution is done by accurate, rapid self-measuring pumps—no oils are left in shipping containers to dry up, leak and seep away—none is lost through spilling or dripping faucets. Every operation in the use of oils is done in a systematic, safe and saving manner.

Write us for literature, showing why Bowser Systems are a paying investment

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Bristol 12-inch Rotary Precision Surface Grinder

Built for rapid production on grinding work.

It handles work either singly or in multiples within the capacity of the chuck and not thicker than 6-in., and grinds within quarter thousand in. of manufacturing accuracy.

And it is built to last.

It is provided with exceptionally long bearings throughout, especially in the back column. This prevents the wear, which is very slight, from affecting the accuracy of the grinder. The Back Column is made to swivel four degrees, which allows concave or convex grinding.

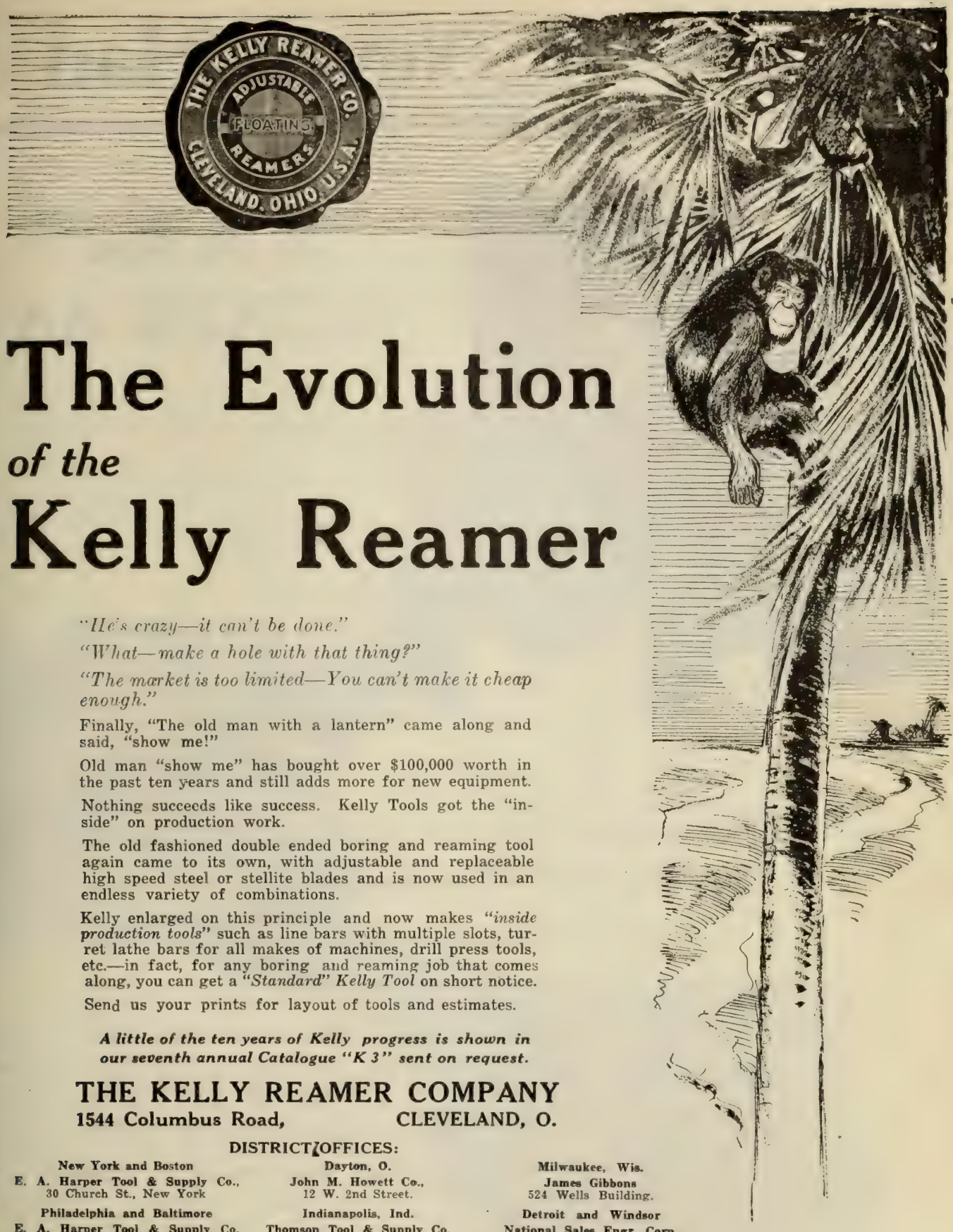
Bristol Rotary Surface Grinders are made in several types and sizes and are regularly equipped with 8-in., 12-in., and 16-in. magnetic chucks, either belt or motor driven and for dry or wet grinding.

Our Bulletin describes the many good points fully. Send us your name and address and we'll gladly mail you one.

Grinds within .0004 in. of absolute Accuracy

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SUCCESSORS TO C. G. GARRIGUS MACH. CO.
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"He's crazy—it can't be done."

"What—make a hole with that thing?"

"The market is too limited—You can't make it cheap enough."

Finally, "The old man with a lantern" came along and said, "show me!"

Old man "show me" has bought over $100,000 worth in the past ten years and still adds more for new equipment.

Nothing succeeds like success. Kelly Tools got the "inside" on production work.

The old fashioned double ended boring and reaming tool again came to its own, with adjustable and replaceable high speed steel or stellite blades and is now used in an endless variety of combinations.

Kelly enlarged on this principle and now makes *"inside production tools"* such as line bars with multiple slots, turret lathe bars for all makes of machines, drill press tools, etc.—in fact, for any boring and reaming job that comes along, you can get a *"Standard" Kelly Tool* on short notice.

Send us your prints for layout of tools and estimates.

A little of the ten years of Kelly progress is shown in our seventh annual Catalogue "K 3" sent on request.

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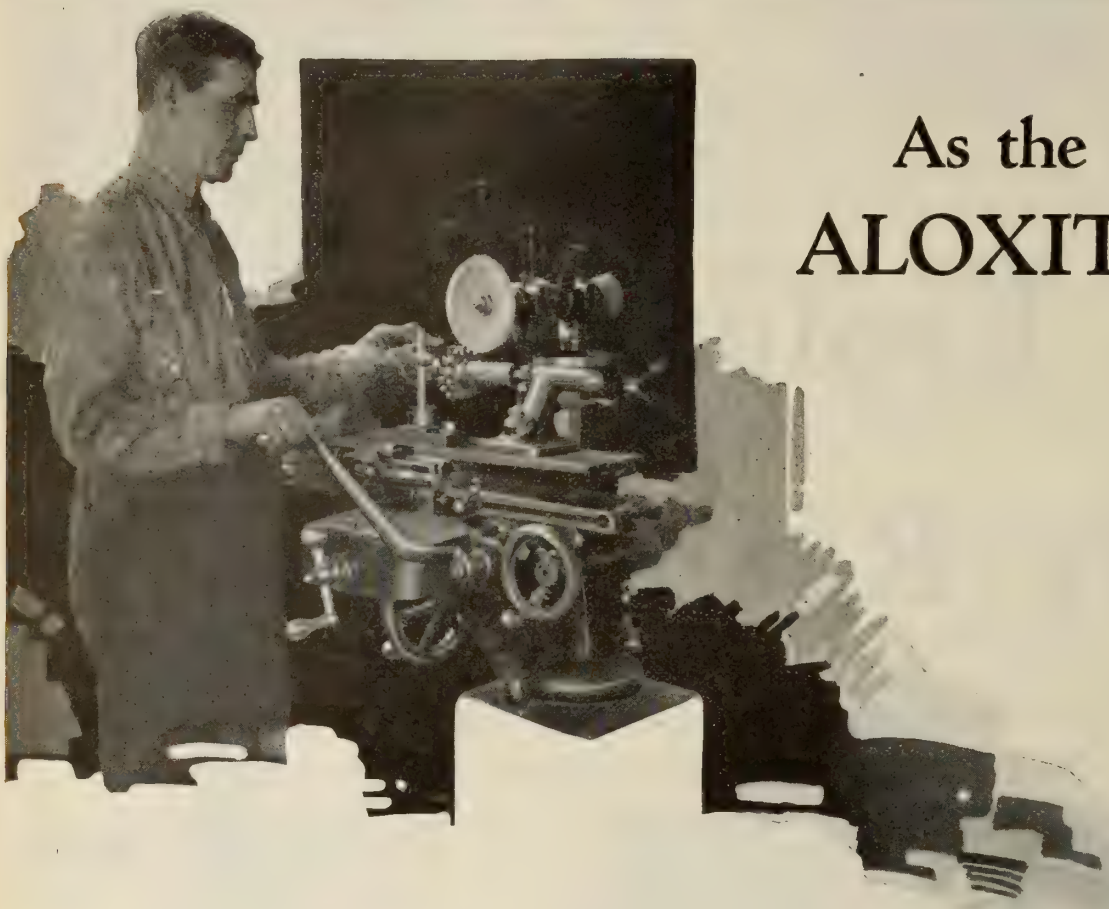
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It is in a sense making grinding history.

For years you have been looking for just such a wheel to grind reamers, cutters, hob mills and general tool room work—for surfacing high speed steel for die work and for internal grinding on steel. You have wanted a wheel that was so open and

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Wheel that Cut So Fast

porous in its structure that it would cut cool, clean, free and fast—that would keep on cutting that way, freeing itself and keeping sharp with practically no dressing, because of its sharp, tough, remarkably large crystals.

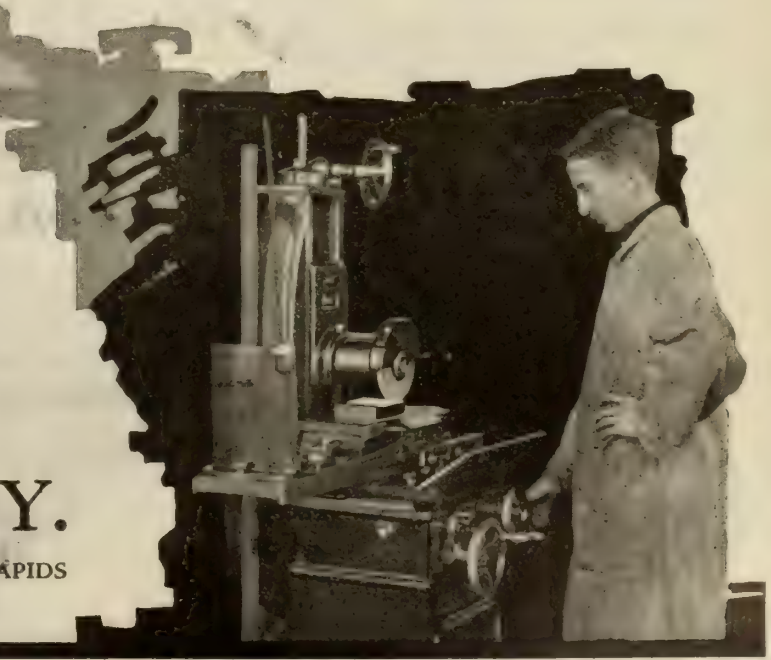
Tests have proved that the Aloxite AA Wheel has every one of these qualities.

And many a time you have wanted a wheel that would take off heavy cuts without burning.



This Aloxite AA Wheel Took a Cut of .035

A 36 grit T grade Aloxite AA Wheel, in a test on hardened steel dies, started in with a cut of .005, then gradually increased to .020, finally taking a cut of .035. Give Aloxite AA a test in your tool room. You will find that you have never had a wheel that cuts so fast, so free, so cool.



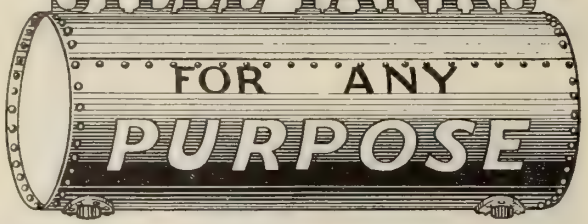
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PRESSURE TANKS
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"ARGO" BRAND *HIGH-SPEED* STEEL

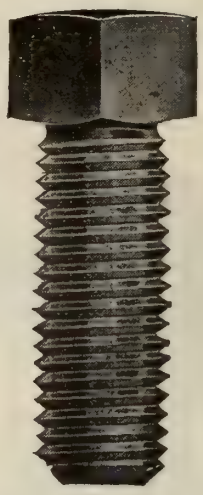
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1856

Frankford, Phila.
New York Office 217 Broadway

RALPH B. NORTON, AGENT
124 Craig St. W.
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Prompt shipments of all Standard Sizes in
Cap Screws, V or U.S.S.
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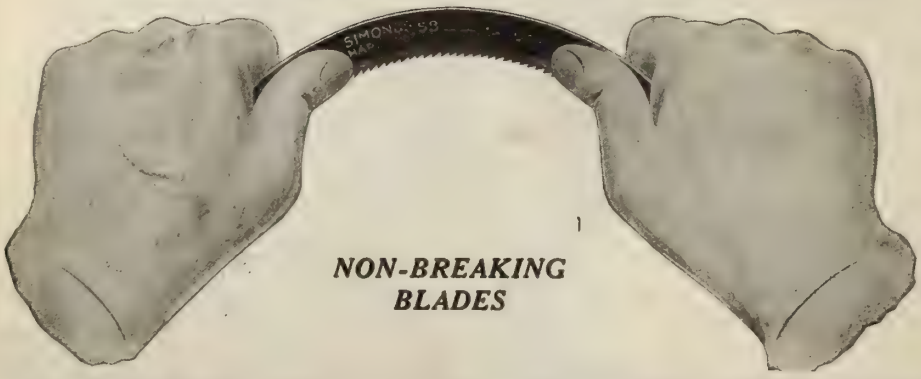
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GALT, ONTARIO

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NON-BREAKING BLADES

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Are you interested in a description of these furnaces? Bulletin 54 is yours for the asking.

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Of Every Description

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We're *Proud* of the Holyoke Construction

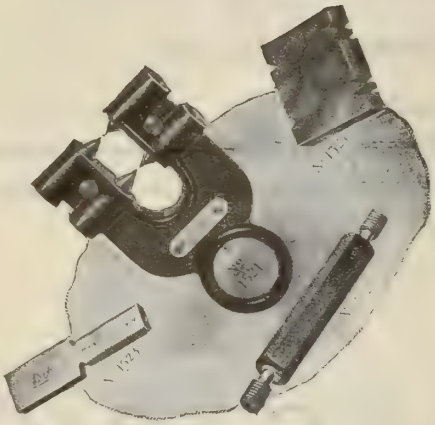
Very few firms would think it worth while to equip the industrial trucks they make with Chrome Nickel axles, Hyatt Roller Bearings, self aligning swivels, and all the refinement of detail which adds to the durability, and the ease and speed of operation. We embody all these features in our truck and are continually striving towards still further improvement **because we can afford to do it. A single "Holyoke" truck may cost as much as four or five ordinary trucks, but one "Holyoke" can handle as much work as any number of ordinary trucks—a hundred if you like.** That's why the "Holyoke" is cheaper in first cost, anyway, and why we have to build it to last. Every platform is a truck—you can put it on wheels in a jiffy—and platforms are cheap.

Shall we send you our booklet "Inside Transportation?" It shows you where to economize on your trucking.

Holyoke Truck Company
119 Race Street Holyoke, Mass., U.S.A.

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Easy-Cutting — Long-Wearing
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(See our new Gage Catalog No. 43)

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Company of Ltd. Galt, Ontario

Canadian Plant of the Greenfield Tap & Die Corp.

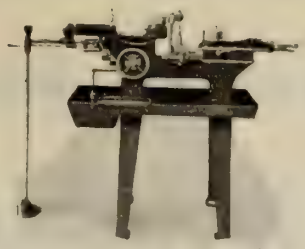
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World's Largest Manufacturers of Screw Cutting Tools.

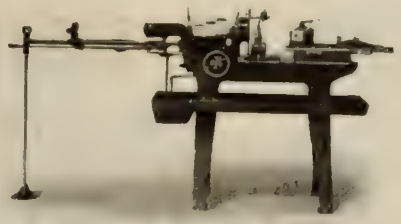
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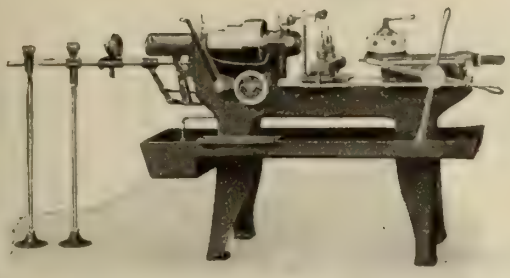
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Please send me the following catalogs:
Small Tools No. 40 ☐ Pipe Tools No. 42 ☐
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Name_____ Position_____
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CM 1003



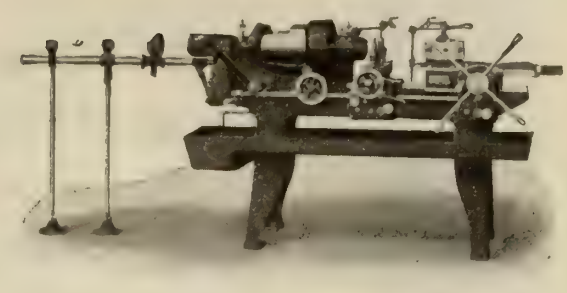
No. 0 P. H. Screw Machine



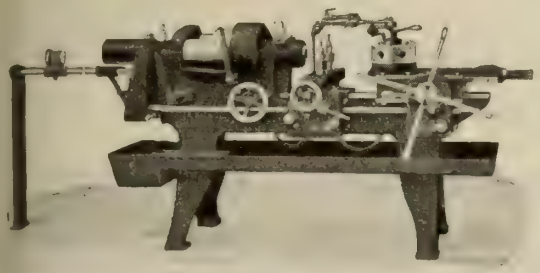
No. 1 P. H. Screw Machine



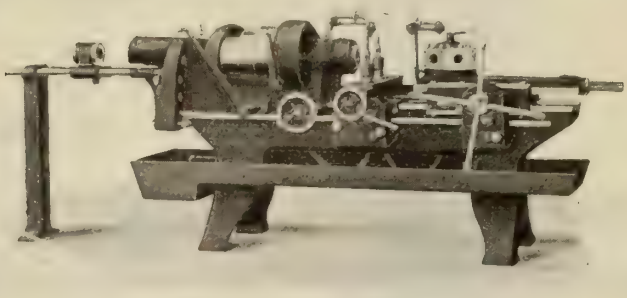
No. 3 P. H. Screw Machine



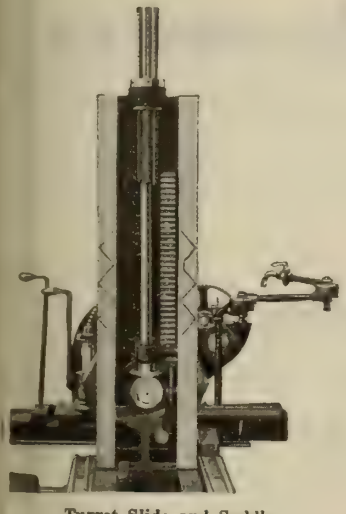
No. 3 F. H. Screw Machine



No. 5 F. H. Screw Machine



No. 7 F. H. Screw Machine



Turret Slide and Saddle

Design of Turret Slide and Saddle of Nos. 3, 5 and 7 Screw Machines.

Third of a Series of Advertisements Describing the Foster New Line of Hand Screw Machines.

The superiority of design of this unit must be considered in the light of two features that are of vital importance to the success of the entire machine. These are: The accurate index of the turret, and the ease of operation of the turret slide.

The turret is indexed automatically by the rearward movement of the turret slide. The index pin synchronizing with the forward turret station is engaged by the pawl mounted in the saddle, thus revolving the turret to the next station. The vertical lock-bolt located virtually underneath the turret in the working position registers the turret with absolute accuracy. The head of the lock-bolt and the bushing on the underside of the turret are of new design, permitting a degree of accuracy not possible with the design of lock-bolts used by other Screw Machine manufacturers. The lock-bolt is fitted with extreme care.

A lever mounted in the slide and engaging the lock-bolt withdraws same at the psychological moment. The rearward movement of the slide brings one end of this lever into engagement with a tumbler cam mounted in slide, thus actuating the movement of the lock-bolt. For additional sensitiveness of operation the end of the lock-bolt lever engaging the tumbler cam carries a roller.

The turret stud is tapered, hardened and ground and is journalled in a hardened and ground sleeve. This design permits extreme accuracy in assembling and also provides means of adjustment for wear, a point of high importance.

The six independently adjustable screw stops mounted in spool at the rear end of the turret slide indexes with the turret. The stop synchronizing with the forward turret station abuts on the forward movement of the turret slide a slidable stop. The movement of this slidable stop is transmitted through a system of plungers to the drop-off lever, causing the disengagement of the power feed. A very rigid dead stop, in the apron, provides means for the accurate duplication of shoulder lengths.

The rack on the underside of the turret slide is engaged by the pinion mounted on the turnstile shaft through which the movements are transmitted.

All bearings are liberally proportioned against wear. A taper base, underneath the saddle, provides means for the vertical adjustment of the turret.

Our complete Screw Machine and Turret Lathe catalogue ought to be in your file. Write for it to-day while the thought lingers.

FOSTER MACHINE CO., ELKHART, IND.

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DOMINION BRIDGE COMPANY LIMITED

MONTREAL, QUE.

STRUCTURAL STEEL

FOR

Bridges Buildings Tank Work

Transmission Towers Penstocks

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Electric Hand Power Travelling Cranes

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Main Office and Works: LACHINE, QUE.

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Nichrome Castings

TRADE D·H MARK

The Range of Size is Wide—

But the Range of Utility is Wider.

From Tubular Retorts Weighing 2500 Pounds →

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Nichrome gives Thousands of Hours of Service at 1800 degrees Fahrenheit.

Manufactured Under Henderson Patents



CANADIAN DRIVER-HARRIS Co., Ltd.

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WALKERVILLE, ONT. CANADA AMERICAN OFFICE AND WORKS HARRISON, N. J

BRITISH WORKS MANCHESTER ENGLAND

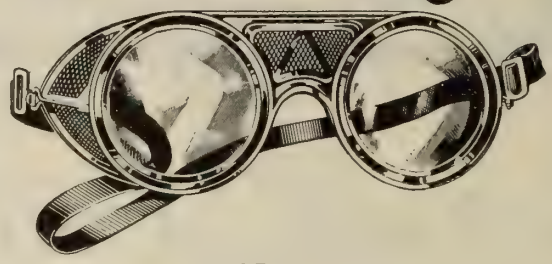
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No Difference in Visibility—



OPTICAL GLASS LENSES



CELOGLAS LENSES

But

Considerable Difference in Strength!



OPTICAL GLASS LENSES



CELOGLAS LENSES

STOCO

SAFETY GOGGLES

"CELOGLAS"

SHATTER-PROOF LENS

STOCO Celoglas Shatter-proof Lenses can hardly be distinguished from optical glass lenses. They will not strain or tire the eyes or cause headaches no matter how long or continuously they may be worn. And they have this invaluable advantage over the optical glass lens—they will sustain a shock of extraordinary force without leaving the frame of the goggle or splintering into the eye they are protecting.

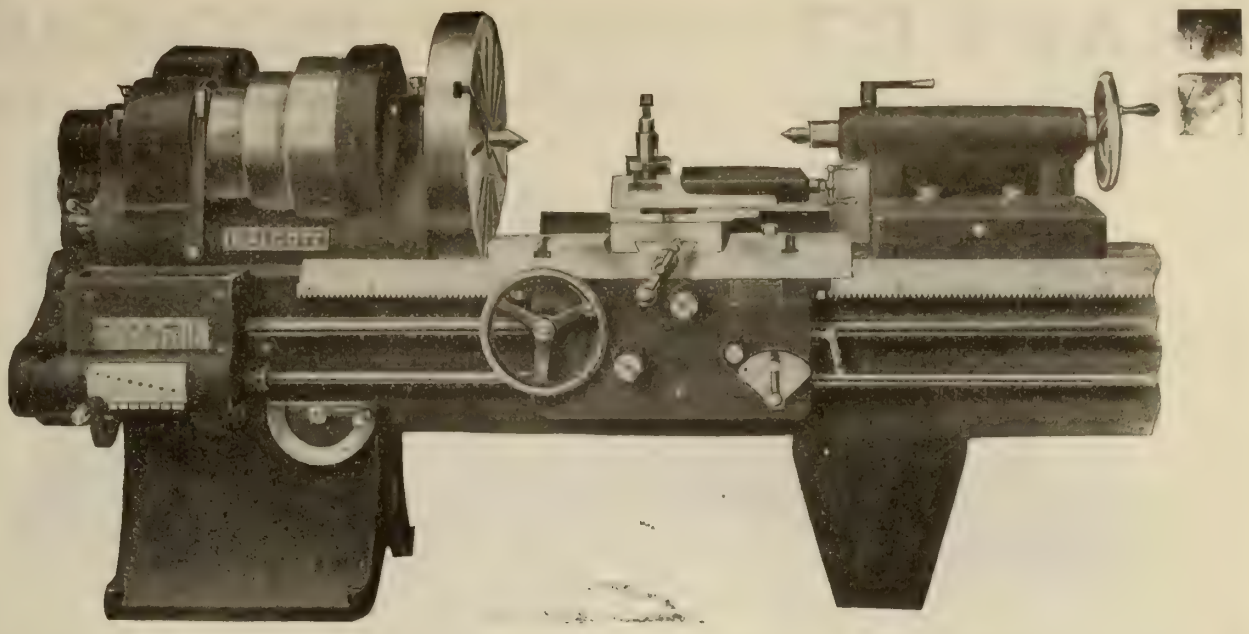
Price (f.o.b. Geneva, N.Y., U.S.A.)—With Celoglas Shatter-proof Lenses, $115.00 per hundred. With extra heavy optical glass lenses, $90.00 per hundred.

Black elastic headbands or easy cable temples at same price. Attractive discounts for quantity orders.

NOTE.—A sample STOCO Safety Goggle will be sent interested responsible people without charge on receipt of request on firm letterhead.

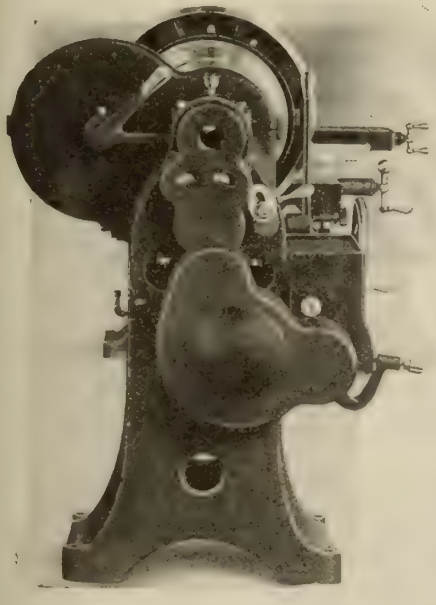
STANDARD OPTICAL CO.

GENEVA, N.Y. U.S.A.



Walcott Lathes—Time Tested

It did not take 38 years to establish a reputation, but you can benefit by that experience.



YOU can subject this 26″ Engine Lathe to any test and at the outcome you will find that 38 years of lathe building have enabled us to present a machine that answers the most rigid requirements.

Reinforced and strengthened at the points of stress, this machine includes such features as: double apron plate, drop forged gear in apron, rigid compound rest, back gear arm reinforced by one-piece gear guard and headstock, not a single tooth exposed, feed gears run in oil, large frontway on bed, and quick change gear box. The lead screw and feed rod are separate.

Made in 14″, 16″, 18″, 20″ and 29″ sizes.

Our experience and co-operation are entirely at your disposal. Write us.

WALCOTT LATHE COMPANY

135 Calhoun St. *Established 1881* **Jackson, Mich.**

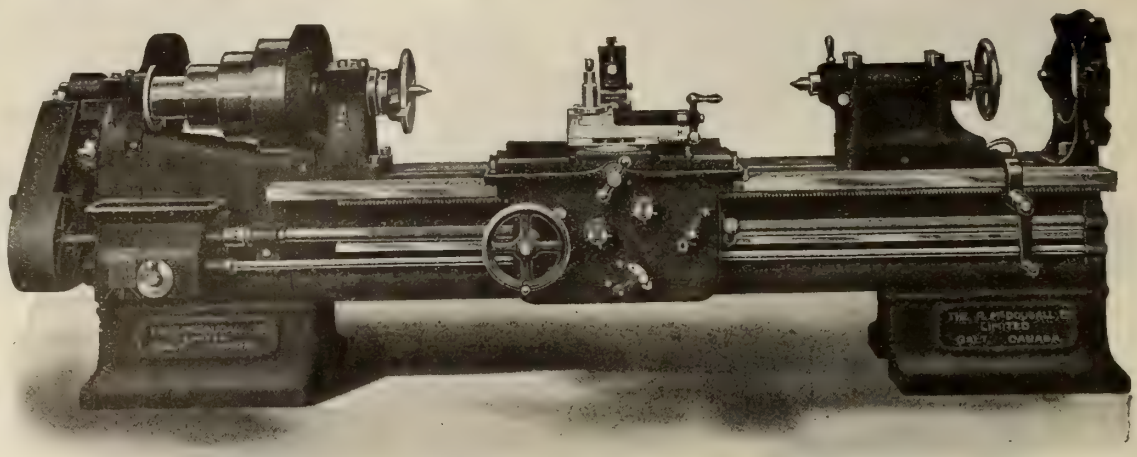
Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria, F. H. Andrews & Son, Quebec, Que.

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EXPERT Workmanship

IS MUCH IN EVIDENCE IN THE CONSTRUCTION OF

McDOUGALL Engine Lathes

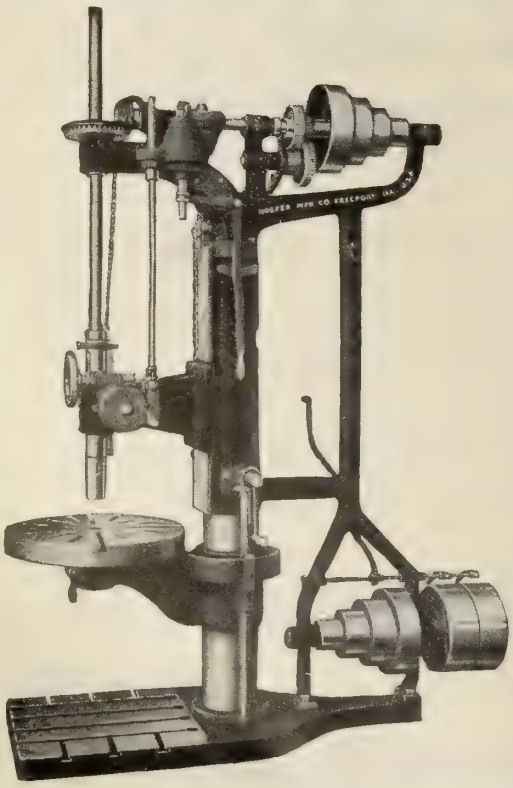


No pains are spared in the construction of this machine to make its accuracy and finish consistent with its perfect design.
McDougall Engine Lathes possess all the features which ensure economical production, dependable accuracy, and ease of operation.
Shall we send you our literature describing this lathe in detail?

THE R. McDOUGALL COMPANY, LIMITED, GALT, ONTARIO

The Canadian Fairbanks-Morse Co., Limited, Sales Agents

The Driller for Exact Work



HŒFER

Enable Your Workmen to Eliminate Spoilage

The Hoefer Driller is pre-eminently the one to be found in the best plants. "It's almost as good as a Hoefer," so often heard in the machine and tool trade, indicates the position held by Hoefer Drillers.
Exact drilling, to the last thousandth of an inch, pays by eliminating spoiled material. Hoefer Drillers pay for themselves and increase the workman's pride in his work.

Twenty-five Years on Market

Twenty-five years making drillers has given Hoefer the "Know-how." The Hoefer Drillers are used by many of America's leading manufacturers. Equip your factory the Hoefer way. Take any kind of a drilling problem you have to the Hoefer Manufacturing Company, and the Company's experts can tell you how it was solved by other men, some of whom you may know.
Investigate now. Write to-day for catalog. The Hoefer engineers are at your service.

HOEFER MFG. CO.

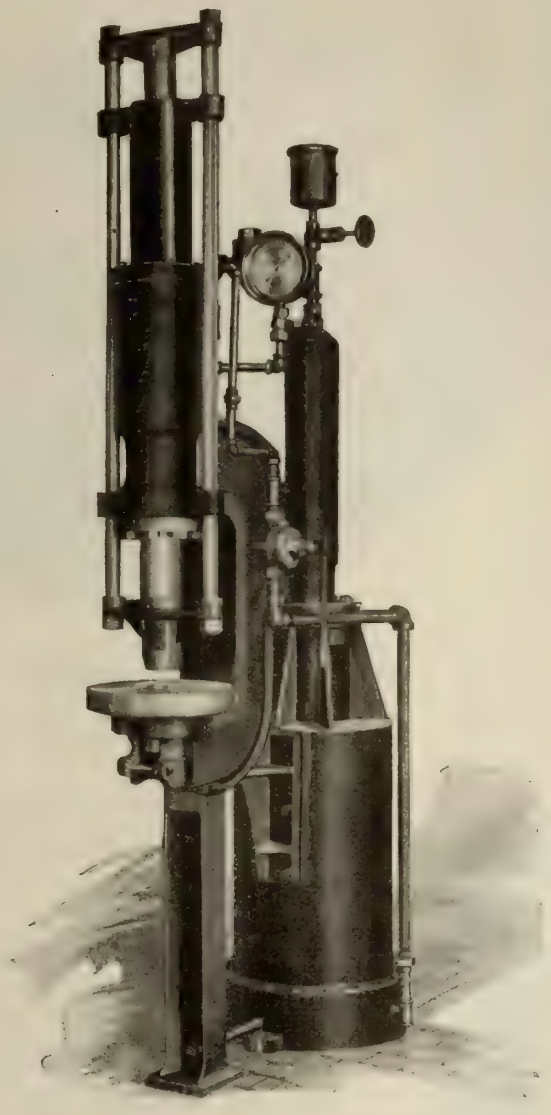
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ORIGINALITY

is Characteristic Always of

"METALWOOD"

DESIGNS and DEVELOPMENTS



The "Metalwood" line of these Quick Operating Hydro-Pneumatic Presses comprises a variety of styles, types and sizes.

By performance through a period of years, these presses have established themselves in a wide range of industries as standard tools for light straightening, broaching, forcing and assembly operations.

The "R-149" style press of 20-ton capacity shown here is described in our bulletin B-47.

METALWOOD MANUFACTURING CO.

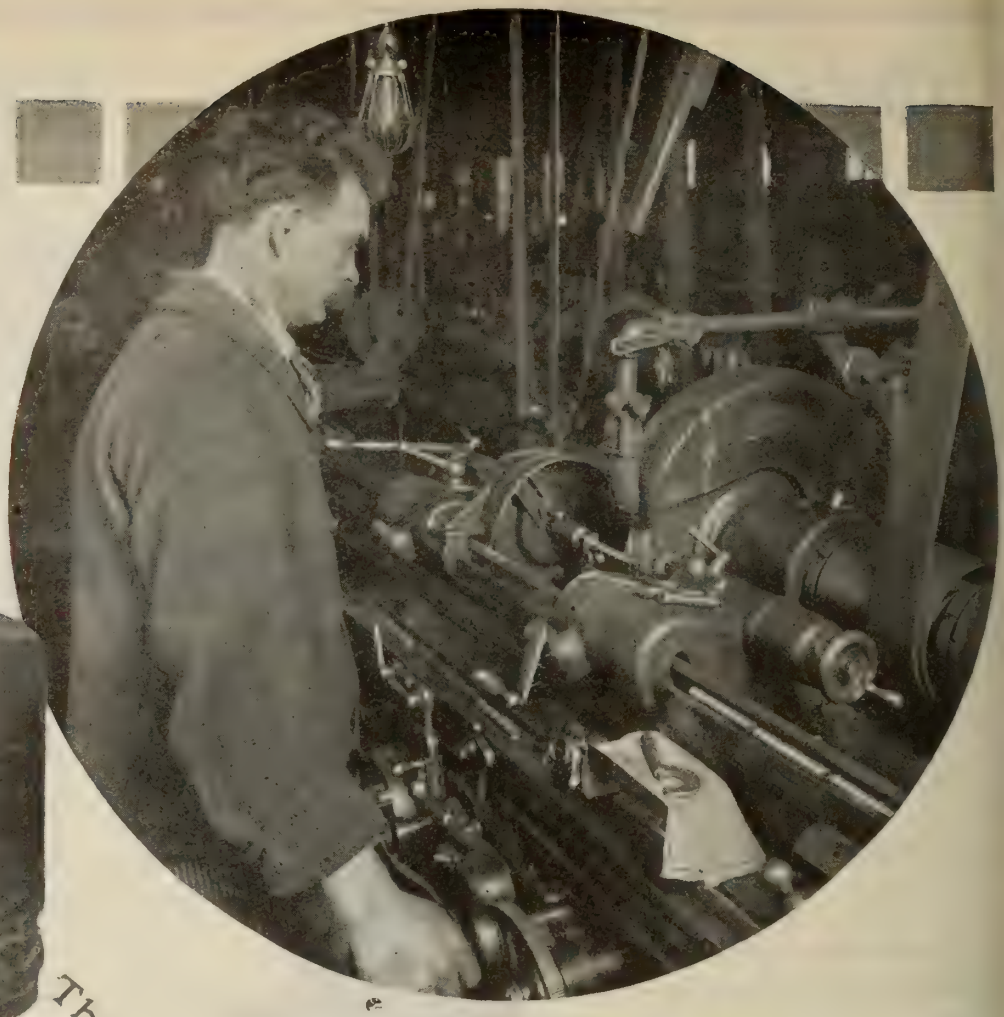
High Speed Hydraulic and Hydro-Pneumatic Machinery

DETROIT, MICHIGAN

EXCLUSIVE SALES REPRESENTATIVES:

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There's only 150 seconds between them—

Despite the close limits—plus or minus .001 in.—that must be maintained on this yoke for universal drive, it is being ground on a highly productive basis by Norton Grinding Machines.

It is made of carbonized machine steel and has a rough diameter of 3.265 in., when the grinding department receives it. Fifteen thousands of an inch is removed to permit a perfect fit with the casing which retains the driving blocks in the slots shown in the illustration. The piece is a product of The Hartford Auto Parts Co.—if you're in doubt about Nortons get in touch with the above customer—the experience they have had will be helpful to you in deciding.

We'll give you their address on application.

NORTON COMPANY
Grinding Wheel Division
WORCESTER, - MASS.

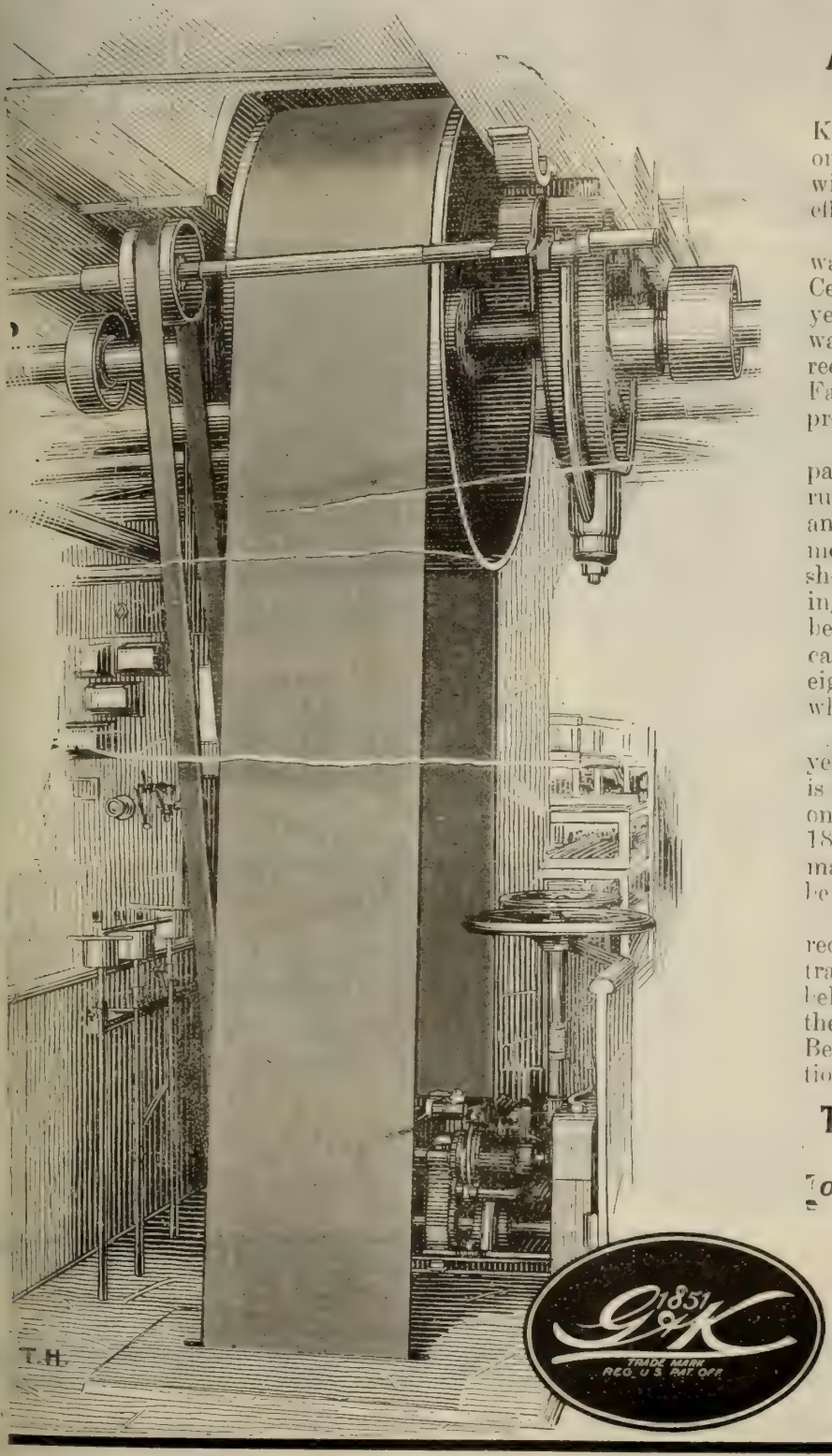
Electric Furnace Plants:
Niagara Falls, N.Y. Chippawa, Ontario, Canada

Canadian Agents:
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.
F. H. ANDREWS & SON,
Quebec, Que.

Graton & Knight

Standardized Series Leather Belting

Tanned by us for belting use



A Forty-Seven-Year Belt

This twenty-four-inch Graton & Knight Belt has transmitted power on one drive for forty-three years. It withstood four years of neglect. Its efficiency today is unimpaired.

In 1872 the belt was placed on a water-wheel drive in a woolen mill at Central Falls, R.I. For thirty-three years it did its work well. The plant was shut down in 1903 and was not reopened until 1907, when the Central Falls Mazda Lamp Division bought the property.

Upon inspection the wheel-pit and part of the belt were found covered with rubbish. The belt was a sorry sight, and the first decision was to junk the mess. Cleaning operations, however, showed that the belt was practically uninjured. The power was turned on, the belt picked up its load, and has been carrying it ever since, driving a sixty-eight-inch pulley from a ninety-six-inch wheel.

That this veteran of forty-seven years is doing a youngster's work to-day is proof positive of the quality of Graton & Knight Tannage of Leather. In 1872, as now, Graton & Knight were making the right belts for the job to be done.

Graton & Knight have classified the requirements of every kind of power transmission, and make a standardized belt to meet every demand. Write for their book, "Standardized Leather Belting," which gives valuable information on belting power transmission.

THE CANADIAN GRATON & KNIGHT, LIMITED

Oak Leather Tanners and Belt Makers

MONTREAL, CANADA

Canadian Representatives:

Canadian Fairbanks-Morse Co., Limited.,

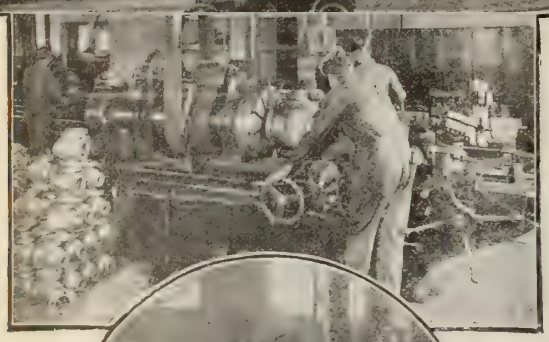
St. John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Vancouver, Windsor, Winnipeg, Victoria.

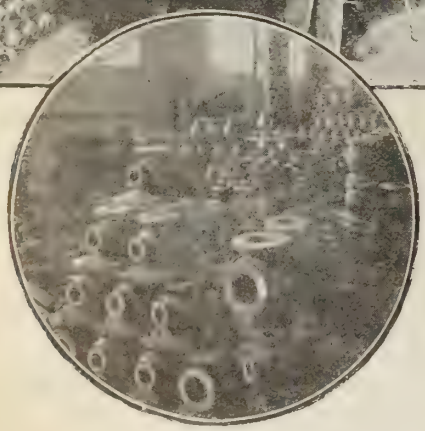
Branches and Distributors in all Principal Cities.

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Every Day

These Gisholts Strengthen Their Value

Every day the owners of these Gisholt Turret Lathes are more satisfied with their investment. Let similar machines do your work.

The new catalog will show you how. Send for it.

GISHOLT MACHINE COMPANY, 1201 EAST

Builders of Standard and Automatic Boring Mills, Tool Grinders,

Eastern Sales Office: 30 Church St., New York.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.

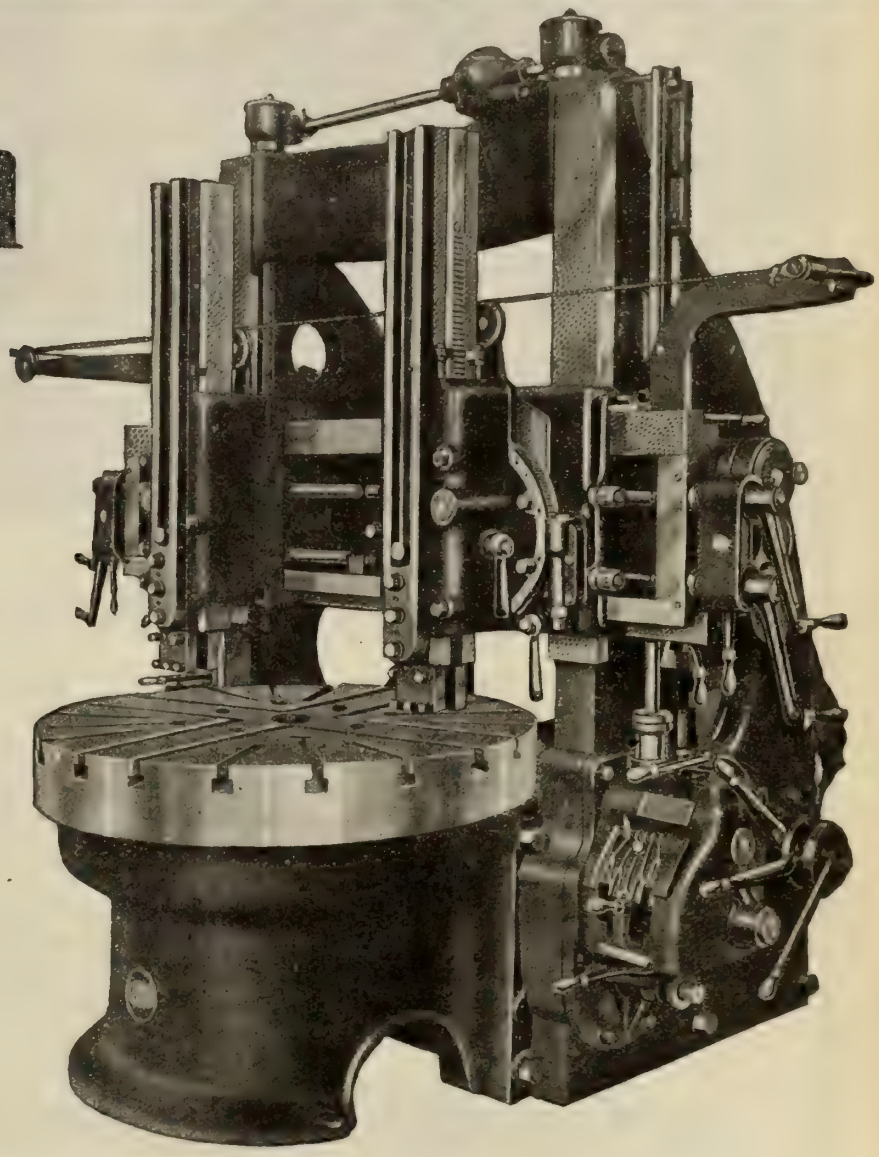
HOLT

Strength

shows in every line of this Gisholt Boring Mill.

Satisfaction is developed in every cut taken in your shop.

Put your Vertical Mill problem up to Gisholt.



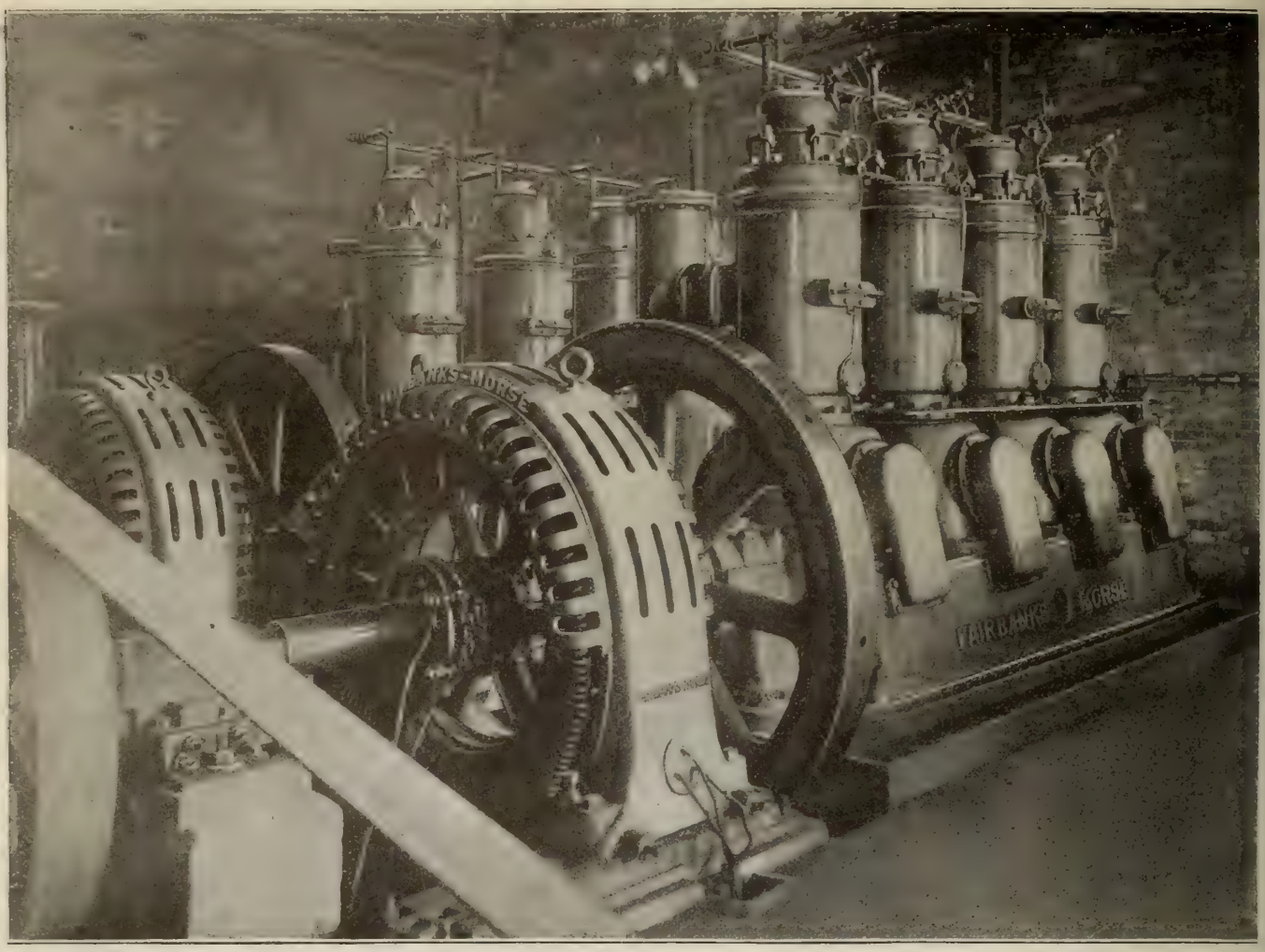
Gisholt Methods Insure Accuracy and Economy

WASHINGTON AVE., MADISON, WIS., U. S. A.

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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXIII., No. 10 March 4, 1920

Canadian Firms Bidding Now for World Trade

Big Exhibition for Overseas Buyers to be Held in London in June —Large Number of Canadian Firms Are Going to Have Representative Exhibits There

THE enthusiastic interest aroused among the industries of the Dominion by the announcement of the great Canadian Industries Exhibition to be held in London next June has produced a remarkable crop of applications for space, as the result of which the greater part of the Agricultural Hall, vast as it is, has already been allotted to intending exhibitors. In addition, a great number of firms have secured options on positions, and many more who have expressed their interest in the Exhibition will doubtless be added to the list of exhibitors when details have been arranged between them and their agents in Great Britain.

Sir George Foster's Support

The exhibition has been strongly recommended by the Canadian Manufacturers' Association, and is actively supported by the Canadian Trade Commission, the Department of Trade and Commerce, Ottawa, and the Canadian Mission in London; but, without that, manufacturers and producers were quick to realize the splendid opportunity London affords for an introduction to the world's buyers, and, in many cases, the wish has been expressed that the exhibition should be held periodically as the recognized medium of showing the progress of Canadian productions. Sir George Foster, the Canadian Minister of Commerce, has succinctly stated the general feeling towards the enterprise in Canadian industrial circles in his letter to the Manufacturers' Association, recommending its members to participate.

"I desire" (writes the Minister) "to commend the Exhibition to the thoughtful attention of manufacturers and producers. It opens up one of the quickest possible opportunities of practically and efficiently representing Canadian products to a large clientele, of following up the work of the Canadian Trade Mission, of continuing connections already made, and opening new ones for the extension of our export trade, all of which are vitally necessary in Canadian interests. We should lose no ground already gained, and should make every endeavour to take advantage of present conditions in the British market to secure a permanent foothold in the great trade exchanges centred in Britain.

Yours, etc.,
(Signed) George E. Foster."

Firms To Be Represented

While negotiations for space are in progress with so many firms, it would be unfair to give a list of exhibitors; but we may say that all the firms mentioned below are expected to be represented at the Exhibition:—

Canadian Export Association, Ltd.
Chase Tractor Corporation.
Massey-Harris (agricultural machinery).
Cockshutt Plow Co.
International Harvester Co.
Goodyear Tire Co.
Canadian Biscuit and Confectionery Association.
Acadia Gas Engine Co.
Nielsen's, Ltd. (chocolates).
Willard's, Ltd. (chocolates).
Staunton's, Ltd. (wallpapers).
Reg. N. Boxer Co. (wallpapers).
Sheet Metal Products Co.
Dominion Steel Products Co.
Steel Co. of Canada.
Shawinigan, Ltd. (chemicals).
Canadian National Railways.
Canadian Pacific Railway.
Stevens & Co. (canned fruits and foods).
Ludgate, Ltd. (office furniture, etc.).
John Morrow Screw & Nut Co.
Eisman & Co. (elastic goods).
Beatty Bros. (washing machines, etc.).
A. Boake, Roberts & Co. (chemicals).
S. D. Simond & Co. (provisions).
Hargreaves & Radclyffe (wood working machines).
Empire Typewriter Co.
Canadian Chicle Co.
British-American Nickel Corporation.
Canada Cycle & Motor Co.
Kindel Bed Co.
Canadian Pulp and Paper Association.
Dominion Textiles.
Office Specialty Manufacturing Co.
London Concrete Machinery Co.
McClary Manufacturing Co. (hardware).
Empire Manufacturing Co. (plumbers' supplies).
Battle Creek Toasted Corn Co..
McCormick Manufacturing Co. (biscuits).
Spramotor Co. (spraying machines).
Nova Scotia Steel Co.
Dominion Battery Co.
Canada Malting Co.
Silver Bros. (furs).
Marsh Engineering Works.
Canadian Des Moines Steel Co.
Small's, Ltd. (syrups, etc.).
H. E. Furniture Co. (kitchen cabinets).
Pedlar People, Oshawa (sheet metal products).
Beach Furniture Co.
E. T. Wright & Co. (metal sundries).
Sherlock Manning Piano & Organ Co.
J. B. Keeble & Co., Ltd.
Dominion Paint Works.
Canadian Polishes, Ltd.
Canada Foundries & Forgings, Ltd.
J. H. Gignac, Quebec (lumber).
Petrie Mfg. Co. (cream separators).
Dominion Machinery Co.
Iona Gypsum Co.
Canada Overseas Trading Co.
Anglo-Canadian Homes Construction Co.
Dominion Industries, Ltd.

A Wide Range of Industries

This list is only a selection of the firms interested as exhibitors or possible exhibitors, but should serve to give British and other overseas buyers some idea of the wide range of Canadian industries now actively interested in export trade, and which are contemplating, if they have not decided to do so, going to London next June to show buyers their productions and negotiate business.

CANADA CAN HOLD HER PLACE IN SOUTH AFRICAN BUSINESS

WILL Canadian trade hold its place in the South African field when it has to meet world competition? Mr. W. J. Egan, Canadian Trade Commissioner in South Africa, thinks it will.

Interviewed in London by "The Pioneer," prior to his sailing for Capetown, Mr. Egan said that with developments in sight in the mining and agricultural industries of South Africa, Canada could, in a few years, be in a position to ship $25,000,000 worth of goods to that country. However, to do so, Canadian manufacturers must be prepared to compete. There was no limit to the possibilities of the trade which might be done in rails, wire, steel, and corrugated iron manufactures if Canadians would go in for this business on a large scale. In this connection, Mr. Egan thought the reorganization of the Dominion Steel Company, recently announced, might portend some development of this kind. As regards other lines, the Trade Commissioner thought the Dominion could hold its position in the South African paint and varnish market, even when British competition was again a factor. He did not think British manufacturing conditions would ever be on the old pre-war basis again.

Despite the drop in sterling, he continued, South African exchange was not actually against Canada in the sense that as yet our competition came from the United States, whose exchange rate was even higher. When British exports again commenced to pour into the South African market, the situation, of course, would be different. As compared with the United States, the rate was in Canada's favor, but this was offset to a certain extent by the fact that some large firms quoted in New York instead of Montreal, in order to meet bills which they might have in America. This practice was to be deplored.

Mr. Egan, who had intended to spend six weeks in Canada, spent almost six months there, and in this time interviewed some 450 firms interested in the South African trade. Over 140 Canadian firms have asked him to secure representation in this field, and twenty-one companies are sending out their own representatives to study the situation. Twenty-seven agency arrangements were made by South Africans who had visited Canada on Mr. Egan's recommendation to secure agencies.

Mr. Egan said industry seemed to be at its best in Canada at present. There was a shortage of labor, particularly female labor, but demobilized men were settling down rapidly. Activity was noticeable in the Canadian textile industry, which had taken giant strides since he had last been in the Dominion. The banks were also interesting themelves very helpfully in export trade.

Ninety per cent. of Canadian manufactures would find some market in South Africa, said Mr. Egan in conclusion. He also found while in Canada a considerable interest in the possibilities of German Africa, recently annexed.

CANADIAN TRADE COMMISSIONERS

Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

Argentine Republic—B. S. Webb, Canadian Government Trade Commissioner, Reconquista No. 46, Buenos Aires. Cable address, Canadian.

Australia—D. H. Ross, Canadian Government Trade Commissioner. Address—for letters, Box 140 G.P.O., Melbourne; office, Stock Exchange Building, Melbourne. Cable address, Canadian.

Brazil—G. B. Johnson, Canadian Government Trade Commissioner. Address for letters—Caixa (P. O. Box) 2164, Rio de Janeiro; office, Rua Gonçalves Dias 30, Rio de Janeiro, Brazil. Cable address, Canadian.

British West Indies—E. H. S. Flood, Canadian Government Trade Commissioner, Bridgetown, Barbados; agent also for the Bermudas and British Guiana. Cable address, Canadian.

China—J. W. Ross, Canadian Government Trade Commissioner, 13 Nanking Road, Shanghai. Cable address, Cancoma.

Cuba—H. A. Chisholm, Canadian Government Trade Commissioner, 501 and 502 Antigua, Casa de Corres, Teniente Rey, 11, Havana. Cable address, Cantracom.

France—Hercule Barré, Canadian Government Trade Commissioner, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Holland—Ph. Geleerd, Acting Canadian Government Trade Commissioner, Zuidblaak 26, Rotterdam. Cable address, Watermill.

Italy—W. McL. Clarke, Canadian Government Trade Commissoiner, via Carlo Cattaneo, 2, Milan. Cable address, Canadian.

Japan—A. E. Bryann, Canadian Government Trade Commissioner, 53 Main Street, Yokohama. Cable address, Canadian.

Newfoundland—W. B. Nicholson, Canadian Government Trade Commissioner, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand—W. A. Beddoe, Canadian Government Trade Commissioner, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

Siberia—H. R. Poussette, Acting Canadian Government Trade Commissioner, Aleutskia No. 11, Vladivostok. Cable address, Canadian.

South Africa W. J. Egan, Canadian Government Trade Commissioner, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

Southeastern Europe—L. D. Wilgress, Canadian Government Trade Commissioner, c/o Canadian Trade Commissioner, via Carlo Cattaneo, 2, Milan, Italy.

United Kingdom—Harrison Watson, Canadian Government Trade Commissioner, 73 Basinghall Street, London, E. C. 2, England. Cable address, Sleighing, London.

J. Forsyth Smith, Acting Canadian Government Trade Commissioner, 87 Union Street, Glasgow ,Scotland. Cable address, Cantracom.

J. E. Ray, Canadian Government Trade Commissioner, 4 St. Ann's Square, Manchester. Cable address, Cantracom.

J. Forsyth Smith, Canadian Government Trade Commissioner, Century Bldgs., 31 North John Street, Liverpool. Cable address, Cantracom.

N. D. Johnston, Canadian Government Trade Commissioner, Sun Building, Clare Street, Bristol. Cable address, Canadian.

CANADIAN COMMERCIAL AGENTS

Australia—B. Millin, Canadian Government Commercial Agent, the Royal Exchange Building, Sydney, N.S.W.

British West Indies—Edgar Tripp, Canadian Government Commercial Agent, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Canadian Government Commercial Agent, Nassau, Bahamas.

Norway and Denmark—C. E. Sontum, Canadian Government Commercial Agent, Grubbegd, No. 4, Christiania, Norway. Cable address, Sontums.

BIG EXHIBITION NOW PLANNED FOR LONDON

The second International Engineering and Machinery Exhibition will be held in London from 4th September to 25th September, 1920, and it is already known that the Exhibition will contain the finest and most comprehensive display of machine tools and workshop equipment ever seen at an Exhibition in any country at any time. About two hundred firms, consisting of members of the British industry, will exhibit, and at present, more than six months before the opening, the whole of the ground floor and two-thirds of the gallery space have been allocated.

A comprehensive catalogue, which is expected to run to 350 pages, will be printed, and this will form a permanent book of reference for buyers of machine tools and workshop equipment generally.

The Machine Tool Trades Association, under the auspices of which the Exhibition is being held, is the representative association of British Machine Tool Manufacturers, exceedingly anxious that overseas buyers should have every opportunity of visiting this exhibition. Season tickets admitting to the exhibition on every day will be sent by the secretary to any overseas buyer who is likely to be in England during the run of the exhibition. Engineers and others who are not themselves buyers, but who are interested in some way in the furtherance of export trade of British goods of this kind, may also receive such season tickets, for which application should be made to the Secretary, Machine Tool Trades Association, Queen Anne's Chambers, Tothill Street, London, S. W. Officers of the Department of Overseas Trade are requested to make this exhibition as widely known as possible to foreign buyers and others who may be interested.

PACKING MACHINERY FOR SOUTH AMERICA

Some Suggestions that Should be Noticed in Successful Shipping is to Result

A mechanical engineer with many years of experience on the west coast of South America has given H.M. Commercial Secretary at Lima the following note on the packing of machinery, particularly electrical machinery, for South America:

All engineering plant should be packed in strong, braced, open cradles of deal, and these cradles should again be packed in a heavy deal packing case, fitted with battens and, if possible, with diagonal braces. Machines must, under no circumstances, be bolted down to one side of the case. There is no objection, however, if the opposite side of the machine is bolte dto the case, too. It is much better, however, to pack the goods in a cradle and to make the cradle fit year (1913) will enable one to realize the case exactly, so that, even if the case is dropped, the stress is distributed equally all over the case and not on any one side or end.

All such small fittings and projections as handles, levers, valves, pressure gauges, etc., should be detached and packed tightly with wood wool into a small, strong wooden box, firmly screwed on to the inside of the main case or cradle. Any moving parts (as armatures of electric motors) must be wedged tight relatively to the fixed portion, to prevent oil rings being sheared off, bearing shields broken, and other damage occurring.

Any case containing machinery should be capable of being dropped fifteen times from a height of one metre on to a concrete floor without injury to case or contents. This represents the average history of a case of machinery leaving the United Kingdom or America, and arriving on site at final destination. So few breakages have occurred with this system of packing over a very large number of consignments that insurance against it is not really necessary. The cost of the packing is 30 per cent. above that of ordinary heavy cases.

Canadian manufacturers of electroplate are invited to furnish the Department of Trade and Commerce, Ottawa, with catalogues, prices and full particulars of their goods. Prices should be on the basis of f.o.b. steamer at Montreal, St. John or New York, as importers find it difficult to ascertain Canadian inland charges at this end.

It is stated that some time prior to the war there was some Canadian plate on the Australian market which was looked upon as exceptionally fine in quality and design, and that a renewal of supplies from the same source would be welcomed.

At the present time the United States and Japan are mostly supplying the demand, but dealers are desirous of having the opportunity to purchase elsewhere and would therefore give Canadian goods a favorable reception.

AUSTRALIA OPENS BIG FIELD FOR TRADE

St. John, N.B., Firm Shipping in Good Quantities to Melbourne and Sydney

English manufacturers have, until just very recently, enjoyed the bulk of trade entering into the ports of Australia, probably on account of the close business relationship existing between the two countries and of the similarity of trade conditions, currency, etc., and it has been rather a hard proposition for Canadians to break into this field. Nine cases out of ten Australian buyers looking outside of their own country for material mailed their orders to firms in the British Isles, while the balance of business probably went 50-50 to United States and Europe.

The Canadian Trade Commission is reporting a considerable amount of material being booked up by Canadian manufacturers for shipment to this market, which is the direct result of "After-the-War" trade drives, and which shows that they (the manufacturers), are able to compete successfully with other countries there.

Messrs. T. McAvity & Son, Ltd., of St. John, N.B., are one of the Canadian firms who have established a business connection in the Commonwealth, and they are making, and have made, many large consignments of brass valves, steam cocks and steam fittings, etc., to firms in Melbourne and Sydney, who, in turn, are placing the goods on the market. The buyers demand goods of first class material and manufacture, and everything to strict specification. A direct steamship line between St. John and Melbourne is a feature which facilitates shipping done by the firm to that port and their location, in Canada's winter port, from which direct lines of steamers ply to England, France, West Indies, etc., affords them an excellent opportunity and a decided advantage over others in developing export trade generally.

As outlined in last month's CANADIAN MACHINERY, "McAvitys" are also carrying on an extensive trade with the Old Country, having Lieut.-Col. T. Malcolm McAvity on the ground there in their interest. A branch office and warehouse will be opened in London in his charge shortly, where a stock of the firm's manufactures will be carried for the use of the English trade.

B. C. Saunders, who recently resigned his position as sales manager of the Wilmarth & Morman Co., has purchased an interest in the Grand Rapids Grinding Machine Co., and becomes associated with that firm in the active management of the business. At the annual meeting just held he was elected secretary and sales manager.

GETS APPOINTMENT AS TRADE AGENT

Capt. Edwards to Represent British Interests in the Dominion

Captain Evan J. Edwards has been appointed to act in the Senior Trade Commissioner post of Canada at Montreal, vice Mr. G. T. Milne, O.B.E., who has been appointed Commercial Secretary to the British Legation in Cuba.

Captain Edwards has had a large and varied business experience in various parts of the British Empire, recently holding the post of Manager of Sales (Home and Export), for a large manufacturing firm in the United Kingdom. During the war he served in the Royal Naval Volunteer Reserve in home and foreign waters, and later was appointed Admiralty Overseer in an airship works in the North of England.

For several weeks he has been busy at the Department of Overseas Trade, making himself conversant with the general conditions in Canada and the methods by which he will apply his past experience to this work. Captain Edwards is leaving England immediately to take up his duties at Montreal.

FARM IMPLEMENTS SHORT IN RUSSIA

High Prices Paid For Anything That Looks Like an Agricultural Machine

Canadian agricultural engineers, who had developed a considerable market in Russia before the war, should find ample scope there when the country was settled down again to sober business. It is a noteworthy fact that Russia possesses no large factories for making agricultural machines and implements. Even scythes are not made in Russia. The ordinary plough with one share is made in two factories—one in Riga and one in Kharkof. The attempt made by the locomotive works at Kharkof to manufacture other agricultural implements is stated to have proved a total failure, in spite of the large sums of money that were spent. When the war broke out wholesalers were quickly cleared of what stocks they had, and domestic production ceased. Even the locomotive works at Kharkof turned its plant for making agricultural tools into a munition factory. During the revolution much of the equipment of the large estates was destroyed, and, in short, Russia now faces a total lack of farm implements. How great this lack is may be seen from the fact, stated in a Dutch contemporary, that in the summer of 1918 150 roubles apiece was paid for ordinary scythes, and even broken or blunted scythes were sold for 75 to 90 roubles apiece.

Manufacturing Washers is a Special Study

On the Assumption That Washers Should be Perfect, This Concern Has Made a Special Study of Their Business. Nothing But Washers Are Made in the Plant About to be Described

By J. H. MOORE

A LITTLE Irish lad was passing, or at least attempting to pass his examination, when he came to a question that sadly puzzled him. Here was the question: "What is a washer, and what are washers used for?" Scratching his tousled head, he suddenly had an inspiration, and wrote the following: "A washer is a piece of iron or steel with a hole in it, and they are used for everything."

Granted that technically he was rather off in his description, yet he wasn't so far from the mark, for washers are in reality made in almost every conceivable shape, and have without question a hole in them. The uses to which they can be put are innumerable, although one would hardly like to say they were used for everything.

Leaving the Irish lad to his own answer, here is how the Union Iron & Metal Co., Ltd., Toronto, came to make nothing else but washers.

During the war this concern was busily engaged in the manufacture of shrapnel shells. On the cessation of hostilities, they looked around them for a commodity that they could manufacture, yet feel sure that the demand for such a product as they would decide upon would continue. After considerable discussion the product that was decided upon spelt WASHERS. It was figured out in this way that a washer was always a washer, no matter where you went. Britain had its standard bolts, and certain standard threads, V-threads, Whitworth, etc., while other countries had their particular standards, but a washer was standard for any of these different bolts. In other words, a washer is a washer the world over.



FIG. 2—THIS COMPLETE LINE OF AUTOMATIC PRESSES HANDLE THE SMALLER SIZE WASHERS.

Having made up their mind on this point, the next step was to concentrate on the problem of rapid production with guaranteed quality. As Mr. O'Brien, the manager of the concern, stated to the writer, "We felt that while production was a big item in our program, quality was something bigger. First, let us convince the trade that we intend producing and delivering only first quality washers, and the rest will come easy was our slogan."

The advisability of this plan has proved itself without doubt, for the writer personally saw washers that were so far ahead of the average style, as to merit not being spoken of in the same breath.

A washer, to be a good washer, should be flat, without burrs, and the hole should be in a central position. This description will, no doubt, bring to readers' minds, some washers they have seen that did not fit in with these qualifications, so that although we said a short time ago that a washer is a washer the world over, we might safely add, "There are Washers—and Washers."

In starting this industry, they made the same mistake as many others, namely, that they started by constructing gang dies for rapid production. These dies were arranged so that a quantity of washers were punched out at one time, certain punches performing the function of piercing the centre hole, while the others were blanking the outside diameter. Not only was this plan a costly one as regards die and punch upkeep, but it was very unsatisfactory from a quality standpoint, as the washers came out distorted and with a very dished appearance.

After quite a discussion, it was de-

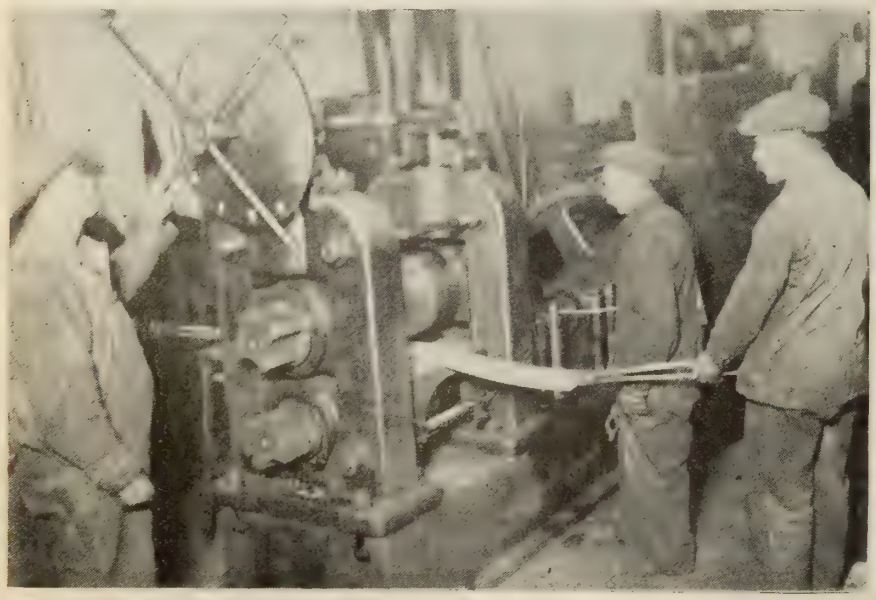


FIG. 1—THE ROLLING OF STOCK TO THE PROPER GAUGE.

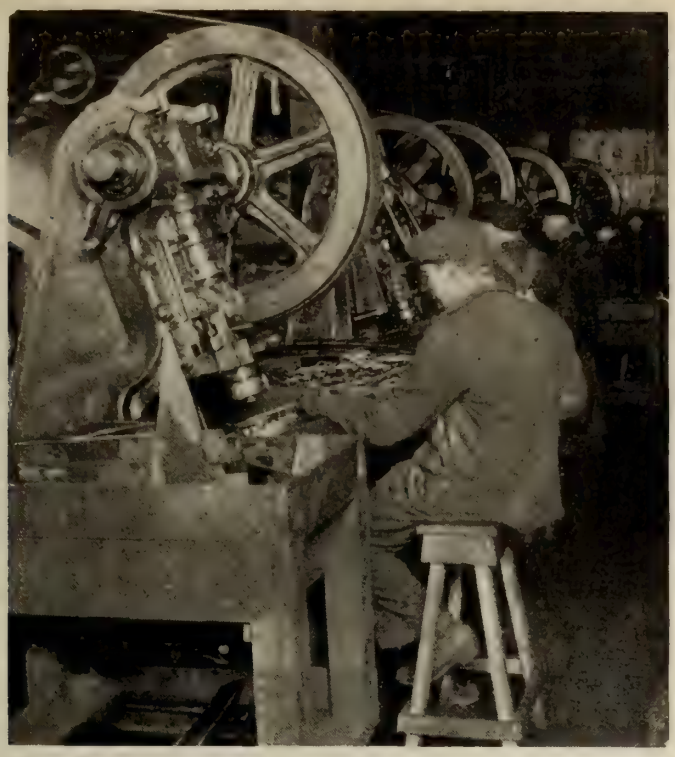


FIG. 3—A LINE OF HEAVIER PRESSES THAN SHOWN AT FIG. 2.

cided to scrap these gang dies and go after the problems from an entirely different angle. It was arranged that only one washer would be produced at a time, and that the piercing of the centre hole, and the blanking of the outside diameter would take place on the same stroke of the press.

This was done, and results have far exceeded the most sanguine expectations. Not only do the washers come out perfectly flat, but as the centre hole piercing and blanking operation occur at the same time, the hole cannot help but be concentric with the outside diameter. In this way they have produced a perfect washer. Let us enter into the actual making of the washers from the time the plate is delivered to the storage yard.

The Rolling Operation

The stock is first cut to proper widths on a huge shear of 36 inches capacity. This machine ranks with the largest in Canada, weighs approximately 27,000 lbs., and can cut up to 6½ round bars. It is driven direct from a 50 h.p. motor, and cost over $10,000 to install.

After shearing, the stock is trucked to the plant. Should the material be of the proper gauge, it goes directly to the press room, but in the event of some gauge be required that is not in stock, they proceed to roll their own material. At Fig. 1, we show these rolls in operation, installation being from the Toledo Machine & Tool Co.

Six men work in conjunction on this operation in the following capacity:

The stock is placed in a Strong, Carlyle & Hammond furnace, and heated to 1,300 degres Fah., the fuel used being crude oil. The operator attending to the furnace pulls the stock partially out of furnace, while one of the two men stationed at front of machine take the stock on tongs, and pass it through the rolls. The reason two men are used at this position is to guarantee the running of rolls to full capacity.

Referring to the picture, we see a worker stationed at side of rolls operating the thickness dial. As a rule, two passes, or three to four at the most, are sufficient, but of course the number of passes depends on the amount which the material has to be reduced. The dial operator is thoroughly conversant with these conditions, and regulates the rolls as each pass takes place.

The Press Room

The next operation in sequence is that of the stamping of the washers. This work is done on a variety of presses. Fig. 2 illustrates a line of Niagara Automatic Presses, while Fig. 3 shows a batch of heavier presses of different makes. As explained previously, this concern has adopted the principle of one washer for every stroke of the press. They accomplish this in the following manner. The dies are constructed on the sectional plan, that is, the dies are made up of various pieces or sections. Suppose we had to punch some washers two inch diameter with a ½ inch hole. The outside die would be a two-inch blanking die, while the centre die would be a ½ inch piercing die. The ram of press would be equipped with two punches, a ½ inch punch and a 2 inch blanking punch. Readers will, no doubt, follow this description, so we will go one step further. Suppose another washer is required, 2½ inch diameter with a ½ inch hole as before. In this case, the centre punch and die are not disturbed, but only the 2 inch die and punch removed. The 2½ inch size is placed in position, and away the production goes without any lengthy interruption. Every die is standard as far as fitting the bolster is concerned, so that this sectional die proposition is not only economical, but ideal from a quick changing point of view as well.

Rumbling the Washers

When a sufficient quantity of washers have been punched, they are placed in rumblers, as shown at Fig. 4, and revolved in this machine for one hour or more. This operation polishes the washers, besides removing all burrs. In coming out of these barrels, they are transferred to the packing and storage department.

This department employs a simple and efficient scheme for handling standard lines. The photo at Fig. 5 illustrates the idea clearly. The storage benches are so arranged that each size washer has a certain compartment. On the wall above this section is plainly



FIG. 4—REMOVING THE RUMBLED WASHERS.

marked the size washers contained in each bin. These bins are equipped with a sliding door which on being pulled up allows the washers to come down into the box, as shown in packer's hand. The benches are built on a slight slope to aid in the removal of the washers. They are next packed in two ways, in boxes of 50 lbs. and in kegs of 150 lbs.

To mention how many types of washers this concern makes would be impossible, for as they say themselves, show us the style washer you require and we will make it. The safest way to state their present range would be to say any old size and shape from No. 30 gauge stock to as high as ⅝ inch thick.

Leaving the washers packed ready for shipment, let us consider various ideas adopted by this concern that are worthy of attention.

Item of Interest

For certain classes of washers, they use what is termed scrap plate. This plate, although called scrap, is in reality new material. It is composed of scrap pieces of plate used for innumerable other purposes. This plate is bought up and brought in from all parts of America and Canada, and to give readers an idea of its general appearance, we have photographed a pile of the material as it arrives at the plant. It is used just as shown (that is if of proper gauge) and whatever scrap is left over does not really amount to anything.

All scrap from any stock or plate is placed in a baling machine. No wires are used for baling purposes, but the material is compressed into bale form. This baled material is returned directly to the mills.

A close tab is kept on all stock used, and everything is carefully weighed in order to keep track of material passing through their hands.



FIG. 5—THE TYPE OF STORAGE BINS USED.

In the packing room, a large blackboard is installed. This board is arranged with certain spaces covering all their standard sizes of washers from 3/16 inch to 2⅛. Opposite the various sizes is marked the number of boxes of washers in stock. By glancing at this board, anyone can immediately tell what stock is on hand.

Some Examples of Special Washers

"Can you give us information of any special washer that saved considerable money to the firms ordering it?" we asked, and here is the story as told to us.

A certain automobile firm was desirous of obtaining a special washer made from cold-rolled stock. The washer



FIG. 6 -WHILE THIS LOOKS LIKE A JUNK HEAP IT IS A COLLECTION OF SCRAP ENDS OF FIRST-CLASS PLATE.

was 4½ inch diameter, 2⅞ inch hole, ⅛ inch thick, and it was essential that the washer be absolutely flat to within two-thousandths of an inch. We produced and delivered at a cost of 21 cents each.

The previous method of production was an extremely expensive one as the following operations will show: The washers were turned from the solid on the lathe, and the highest production was 20 washers every ten hours or an equivalent to two per hour. Not considering material at all, and figuring labor at 75 cents per hour, we have a cost of 37½ cents per washer. On top of this figure, you must add, not only material cost, but the upkeep on a machine tool worth in the neighborhood of two or three thousand dollars.

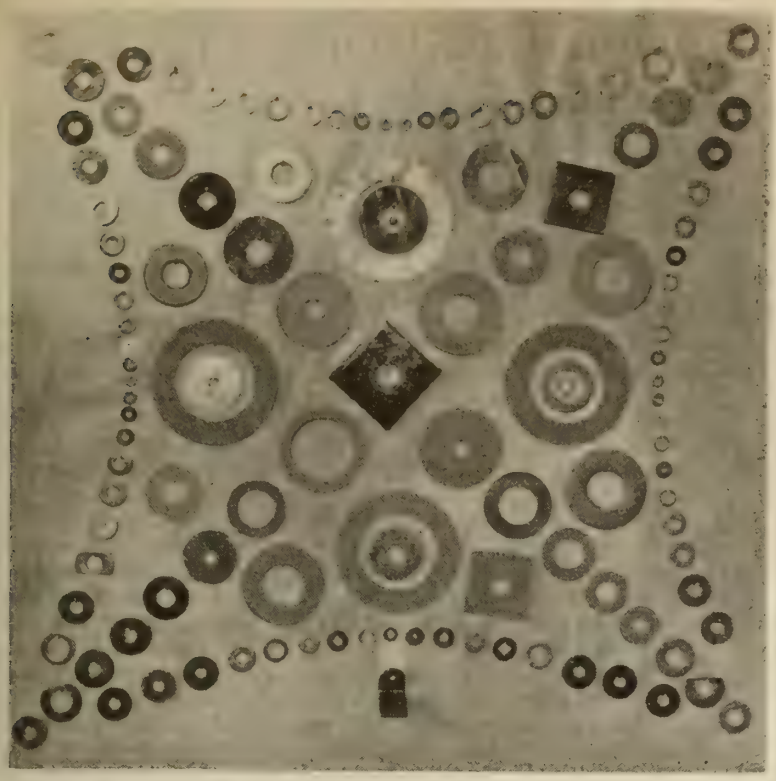
Another notable example that came to our attention was a case of quick service de luxe. A certain firm had a large quantity of angle iron which had become useless for its original purpose owing to a change in plans. They hated to scrap this material, and as they required a large quantity of washers in a hurry, they got in touch with the concern whose plant we have described.

The result was that the angle iron was sent to this firm at 10 o'clock in the morning, and the washers finished and delivered by 4 in the same afternoon. Some hustling. Here is how it was done:

The angles were first rolled out flat, then sent directly to the press room. Work was commenced immediately, everyone co-operating in the rush. Needless to say, they are proud of this record as they have good cause to be. Our reason for retelling the tale is to illustrate how far real service can be carried out.

Production Costs

Believing that they should know exactly to a decimal portion of a cent what their various lines are costing them, this firm has different cost charts, graphs, etc., which show clearly these expenses. The charts are so arranged to show a



THIS PICTURE GIVES SOME IDEA OF THE RANGE OF WASHERS MANUFACTURED.

week's production. Naturally, if the costs go up or down the cause is fully investigated.

The cost report is divided into certain headings which are well worth mentioning. First comes the size of washer, inside hole, and outside diameter. Next in sequence comes the gauge, pounds produced, scrap percentage, labor cost per pound, material cost per pound, direct overhead cost per pound, and ideal selling price. The last item is figured in the following manner: They figure approximately the overhead cost, then add a reasonable profit to this figure. By totalling the labor and material cost to this figure, they arrive at an ideal selling price. Nothing is left to chance but the entire business is run in an honest, common-sense basis.

Although they have only been making washers since June, 1919, a production of 1,000 tons a year has been attained. When we state that there are 64,000 washers in 100 pounds of small-sized washers, one can readily see the quantity necessary for 1,000 tons of washers. Of course, all washers are not so small, therefore, have less quantity per thousand pounds.

It is the intention of this concern to go after the world's market, but up to date it has had all it can do to cope with local demands, so that we can safely conclude by remarking that they surely picked on a commodity that was ever in demand, when they decided to specialize on washers.

INTERESTING DATA ON FUSIBLE METALS

Many times a person will want to make a cast or die in metal for use in embossing a token for Christmas or as a present, and for this and many other purposes the fusible metals are convenient on account of their low melting point. Some of them melt at even a lower temperature than is required to boil water.

Type metals, although they do not melt at very low temperature, are much preferable where a clean, sharp and fairly durable cast is wanted.

In order to mix and use these metals intelligently one should know something about their properties, especially those of antimony, bismuth and tin. Antimony and bismuth, each in their own way, have a marked effect upon any alloy with which they are incorporated. Antimony is very brittle; it also has the property of expanding when it solidifies; and, best of all, it imparts this property to its alloys, thus making them give fine, sharp castings.

Bismuth is very brittle; it forms alloys with other metals readily, and also imparts to them hardness and fusibility. In other words, it makes them melt at a lower temperature than they alone would melt. Most fusible metals contain bismuth.

Tin, when used with antimony, gives toughness and tenacity, and removes the brittleness caused by the antimony. Some formulas for the most common fusible metals are as follows:

1. Wood's metal—Bismuth, 4 parts; lead, 2 parts; tin, 1 part; and cadmium, 1 part. Melts at about 149 degrees F.

2. Fusible metal—Lead, 1 part; tin, 1 part; and bismuth, 2 parts. Melts at about 190 degrees.

3. Fusible metal—Bismuth, 8 parts; lead, 5 parts; and tin, 3 parts. Melts at about 200 degrees.

4. A tough type metal—Lead, 5 parts; antimony, 2 parts; and tin, 1 part.

5. Ordinary type metal—Lead, 5 parts; antimony, 1 part; and tin, ½ part.

By adding more lead in these type metals a softer alloy will be obtained. Some other useful formulas are as follows:

6. Stereotype metal—Lead, 5 parts; antimony, 1 part; and tin, ¼ part.

7. Non-friction metal—Tin, 10 parts; antimony, 1 part; copper, 1-5 part.

8. A German silver metal for casting—Copper, 2 parts; zinc, 1 part; and nickel, 1 part.

9. Pewter—Tin, 6¼ parts; antimony, 1 1-16 parts.

For the convenience of those who wish to use any of the foregoing formulas, the following table may be of use to determine the melting points. The degrees are Fahrenheit, and are the ones accepted by the United States Bureau of Standards.

Wrought iron	melts	at	2,737	degrees.
Copper	"	"	1,981	"
Bronze	"	"	1,692	"
Antimony	"	"	1,166	"
Tin	"	"	450	"
Bismuth	"	"	520	"
Cadmium	"	"	610	"
Lead	"	"	621	"
Zinc	"	"	740	"

Want Canadian Lines.—"The British firm of Albert Moloney & Co., 12 Amargura Street, Havana, Cuba, are anxious to obtain sole agencies in Cuba for the following heavy machinery manufactured in Canada: Return Tubular Boilers, Water-tube Boilers, Condensers (surface, jet and barometric), Power Pumps of all types (steam driven, motor and belted), Vacuum Pumps, Steam Engines, Valves and Fittings, Electrical Generators and Motors. Canadian manufacturers must bear in mind that Americans enjoy a preferential tariff in Cuba, but that this is more than offset at the present time by the discount on the Canadian dollar. Another substantial assistance to Canadian trade with Cuba is the recent establishment of a direct line of the Canadian Government Merchant Marine between Cuban ports and Havana."

Jones—that is not his name, but it will do—had the misfortune to get in the way of an automobile driven by a lady on Van Ness Avenue, and was taken to a hospital; but his injuries were not serious, so he was immediately removed to the police station, where his assailant was being held. And as soon as Jones got there the lady started in to impress him with the fact that blame for the accident was all his.

"You know, M. Jones," she said, "you must have been walking very carelessly. I am a very careful driver. I have been driving a car for seven years."

"You've got nothing on me, ma'am," said Jones, politely. "I've been walking for thirty-four years."

Machine Design in Manufacturing Practice

The Subject of Design, From Both a Functional and Manufacturing Standpoint is Taken Up. This Article Should Interest Tool Designers, Superintendents, Foremen and Workmen Alike

By E. BUCKINGHAM

IN early days the design of a new mechanism existed only in the mind of the mechanic engaged in its construction. It was made piece by piece, each detail taking definite shape as it was constructed. The original mechanism was completed, tested, and corrected or rebuilt before the design was finished. Duplicate mechanisms that might be constructed were patterned after the original, and modified or improved as suited the ideas of the mechanics who performed the actual work. Needless to say, interchangeability and quantity production were non-existent factors.

Sketches and drawings were next employed to express the ideas of the inventor, but little attempt was made to indicate more than the general idea and construction. The details of the design and the dimensions of the individual parts were matters for the workmen to decide. A competent mechanic was required to determine these for himself. It was part of his training. Details and dimensions, more or less complete and consistent, made their appearance on the drawings later. Errors and omissions were of little moment, as the mechanic who worked to the drawings expected to select and use the proper information given and to ignore the incorrect, supplying all omissions from his own store of mechanical knowledge and experience. The quantity of production was small. Little or no importance was placed on interchangeability. A few workmen thoroughly acquainted with the requirements of the mechanism or with the intentions of the designer performed all the actual work of construction. Under these conditions functional drawings, which make no pretence of giving more than the general construction or combination of mechanical movements and the general outline of the detailed parts, are sufficient.

Under present manufacturing conditions, with productive operations subdivided into elementary tasks, with productive labor trained along specialized lines, with productive equipment specialized and more nearly complete, with the rate of production greatly increased, with larger organizations in which but few individuals are thoroughly conversant with all the detailed requirements of the mechanism, the design must cover a wider field and be much more comprehensive and accurate. In addition to epresxsing the iueas of the inventor it must supply most of the knowledge and experience formerly brought to this work by the mechanic.

We now have, therefore, two types of designing to consider, which we will call the functional design and the manufacturing design. The manufacturing design is a detailed development of the functional design. It corrects and modifies the functional design where necessary to facilitate the economical production of the mechanism, giving as much as possible of the information previously supplied by the workman. It is evident that the manufacturing design will always be incomplete to a certain extent. Suitable provision for its modification must be made to obtain the advantage of the new and improved methods of manufacture which are constantly developed. Changes, however, in proved manufacturing designs should be avoided when possible. As much or greater care should be taken in adopting changes as is exercised in establishing the original manufacturing design. After equipment has been completed, changes are very costly. A change which might be justified in the early stages of work often costs more than it is worth in the later stages. This makes it of the utmost importance that great care be exercised in the development of the original manufacturing design of a new commodity which is to be manufactured in large quantities on an interchangeable basis.

For the construction of a small number of special machines, or tools and fixtures, which are built in a general machine shop or toolroom, the functional design is all that is required. The number of men engaged in the production is small, their training is general, and the requirements of the mechanisms can be explained to them personally by the designer as questions arise; therefore, the additional expense of a manufacturing design is not justified. However, in the manufacture of a large quantity of any article, particularly if interchangeability is sought, a complete manufacturing design is necessary. True, this design will work itself out in practice in the course of time, but this is a very slow and expensive method. It means that experimental work on a large scale is carried on, whereas it can be done on a smaller scale with better and speedier results. Furthermore, this method results in continual alterations in the equipment and a loss of interchangeability. However, this article is not concerned with designs of special mechanisms, tools, fixtures, etc.; attention will here be given to the requirements of designing as applied to the manufacture of a product in large quantities.

In both types of designing the end in view is the same as far as the functioning of the mechanism is concerned. This is to develop a product capable of performing certain results of which will fill or create a public demand for itself. The means of attaining this are governed by various considerations. For the functional design, any solution is satisfactory. As regards the manufacturing design, the methods adopted must result in ultimate economy. Also, the manufacturing design must resemble the functional to such an extent that all patents will be retained, while those of competitors must not be infringed. This is one of the commercial difficulties that at times prevent the true economic development of a commodity.

It is plain that the manufacturing designer must take into consideration every circumstance involved in the production of the commodity. To be successful he must work in close co-operation with all who will be engaged in the development and operation of the manufacturing equipment. This will include the tool designers, and the superintendents and foremen of the various manufacturing and assembling departments. In general, there is too much detail involved for any one person to carry it alone to a successful completion.

When considering the manufacture of a new product, one of two conditions usually obtains. Either it is to be produced in an established plant with an existing variety of manufacturing equipment, or a new plant must be created. In the first case the designer must be familiar with the available equipment, and must modify the functional design so as to utilize these facilities to the best advantage. In the second case he is not restricted to the use of any specified equipment. In either case, unless the volume of production is to be extremely large with many automatic operations, every effort must be made to reduce the machined surfaces of the various components to simple, elementary surfaces, which can be readily machined on standard machine tools with simple, rugged, and inexpensive tools, jigs, and fixtures. If, in the manufacturing design, the component parts are thus simplified, a further advantage is gained. The productive operations on these parts are resolved into simple, elementary tasks, and this simplifies the problem of securing and training the necessary productive labor. Simplicity is a

primary source of economy. The number of machining operations is reduced and the direct labor cost thereby lowered. The amount of time that raw material is tied up in process of manufacture is reduced, and quicker returns are secured on the money invested in direct labor and materials. The many other economies resulting from simplicity in design, such as lower equipment and maintenance costs, are obvious.

Those responsible for the manufacturing design must pay close attention to the character of the materials they specify for the individual components. Ultimate economy is the desired end. This is affected by many different and sometimes opposing factors. The first cost of the material is one of these. When several thousand duplicate mechanisms are manufactured, the slightest saving in the cost of direct materials is multiplied over and over again in the course of time. As many parts as possible should be made of the same size and kind of material. This permits purchasing in larger quantities, and reduces the gross amount of raw material carried in the storeroom. As far as possible this material should be of standard sizes and forms that can be purchased in the open market at the lowest prices.

Due consideration must be given to the possible sources of supply for the materials specified. It is a serious matter when production is held up because of lack of material, which has a limited or uncertain source of supply. Every effort must be put forth in making the manufacturing design to specify materials which are readily secured.

The actual economy of low-priced material is governed by the ease with which it can be machined. If a part requires many machining operations, a low initial cost for material is often overbalanced by the greater cost of manufacture. Therefore, if a more expensive material can be machined at a lower cost, ultimate economy dictates its purchase. For this reason, the use of extruded or rolled bars of special form is often adopted in the manufacture of small parts for adding-machines, typewriters, counters, and other similar mechanisms.

An illustration of this point occurred in a large plant which makes small duplicate parts. Several of these parts were made of brass castings because of the lower cost of machining, but the price of copper began to rise and was soon about double its normal price. It was decided to substitute cast iron for brass, because the difference in the cost of machining was less than the difference in the market price of the materials. Luckily, an investigation was made before the change went into effect. This plant had its own brass foundry, but no iron foundry. It was discovered that the foundry had purchased no copper for several years. In fact, a large stock of pig copper had been stored in a shed and was never touched. Another department of this plant was engaged in making copper matrices by a plating process, and the trimmings from these supplied all the pure copper which the foundry required. This, with scrap brass stock from other departments, made it unnecessary to purchase any metal for the brass foundry in the open market. Needless to say, no change was made in the material of the castings. This incident indicates in some degree the many factors that must be considered to secure genuine economy. It is not a matter of mere addition and subtraction; every existing condition must be taken into account.

Whenever the weight of a commodity is an important consideration, as with automobiles, etc., the materials used in making it must be of a better grade than when the weight is less important. In every case the materials specified must be sufficiently strong and rigid to hold their form throughout the normal life of the mechanism. Thus, the detailed design of the various components is governed to a great extent by the nature of the materials which are used in their manufacture. For example, if forged steel is substituted for cast iron, the component will be of much lighter design.

The composition of the materials used is governed by the nature of the service which the part must render. One that is subjected to excessive wear must be made of material hard or tough enough to withstand it. Material for parts liable to corrosion or other chemical action must be of the proper composition to counteract it. Material for parts under constant vibration must not crystallize readily. In every event the materials must be selected to withstand both the use and abuse which they will eventually meet.

The establishment of suitable clearances and tolerances is a vital, if not the most vital, factor in the manufacturing design. Tolerances are, in many respects, like laws. There are two classes of laws. One is so severe and exacting in its nature that it cannot be enforced, and soon falls into disrepute and is disregarded, even though it remains on the Statute Book. The other is drawn up with a full understanding of existing conditions, and its justice to all concerned is so evident that it is readily and consistently enforced.

Similarly, tolerances fall into two classes. Those which represent the extreme conditions of accuracy obtainable from the equipment under ideal conditions can be specified without regard to the functional requirements of the product. In such cases they, too, soon fall into disrepute and are disregarded, even though they still remain on the drawings. On the other hand, tolerances are readily and consistently maintained when they represent the widest variations that the functioning of the mechanism will safely permit.

Liberal tolerances and clearances result in easier manufacturing conditions of every sort, and thus promote economy; they make quantity production possible. The serviceable life of tools depends directly on the extent of the tolerances. Every exacting tolerance is a direct check on the economical and rapid production of the mechanism. On the other hand, if the functional requirements do not permit wide tolerances, the functional requirements must prevail.

It is evident, then, that the construction must be carefully studied so that the manufacturing design will permit the widest possible tolerances. It is only in exceptional cases that a mechanism cannot be modified so as to retain all functional advantages and yet allow liberal tolerances on the majority of its dimensions. Very often, when there is a severe functional requirement to maintain, the introduction of simple means of adjustment promotes easier manufacturing conditions. In other cases a system of selective assembly is more desirable.

The designer must determine which parts will be interchangeable. Interchangeability can be carried too far, and thus allowed to defeat its own purpose, as noted in a previous article. Interchangeability and liberal maximum clearances are closely connected. Whenever reasonable clearances are out of the question on certain components, these parts are not suitable ones to be manufactured on an interchangeable basis. In this matter the relative accuracy of the available equipment plays a large part. For example, if the surfaces are elementary and can be finished by a simple grinding operation, much closer tolerances can be economically maintained than if they are composite and require milling or turning operations. The variations on work finished by grinding are about one-third those resulting from milling or one-half those from turning; and the effort expended is no greater. On the other hand, grinding is not always suitable or possible. Therefore, in determining whether or not certain required conditions permit reasonable tolerances, the designer must consider possible methods of manufacture and be well informed as to the normal variations resulting from them in actual practice. This knowledge is the outcome of experience in checking and analyzing results previous secured. This is a matter to which little attention has been paid in the past. For example, in a large and long-established plant, where many milling operations are performed, it had been assumed that these operations were maintained within a tolerance of 0.001 in. Actual measurements brought out the fact that the normal variation was over three times as great as that, and always had been. A similar misconception of actual conditions was apparent in the majority of shops engaged in Government work during the recent war. When their product

was actually checked by limit gauges and held to the specified tolerances, a variation of 0.002 in. or 0.003 in. was found to be an extremely small manufacturing tolerance. It is, therefore, one of the duties of the maker of the manufacturing design to specify the parts which are to be made interchangeable, those to be selectively assembled, and those to be fitted to each other. Careful attention to this detail saves much wasted effort in the shops subsequently.

Almost every mechanism can be subdivided into smaller units, which are distinct in their purpose. For example, an automobile contains an engine, transmission, axle, drive, carburetter, magneto, etc., which are assembled and tested as units and later assembled into the completed car. In like manner a typewriter is subdivided into the carriage, the escapement, the type-bar, and the segment assembly, etc. The assembly is greatly facilitated if the design of the mechanism permits such unit assembly construction; and efforts should be made to obtain this result whenever practicable.

There are many other advantages of this unit assembly construction. Not only the various manufacturing departments of one factory, but also entire plants, are specializing more and more. The automobile has hastened this trend more than any other one thing. Where such unit assemblies are of equal value on several articles, separate plants spring up to produce them as a specialty. This gives the benefits of quantity production where otherwise they would not exist. Therefore, we have as a direct result of unit assembly construction, separate plants specializing in engines, rear axles, carburetters, magnetos, etc., for automobiles; ball and roller bearings for all types of machinery; and many other similar specialized products.

Another practice which allows the benefits of quantity production to be obtained in the production of smaller number of complete mechanisms is the standardization of many of the individual components. For example, most manufacturing concerns have standardized their screws, nuts, studs, rivets, and other small parts. The majority of machine-tool builders also standardize their handwheels, micrometer thimbles, gears, toolholders, work-arbors, etc. A good illustration of the economy of this practice is found in the experience of one plant which originally manufactured over one hundred and fifty special screws and studs for its particular product. Little effort was required to reduce this number to less than half, thus increasing the rate of production of these parts and also reducing the stock of spare parts. This practice is extending to larger and more important components. Not only are similar parts produced by individual plants being standardized, but parts used in common by several manufacturers are also standardized and often manufactured as specialties by other concerns.

The design must permit the ready assembly of the product. Parts which require attention in service must be accessible. Attention to these details reduces assembling and service costs, and these must be considered to ensure ultimate economy.

The service requirements are the most difficult to determine. Time alone brings the desired information. Experiments and endurance tests in the factory are insufficient to give it. After a mechanism is on the market, it receives use and abuse that the makers never dreamed of. Yet if the product fails under these unforeseen conditions, the manufacturing plant is blamed. Naturally, the nature of the commodity determines what sort of service it must render. The service requirements of an automobile are distinct from those of a typewriter; those of a precision machine tool—which is supposedly used by skilled mechanics only—differ from those of a lawn-mower, etc.

The service requirements include the protection of the working parts from dirt and other foreign matter, the provision of proper lubricating facilities, and the protection of the operator from moving parts. The question of the best preservative finishes, such as japanning, plating, painting, etc., must also be answered to meet the service requirements, both of use and appearance. For these and many other similar problems a solution is sought that will result in the maximum amount of service at a minimum expense.

It should be clearly understood that the manufacturing design is not undertaken with the idea of wilfully altering the functional design, but is made to facilitate manufacture and to furnish as much as possible of that vast amount of detailed information previously brought to the productive work by the mechanic who carried out the inventor's ideas. The alterations made in the functional design by the manufacturing design should not be looked on as any criticism of the original lay-out. Each has its distinct purpose to perform. Many large plants recognize clearly the difference between the two types of designing and maintain separate departments for each. The original research and inventive work is carried on independently of the factory operations. New or improved designs are turned over to the factory organization, where they are redesigned to meet the manufacturing and service needs.

SOME SHOP SYNONYMS

We read in a recent issue of "Link" (which is the house magazine of the Coventry Chain Co., Ltd.), a few shop synonyms well worth repeating. Here they are:

A synonym, as is well known, is to be defined as a word we use when we cannot spell the other one. Considering the intricacies of English orthography, this is a highly satisfactory justification of the existence of the synonym, and we are far from having any grievance against it. However, we do not advance the theory that synonyms were instituted as a convenience in spelling. No doubt, like Topsy, they "just growed," and that, in common with language in general. Anyway, like the poor, they are with us, and as we are not concerned here with the question of origins we will proceed to mention a few examples of workshop synonyms.

If we mention that "guessing stick" is a common synonym for a slide rule, it is not intended as any reflection on the drawing office.

The sine bar is often termed a side car, but for such a respectable tool, that is merely flippant. To speak of juice is a rather irreverent way of referring to electricity, and to call an oil separator a whizz is a primitive use of language.

The question of the connection between E. treatment and heat treatment of steel would perhaps be better referred to in the "Things we want to know" column; but anyway, it is not quite as mysterious as it may seem.

Certainly such a pretentious adjective as hermaphrodite would never be allowed to wander about the shop unmolested, and accordingly calipers of that description become a "pair of Jennys," which is a deal more homely.

It might be expected that the war would leave some mark on shop terms, and so we hear double angle plates or U plates referred to as U boats.

No doubt it was originally intended that there should be some difference between adjustable spanners and micrometers, but even in the best of shops, tools and terms alike sometimes get confused. One would hardly take plug gauge to be a synonym for broach, but we know of an occasion when a large plug gauge was so used, and it was only given up when it was reluctantly admitted that "there was no more cut left on it."

It is estimated that the Irish bogs contain between 3,500,000,000 and 4,000,000,000 tons of anhydrous peat, or 5,000,000,000 tons of air-dried peat. At present about 6,000,000 tons of peat are burned as fuel in Ireland per annum, and over 4,500,000 tons of coal are imported. If this coal were replaced by peat fuel at the rate of 2 tons of air-dried peat to 1 ton of coal, the total consumption of peat in Ireland would be about 15,000,000 tons per annum, and the peat deposits would be sufficient to satisfy the fuel and power requirements of the country at the present rate of consumption for more than 300 years.

The doctor was attending an injured woman who had come to his surgery with her arm severely bitten. As he dressed the wound he remarked:

"I cannot quite make out what sort of animal bit you. The wound is too small for a horse's bite, and too big for a dog's."

"Oh, it wasn't an animal!" exclaimed the patient. "It was another lady."

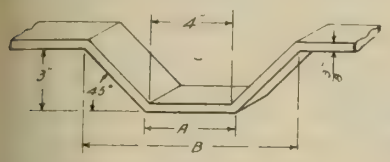
Shop Arithmetic, Continuation of Taper Work

Fifteenth of a Series in Practical Mathematics for the Mechanic and Those Learning the Machinist Trade—The Present Article Goes Still Further Into the Subject of Taper Work

By J. H. RODGERS

IN our treatment of taper work in a previous lesson, the examples were confined almost entirely to circular work produced in the lathe. While the fundamental principles are identical, no matter how the taper is produced, the method of solution frequently requires some mental research on the part of the student or the mechanic doing the work.

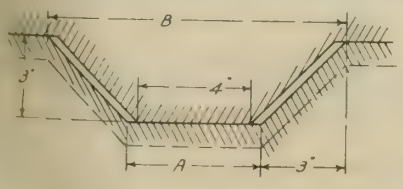
Suppose a punch and die is to be made to form a piece as shown below, made from ⅜ inch by 2 inch strip.



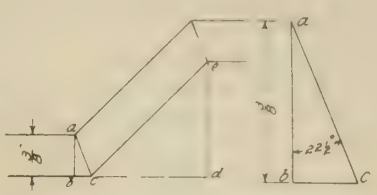
From the dimensions given the tools are to be made. It will readily be seen that the width across the nose of the punch will be 4 inches, and the sides inclined at an angle of 45 degrees. We have the depth of the die—3 inches, so the problem is to find the dimensions A and B. Without previous experience on work of this character a workman would probably make the punch and then fit the die to it. If templates are used he would make one to fit the punch and another to fit the one first made without considering the stock to be bent, thinking that if the punch is raised the thickness of the stock (⅜ inch) that all would be well. However, let us make a line template of the shape required and see the result. Here it is:



The sketch A shows the male and female templates fitted face to face. At B they are separated ⅜ of an inch. It will be noted that the horizontal spaces, equalling ⅜ inch, are wider than the inclined spaces, and the light vertical lines will make the reason quite obvious. It is evident that the space must be uniform throughout. The corrected templates, therefore, would appear as below, when allowing for the stock.



To find width A for the bottom of the die, we must have recourse to the rules on the solution of right triangles, in other words, an application of "trig." To aid the reader in the calculations the sketch below is given.



From the rules of trigonometry the side opposite (b-c) equals the side adjacent (a-b) multiplied by the tangent of the angle. In a formula this would be:

$$(b-c) = (a-b) \times \text{tangent } 22\tfrac{1}{2}^\circ \text{ or}$$
$$(b-c) = .375 \times .4142 = .155 \text{ inch}$$

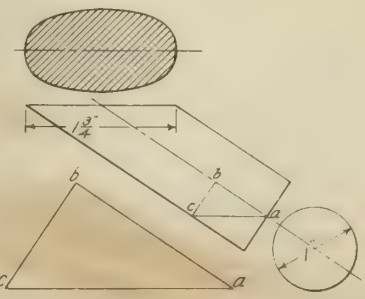
The width of A then would be: ...

$$4 + (2 \times .155) = 4.310 \text{ inches}$$

In the study of right triangles we have seen that, when the two acute angles are equal the sides are equal, therefore, the side c-d will equal the side d-e, so that the diameter at the top of the die will be:

$$4.310 + 6 = 10.310 \text{ inches.}$$

In milling machine operations we are frequently confronted with problems that might well be considered as coming under the head of taper work. Suppose we have a round piece of steel 1 inch in diameter to mill off so that the surface will have the form of an ellipse, the major axis of which will be 1¾ inches long, what will be the angle of inclination of the axis of the shaft?

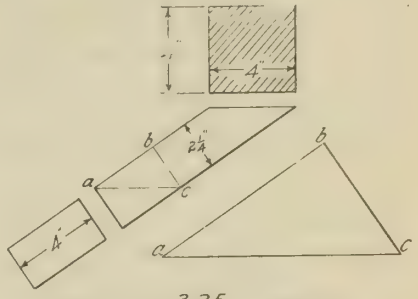


The angle required is that shown in the sketch and will equal (a) in the right triangle a, b, c. To find this angle use the "trig." formula:

$$\text{Sine} = \frac{\text{Side Opp.}}{\text{Hypot.}} = \frac{b-c}{a-c} = \frac{.5}{.875} = .57143$$

From a table of functions this value will correspond to an angle a shade over 33 degrees 50 minutes.

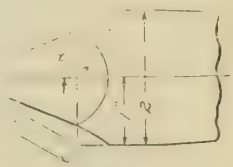
A bar of steel 2¼ x 4 is to be shaped or milled at one end so that the exposed portion will form a perfect square. It is desired to know the angle at which to set the bar so that a horizontal cross section will have the shape required. It is quite obvious, from the nature of the problem, that the narrow side will be parallel with the vertical plane. The solution is the same as that in the previous example and will be clear from the sketch below.



$$\text{Sine } a = \frac{2.25}{4} = .5625$$

and the angle corresponding equals 34 degrees 10 1-3 minutes.

In shops where heavy shafts have to be centred the square centre is a frequently-used tool. To have these made accurately it is often the practice to mill the cutting end to the desired shape, which, when finished, will have the corners uniformly inclined at an angle of 30 degrees with the axis of the centre. Below is show a sketch of a square centre in full lines, the dotted portion indicating the shape of the 60 degree turned centre.



To find the angle of inclination it is necessary, first, to find the distance c, e. On the end view this is seen to be the length o, c, which may be found by solving the right triangle o, c, b. Knowing the length o, b (the radius of 1 inch) and the two acute angles to be equal, the length of one side may be found by extracting the square root of half the square root of o, b, or

$\sqrt{\frac{1}{2}\sqrt{0-\delta}} = \sqrt{\frac{1}{2}\text{ of }1} = \sqrt{.5} = .7071$

7	5000	7071
7	49	
1400	10000	
7	9849	
1407	15100	
7	14141	
14140	95900	
1		
14141		

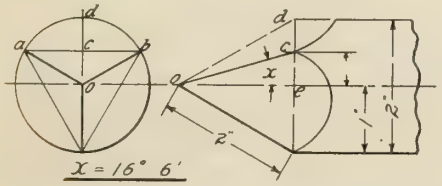
We now find the length o, e, which is done by the formula:

$$\text{Side Adj.} = \text{Hypot.} \times \text{cosine} = 2 \times .86603 = 1.73206$$

The desired angle o, in the right triangle c, o, e, is found by the formula:

$$\text{Tan.} = \frac{\text{Side Opp.}}{\text{Side Adj.}} = \frac{.707}{1.73206} = .40818$$

and the angle corresponding equals 22 degrees 12 minutes. Four sides milled at this angle will give a cutting angle of 60 degrees. In this instance the cutting angle can be measured with a centre gauge. Suppose, however, it was desired to secure the same result by using a triangular or three-sided centre; what would be the angle of inclination? As an aid to the solution the sketch is given.



As the angle a, o, c is equal to 60 degrees the length e, c may be found from the formula:

$$\text{Side Adj.} = \text{Hyp.} \times \cos. = 1 \times .5 = .5 = \tfrac{1}{2}\text{ inch.}$$

The length o, e is found by solving the right triangle o, e, d, and the formula used is:

$$\text{Side Adj.} = \text{Hyp.} \times \cos. = 2 \times .866 = 1.732"$$

Then the angle c, o, e (angle of inclination) may be found from the formula:

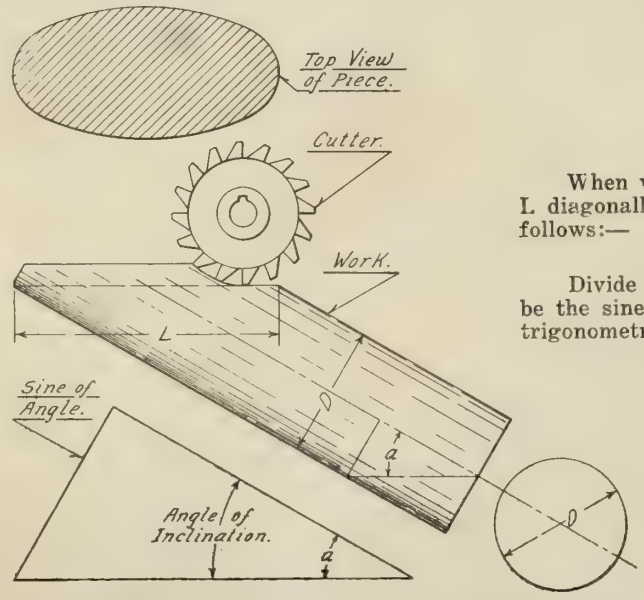
$$\text{Tangent} = \frac{\text{Side Opp.}}{\text{Side Adj.}} = \frac{.5}{1.732} = .28868$$

and the angle corresponding to this value is 16 degrees 6 minutes. This will be the angle at which to tilt the axis of the centre for milling the end and the indexing will be through an angle of 120 degrees.

A British firm has developed an apparatus for testing the physical qualities of steel after heat treatment by means of the magnetic method. The principle on which this instrument is based is that magnetic retentivity of a steel is a function of its hardness. The method of using this apparatus is as follows: First, a specimen (usually a turned piece 3 inches long by 1½ inches in diameter) is subjected to the heat treatment required to be investigated. It is then tested for magnetic hardness by being laid inside a standard magnetizing coil, and a direct current from the mains flashed on to the coil which magnetizes the steel to saturation. The specimen is then removed from the magnetizing coil and is placed in a small search coil, which is directly connected to a Grassot fluxometer, continues "Automotive Industries." The specimen is then sharply removed from the ballistic coil and a reading is obtained on the fluxmeter, which represents the hardness of the specimen. The scale of the fluxmeter is divided in terms of Maxwell-turns. With the search coil of correct design, the reading is also given in terms of C. G. S. units of coercive force, so that the results are in international accord.

Experience has shown that the practice of enclosing metal filament lamps of high candle-power in closed fittings is disadvantageous. According to the "Technical Review," a Swedish engineer, investigating the matter, has found that it is the rise in temperature which causes the rapid diminution in luminous intensity. He ran several incandescent lamps at temperatures of 200 deg. and 20 deg. C., while others cooled by a water circulation device were only at a temperature of 20 deg. or 3 deg. C. After some hours' running, in the case of the lamps at a temperature of 200 deg. C., the luminous intensity had dropped considerably, and they were unusable after forty hours' running, whereas with the lamps run at 20 deg. and 3 deg. C. the diminution of intensity was inappreciable after that period. This is apparently explained by the fact that at high temperature the glass of the bulb becomes porous and air enters the bulb, and it also explains why, where large numbers of lamps are arranged close together in advertisement signs, etc., they rapidly deteriorate.

Vancouver Harbor Board.—The Harbor Commissioners of Vancouver expect very shortly to complete the negotiations for the site at Burrard Inlet for the new harbor. The Great Northern property, which forms part of the proposed works, has been the stumbling block in the way of calling for tenders, but the owners of this property have decided on a price. This has been forwarded to the legal representative of the commissioners, Mr. McNeill, and the matter should soon be adjusted.



TAPER WORK
Milling Machine

When work has to be set at an angle to obtain a certain length L diagonally across a piece of stock, the angle A may be found as follows:—

Divide the diameter or width D by the length L. The result will be the sine of the angle (a), which may be found from a table of trigonometric functions.

Example:—A piece of 1½ inch round stock, is to be milled so that the diagonal section will have a length of 3 inches. What will be the angle of inclination?

.50000 Sine of angle (a)

This value, from a table of functions, will correspond to an angle of 30 degrees.



WHAT OUR READERS THINK AND DO



A SIMPLE JIG THAT WOULD NOT LEAD

By F. SCRIBER

Apparently a simple jig for drilling holes an inch apart in a staybolt tap is shown by Fig. 1, while the tap as drilled is illustrated by Fig. 2, where it will be noticed a series of holes are drilled in the shank so the bushing A may be advanced by even inches and clamped by the screw B at any desired position.

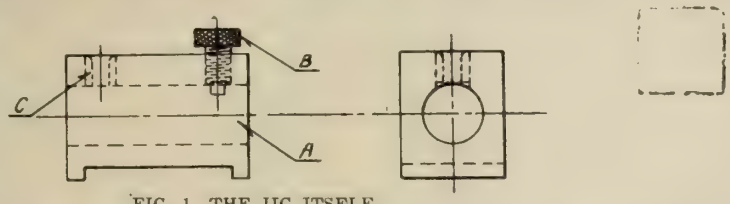


FIG. 1—THE JIG ITSELF.

The object of the jig Fig. 1 was, after correctly locating and drilling one hole, all others were drilled successively from this by setting the point of screw B into, first this hole and then progressively into each hole after it is drilled until all are machined by using the guide bushing C for piloting purposes.

Ten holes were drilled in this manner and it was found almost impossible to have the last holes drilled in anything like the correct location, the last hole often being twenty-thousandths out owto the drill having a tendency to creep while cutting, usually in one direction and perhaps only .002 at each hole, which, multiplied by ten gives the great discrepancy noted.

Fig. 3 shows another instance where minor errors between shoulders on a shaft mount up to considerable in a long length with a number of shoulders, as an error of .005 between shoulders if always short will amount to .030 where six lengths are to be measured.

While mechanics familiar with accurate machining this class of work would not be apt to get fooled by this condition. The point to be observed in this connection is always work from one hole or the same shoulder or the same locating point if you would keep errors down to the minimum. This rule holds good on most all classes of work on both tool design and shop operations.



FIG. 2 THE METHOD EMPLOYED IN DRILLING THE TOP.

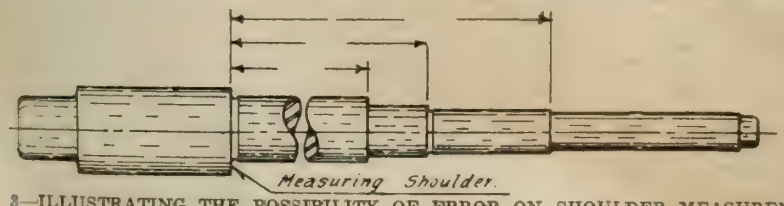


FIG. 3—ILLUSTRATING THE POSSIBILITY OF ERROR ON SHOULDER MEASUREMENTS.

WATERPROOFING BLUEPRINTS, DRAWINGS, ETC.

By F. A. McLEAN.

Architects, engineers, contractors, linemen, etc., are often compelled to refer to drawings, blueprints, etc., in all kinds of weather, with the result that before long the prints are in a very dilapidated condition.

A good way to overcome this trouble is to render them waterproof by saturating them with paraffine wax such as is used for sealing fruit jars, etc., and sold under the name of Parowax.

If the prints are placed directly into a pan filled with this molten wax, they will soak up too much of it and will always be more or less greasy to the touch. The most convenient way, therefore, is to soak a number of pieces of absorbent cotton cloth, about a foot or more square, in the wax. When these pieces of cloth are cool lay as many as are required (depending on the size of the blueprint) on a table or other smooth surface, place the print on top of these and then on top of the print lay more of the cloths until it is entirely covered. After this is done it is only necessary to run a hot iron over them for a few moments. The print will immediately absorb the paraffine until the surfaces become saturated. If the table on which the work is carried out has a highly-finished surface, a layer of wrapping paper should be placed between the cloths and the table. Should the domestic iron be used in the process it would be a good plan to interpose a piece of wrapping paper between the iron and the cloth, also as it may prevent a few hard words from friend wife.

CHART OF STRENGTH OF WOOD BEAMS

John S. Watts

THE accompanying chart gives the section modulii for rectangles up to 16 in. deep by 14 in. wide, and will prove useful for calculations on timber construction.

As it is frequently desirable to know what size of steel I-beams could be used as an alternative, the chart has been extended to show the sizes of I-beams having the same moment of resistance as any size of wood beam up to 16 in. by 14 in.

The stress is taken as 1,000 pounds per square inch for timber, which is safe for the commercial grades, and for the steel beams the stress is taken at 16,000 pounds per square inch.

Taking the stress at 1,000 pounds, the moment of resistance can be read directly off the chart by simply multiplying the section modulus by 1,000.

The moment of resistance for the wood beam as so found is, of course, also the moment of resistance for the steel beam on the same horizontal line.

It may be noted that, in every case up to the limit of the chart the wood beam will be cheaper, that is in first cost. Obviously, in permanent work there are many other considerations to be taken into account, but for comparison, taking steel at say 4 cents per pound, and timber at say $40 per thousand feet, board measure, we have as the cost of the steel beam per foot:

Weight for foot multiplied by 4 cents equals cost per foot in cents. And for the cost of the wood beam there will be in one lineal foot:

$$\frac{\text{area of the beam}}{12} \text{ feet board measure.}$$

Therefore the cost per foot will be

$$\frac{\text{area of the beam}}{12} \times 4 \text{ cents.}$$

The area of the wood beam therefore requires to be twelve times the weight of the steel beam per foot to equal it in cost, which a trial will show the wood beams do not nearly approach.

To use the chart to find the size of beam required for a given moment of resistance, follow along the horizontal line for this moment and read off the sizes at the intersection of each diagonal and vertical line on this horizontal line.

Also at the right, on this same horizontal line, we find the size of the steel I-beam required to give the same moment of resistance.

For example, if we required a beam to have a moment of resistance of 250,000 pounds, following along the 250 line, we get the choice of the following sizes of wood beams: 10½ in. x 14 in.; 11 in. x 13 in.; 12 in. x 11 in.; 13 in. x 9 in.; 14 in. x 8 in.; 15 in. x 7 in., or 16 in. x 6 in., the first dimension being the height of the beam in each case. Continuing along to the vertical line at the right, we find that an 8 in. x 23 in. I-beam is the equivalent in strength to the aforesaid wood beams.

In the matter of cost, as pointed out above, the wood beams would require to have an area of 23 x 12 = 276 square inches to equal the cost of the steel beam, whereas the largest, i.e., the 10½ in. x 14 in., has only 147 square inches, therefore the cost would be only a little over half of that of the I-beam.

In a paper on "The Policy of the Air Board of Canada," read at one of the business sessions of the Engineering Institute convention by Lt.-Col. O. M. Biggar, vice-chairman of the Canadian Air Board, the speaker outlines the development of transportation from the time of the foot runner up to the present time. In speaking of the future possibilities of commercial air service, he touched on the remarkable progress that hade been made during the period of the war, but as this achievement had been made regardless of all costs it would be the duty of the engineers of the country to take hold of this problem and solve it so that the airship could take its proper place in the competitive commercial transportation of the future. The tremendous rate of depreciation on flying machines at present (about $25 per hour on a $10,000 machine) was a factor that minimized their value as a commercial enterprise. Lt.-Col. Biggar predicts a pleasing future for the air service. "There has been such progress in aviation," he said, "that I have no doubt that well within ten years in Canada people will be regularly, but expensively, travelling by air routes, with carriage of certain mails in the same way. With ordinary Government encouragement there is certain to be a tremendous change in our methods of communication as a result of the development of the use of the air. It will not be a cheap method, but it is for the engineers to devise means to make it cheaper, and the future years will see its use to a continually increasing extent, both for civil, mail and military purposes."

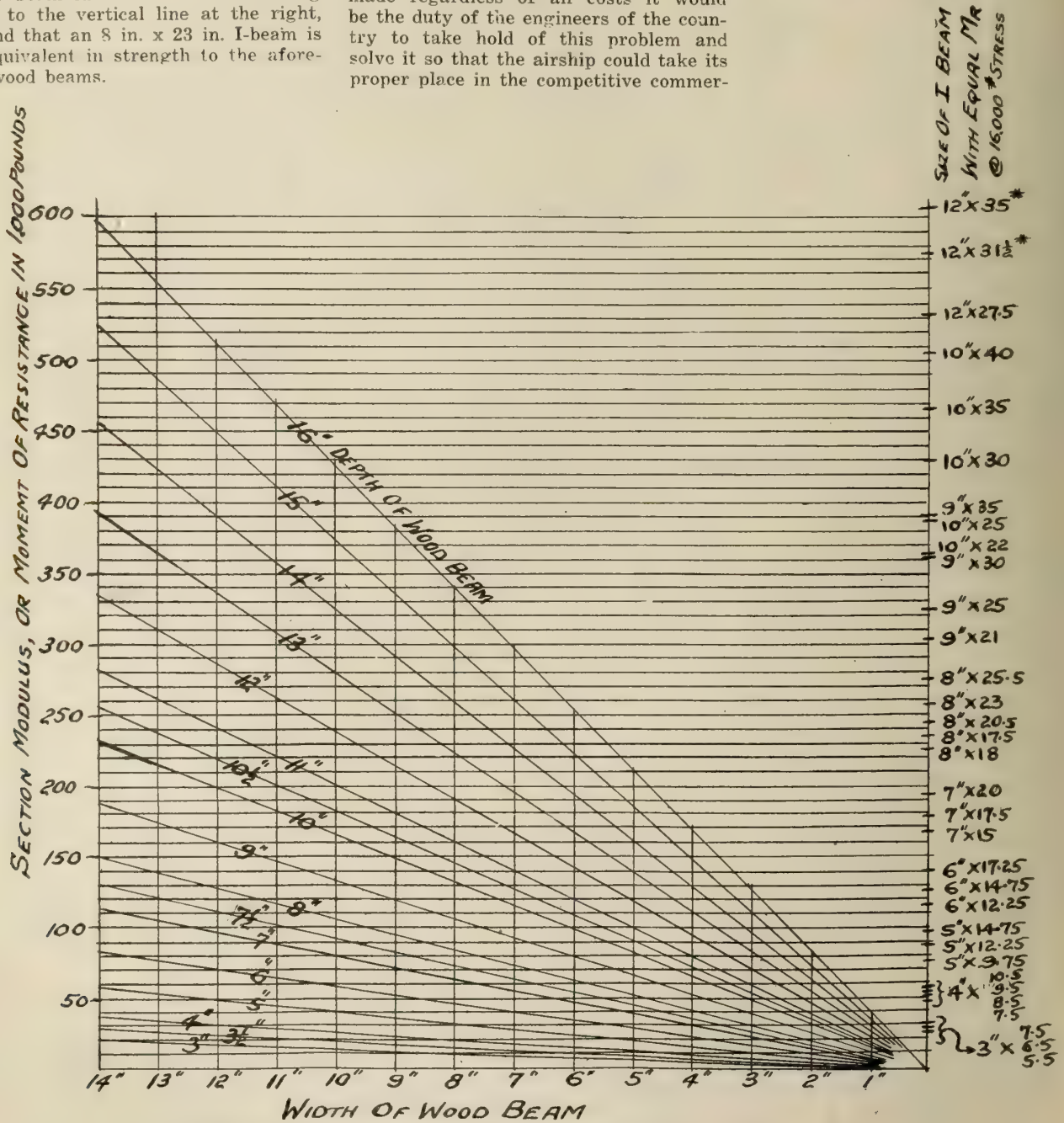


CHART OF MOMENT OF WOOD BEAMS WITH EQUIVALENT OF STEEL "I" BEAMS.

The Ludlum Type of Electric Furnace

An Electric Furnace Distinguished by the Ellipsoidal Shape of the Hearth and by the Arrangement of the Three-Phase Electrodes in Line Which Ensures Proper Heat Distribution

By W. F. SUTHERLAND

IN the manufacture of tool and alloy steels, where refinement is the first consideration, the electric furnace has proven itself superior to the crucible, not only in turning out a more consistently uniform steel of any given analysis, but likewise accomplishing this at less cost than by the older method.

The reason for this is plain in the first place, when it is considered that the electric tool steel manufacturer does not have to purchase selected grades of raw material, but can refine the mix in his furnace.

So, too, in the foundry, the electric furnace is the modern method of melting. The demand is for superior castings. Consequently, the refinement of the metal must be almost as accurate as in the manufacture of tool steel. The rare alloys are frequently added in the process. The percentage of sound and serviceable castings is here the first consideration.

The electric furnace has yet another use in the metallurgy of iron and steel and for the production of pig iron from scrap it has found considerable use, particularly during the war. The Ludlum electric furnace described in this article is being successfully used at the present for the commercial production of the finest quality of cast steel, cast iron, low phosphorous pig iron and washed metal.

Low phosphorus, low sulphur pig iron has been made successfully, both in the plant of the Metal Alloys, Inc., at Watervliet, N.Y., and at the plant of the Omaha Structural Steel Works at Omaha, Nebraska. The operations at Watervliet were more or less in the nature of a war expedient and were abandoned after the armistice on account of the facilities being required for more remunerative work. At the plant of the Omaha Structural Steel Works, where the furnace was put in operation about August 1, they have been making high silicon, low phosphorous, low sulphur pig iron, using a charge consisting of 1,500 lbs. of cast iron borings and 500 lbs. of stove plate, or steel shoveling scrap in a one-ton Ludlum furnace.

Over 200 tons of cast metal have been made by this firm with an electrode consumption of as low as six lbs. per ton and with an average power consumption per ton of less than 600 kw.

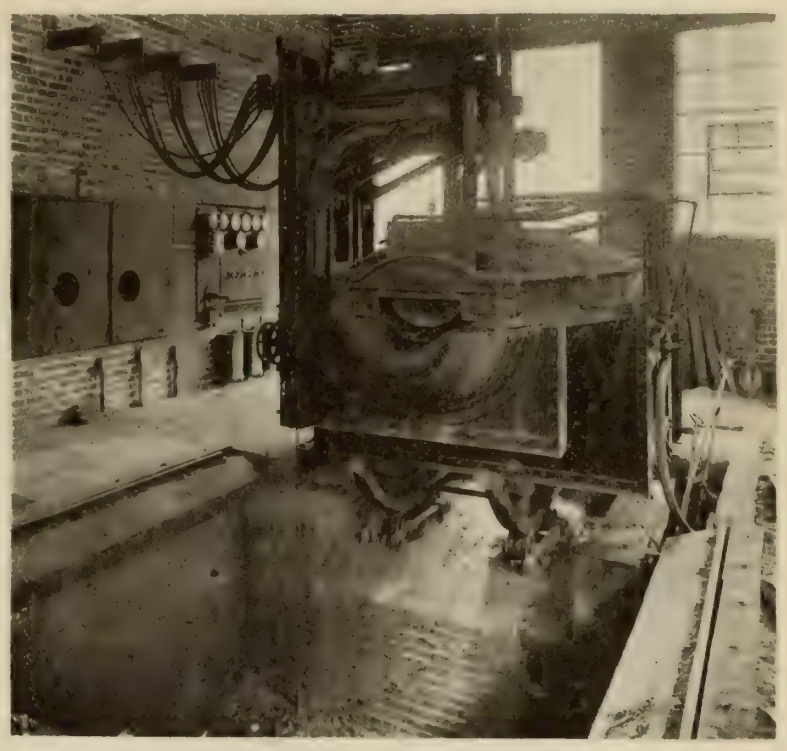
The electrodes are 4 in. graphite, the transformer operating the furnace is a 400 kv-a., Pittsburgh, 3 phase, self cooled, and stepping down the high tension voltage from 13,200 to 110.

This particular furnace is basic lined and no replacements have as yet taken place, the only expense being a small amount of syndolag for patching the bottom, which consists of sintered magnesite on a base of magnesite bricks. It may be mentioned in passing that furnaces of this type operating under much more difficult conditions have been run for more than 2,000 heats with the bottom still in excellent condition.

The pig is run in a sand bed and is afterwards charged in a grey iron foundry in the ordinary way. Castings made from this metal carry a scrap burden equal to, if not greater, than ordinary pig and at the same time the castings made from it have grain about twice as close as the standard pig, are free from inclusions and have a tensile strength of about 3,800 lbs., as against 1,800 for grey iron. This same furnace at Omaha is used during the day shift for steel casting.

The Ludlum electric furnace is an ellipsoidal crucible, consisting of a steel shell, lined preferably with magnesite brick, and covered by a low arched roof of firebrick. Three electrodes are used and these pierce the roof along the centre line, and are held in position by bronze arms projecting from upright beams attached to the furnace structure. These arms can be raised and lowered either by hand wheels or automatic control. There are no bottom connections, nor water-cooled parts below the bath.

There are only two doors, one at either end of the furnace, and no spout. Through these doors every part of the interior is easily accessible from a variety of angles. The furnace can be charged from both ends at once.



GENERAL ARRANGEMENT LUDLUM ELECTRIC FURNACE.

The furnace structure is supported on two sets of rollers, and is tilted by an electric motor to pour through one of the doors. The latest model is built to pour at only one end, and is back heavy as a measure of safety.

The furnace is as small for its capacity as it can be made. This means a very high efficiency due to a minimum: First, of exterior radiating surface; second, of space in the furnace unoccupied by the charge third, of refractory lining required fourth, of electrodes exposed.

To anyone familiar with drawing and setting the slag in electric furnace operation, and patching the lining at the end of a heat the advantages of the design here described should be apparent. Every part of the slag and every part of the lining after the metal is poured is directly accessible through one or other of the two openings.

For basic operation the hearth is lined with magnesite to a thickness of 9 inches or more. A lining will last for several months of continuous operation, and with careful and proper patching its life should be extended many times that long. The shape of the furnace itself is conducive to long life since none of the walls overhang the bath, even when the furnace is tilted. Straight lines are eliminated and the lining is thus stronger through the keying action of the bricks themselves. When the Ludlum furnace requires relining, the whole job can be done from the moment the last heat is poured till the moment when fully lined and thoroughly dried, it is ready to be charged again, in twenty-four hours.

The roof of this type of furnace is a low arch built of fireclay brick.

The flat arch construction reduces the compression in the brick to one plane, instead of a number of planes as in the dome type. It has been found that it will last for several weeks of continuous operation.

In practice, an extra roof is built on a separate roof frame, and is ready to replace the old one at any time. This is most conveniently done when a new charge of scrap is loaded into the furnace, thus losing a minimum of heat in the operation. The charge hardly delays for a moment the ordinary routine.

Operation

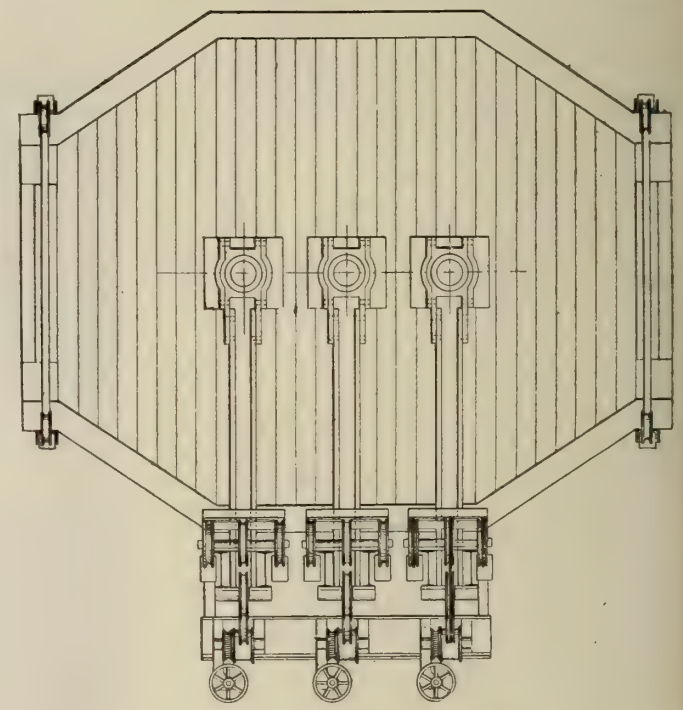
When a charge of scrap is to be melted down, the furnace is filled with the charge. There is no waste space to be heated and a minimum exposure of the electrodes within the furnace. The Ludlum is as small for its capacity as it can posibly be made and therefore as economical.

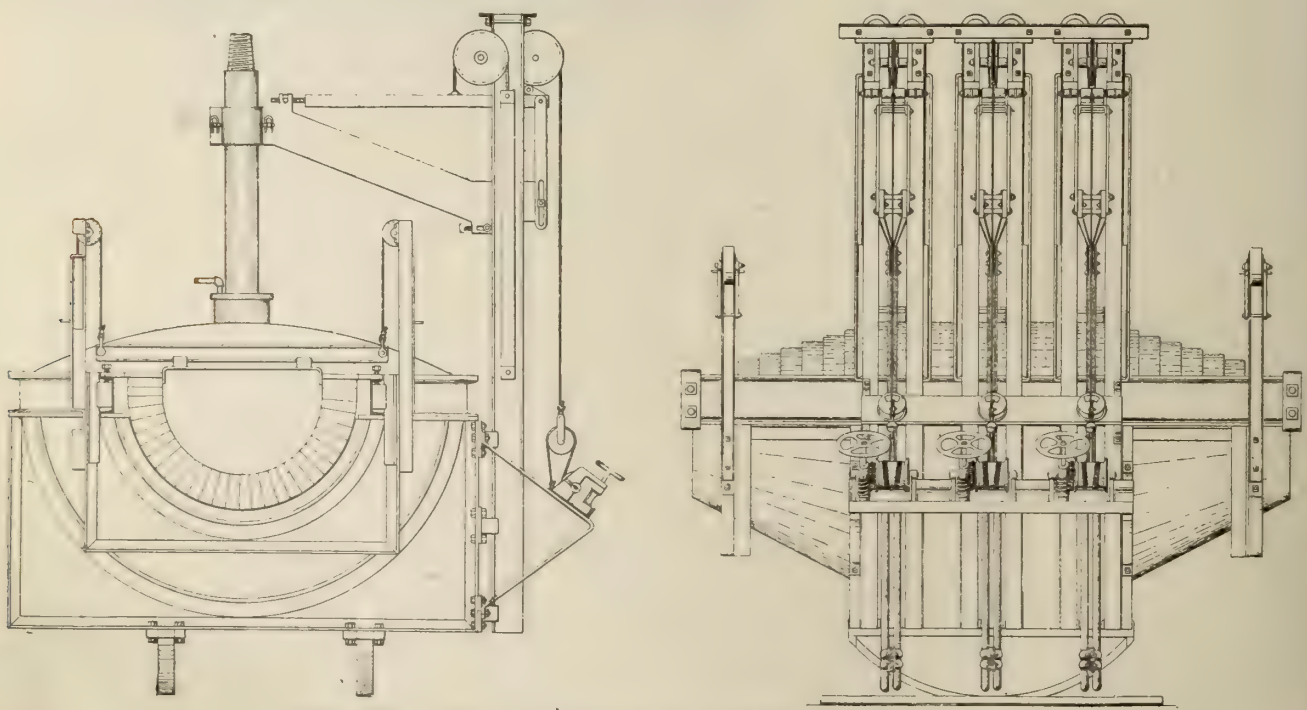
The electrodes at first rest on the charge and as soon as the current is turned on, eat their way through nearly to the bottom. By the time they have melted their way through there is a pool of molten metal beneath them, for there is no deeper part of the Ludlum hearth than that directly beneath the electrodes. The charge is melted from the bottom up, the arcs remaining smothered in the scrap until it is completely melted down. Practically no heat is lost in the operation and the roof is not exposed to the high temperature radiating from an open arc.

In refining alloy tool steel, with the use of two slags, the makers state that the current consumed is very small, about 500 kilowatt hours per ton. The power factor is about 90 per cent.

The use of the electric furnace for the production of high grade steels of all analyses for a period of years has convinced the Ludlum Steel Company of its superiority. This superiority results from the ability to use cheap raw material, even turnings, by reason of the refining ability of the basic hearth; low melting loss, even with small size scrap and an atmosphere which can be controlled to a nicety. This latter feature makes thorough dephosphorizing and desulphurizing, while it also prevents loss of alloys present or added to the steel by reason of the reducing atmosphere obtainable.

The electric arc permits the attain-





PLAN, END AND SIDE ELEVATIONS OF LUDLUM FURNACE.

ing of temperatures above those attainable by any other heating medium, while it gives a clean heat and introduces no contamination or chemical change per se in the charge. Thermal conditions can be accurately reproduced and maintained as desired.

Crucible quality steel of uniform analysis can be produced in large charges from cheap raw material because of the

(a) Refining ability.

(b) Control of temperature possible.

(c) Cleanliness of heating medium and ability to have heating uniform in all parts of the bath.

The electric furnace produces better ingots as flexible temperature control reduces piping and segregation by permitting pouring at the most advantageous temperature for the size of the ingot and the analysis produced by other methods, because of the absence of included slag, non-ferrous segregation and gases.

Specific Claims

The makers of the Ludlum furnace state that it operates smoothly, with small surges, which are prevented from reaching the power company's lines by the use of suitably designed static transformer equipment and automatic electrode regulation.

Due to the correct design of low tension conductors and other equipment, the average operating power factor is at least 90 per cent.

The Ludlum furnace may be provided with either an acid or basic lining, as desired, but lends itself most efficiently to basic operation, because of its maximum of refining ability. For this reason, except for a few special purposes, the makers advocate and furnish a basic-lined furnace, believing that the more expensive basic lining is more than compensated for by the lower cost of raw material used and the higher grade of the output obtained.

The design of the shape of the Ludlum furnace:—

(a) Permits supplying energy to the furnace at a high rate, within the critical limits of the refractories, resulting in quick heats which assist in attaining as low power consumption per ton of metal as is possible for producing a given desired temperature of the bath.

(b) Permits thorough refining by reason of the large area of contact between the slag and steel attained with a shallow bath of large superficial area.

(c) Permits the proper circulation of the entire bath for mixing the charge, which is brought about by the arrangement of the three electrodes in one plane coincident with the major axis of the elliptical hearth, whereby the reaction of the currents between the electrodes provide circulation by electrodynamic means as well as convection currents.

(d) This electrode arrangement, operating on three-phase energy, results in the production of an equal amount of heat at each electrode. The greater amount of heat in proportion to the mass of the bath at the ends cares for the greater radiation at the doors and results in an even temperature, gradient throughout the bath, which favors long refractory life.

(e) Makes sintering in lining easy, as but one piece of scrap electrode is required to reach all three arcs.

(f) Reduces danger of breakage of electrodes as the maximum of space for operating rabbles, test spoons, etc., is available without coming in contact with electrodes.

(g) The use of graphite electrodes reduces the weight of electrodes handled and storage space required; facilitates making of joints having the best electrical and mechanical properties and reduces the freight and handling charges for electrode material per ton of steel.

(h) Requires but two doors, one at each end of the major axis. These doors serve as charging doors and pouring spout and from them every part of the bath is accessible and the lining can be inspected and repaired with a minimum of effort. This makes the care of the bottom simple and results in long refractory life.

(i) The hearth meets the roof without any intervening vertical side walls so that no space is wasted. The contour of furnace interior approximates the natural contour of a pile of cold charge. The cubic contents of a Ludlum furnace is but ½ to 1-3 that of round or square shell types of the same capacity. This, and the small exterior surface exposed, results in high thermal efficiency and favorable power consumption.

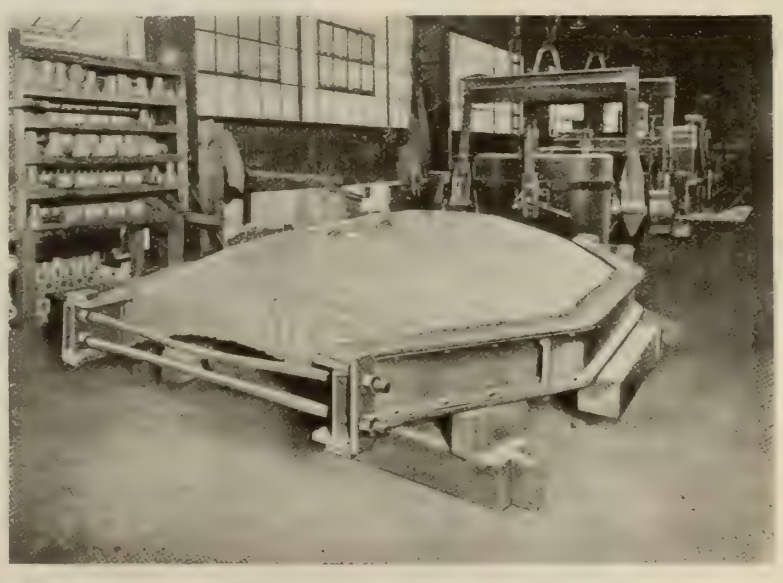
(j) The comparatively low roof results in the reduction of electrode consumption as a minimum length of electrode is exposed to oxidation when dephosphorizing and when charging.

(k) This shape of hearth, tilted in a plane, parallel to the major axis of the furnace, permits thorough clearing of the metal with a motion of only 30° from the horizontal and no refractories overhang the bath at any position of tilting.

(l) No special shapes of brick or exceptionally skilled masons are required to line the hearth or roof and the expansion of the refractories, which takes place when the furnace is heated, is adequately cared for by its shape. The design of the roof arch is simple and provides a very uniform distribution of reflected heat. Favorable thermal conditions permit the use of firebrick roof, which somewhat reduces refractory costs as with proper care the basic sintered lining has an extremely long life.

(m) The arrangement of electrodes and the shape of the bottom results in the formation of a metal pool, which extends under all three electrodes by the time they have cut through the charge. This metal protects the bottom refractories from the arcs and allows melting from the bottom up without injuring the lining. The charge acts as a blanket, which absorbs the excess heat, increases the speed of melting, by being preheated therefrom and protects the roof from the heat until the entire charge is molten, when the covering slag tends to perform the same function.

If, in a photographic dark-room illuminated by red light, the face of a watch with a so-called "luminous" dial be observed, a curious effect is noticed. When the watch is moved to and fro, in the plane of the dial, the green luminous figures appear dissociated from the red illuminated dial and apparently are displaced and lag behind its movement. The illumination by the red light requires adjustment so as to be suitably related to the brightness of the luminous figures and the eye should remain in darkness for 15 to 20 minutes in order to get the best effect.



SHOWING DETAILS OF ROOF STRUCTURE.

"Be Able to Do It Yourself" is the Text Here

Grant Hall, Vice-President of the C.P.R., Has Come Up Through the School of Practical Railway Shop Work—Understands the Problems the Men Have to Deal With Every Day

By Joseph Lister, in *MacLean's Magazine*

"BE able to do it yourself." Probably the whole law and the gospels of Grant Hall, the new vice-president of the Canadian Pacific Railway, are summed up in these simple words. He has made a fetish of not only getting the thing done, but being able to do it himself, and therefore it is that he has climbed steadily from an apprentice machinist in the Point St. Charles yards of the Grand Trunk Railway to the second highest office in the gift of the Canadian Pacific Railway.

This isn't the story of the rise of a horny-handed son of toil. If Grant Hall's hands were horny, it was not because they were born that way, but because his particular ambition was to be able to do what he set his hands to do with efficiency, and he believed the way to do it was to know all about how it was done.

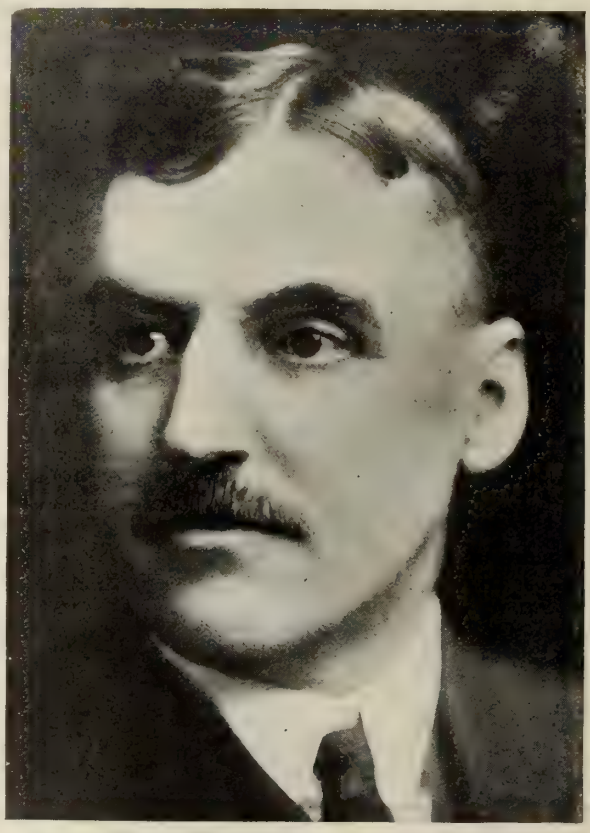
When he left Bishop's College, Lennoxville, Que., a school of some social standing, it was not to seek a profession but to find a job that would make him capable of handling the profession when it came. So it was that he laid aside the college cap with its nicely worked crest on the front, and donned his suit of blue overalls, and started in to learn railroading by way of the underside of the engine—the engine as it looks from the repair pits.

Soft hands soon grew calloused and grimy as to fingernails, and the natty blue overalls were streaked with grease; but Grant Hall knew something about a locomotive from about any angle you might want to view it. Inside or out, it was all the same to him. Three years later he joined the Canadian Pacific Railway, where he learned about all there was to know of the drudgery work of a railroad. But he stuck it, till he got an offer from the Intercolonial Railway to become their general locomotive foreman, with headquarters at Moncton, N.B. Locomotives were dear to the heart of Grant Hall, and the thought of having complete charge of these black beauties, of having the opportunity to learn more of them, to know what they could and could not do, and how they might be cared for to get the maximum result, drew him irresistibly, and he went.

Back Again to the C. P. R.

Five years later he was once again back with the C.P.R. Was locomotive foreman of the Windsor Depot, Montreal; and general foreman at McAdam Junction, Que., a year later. Up to that time he had been an Eastern man, knowing the Eastern end of the system. A change came quickly.. He was made general foreman at Winnipeg, and only a brief time later he was appointed master mechanic at Revelstoke, B.C. In 1902 he was back East again as assistant superintendent of rolling stock, to move West again in two years' time as assistant superintendent of motive power for the Western lines.

Fifteen years out of a nice finishing school, and he still knew more about the underside of an engine than about mahogany desks. But the mahogany desk time was coming, coming because the man who was to sit behind it did know about engines, about road conditions, and most of all about the men who drove these engines and maintained these road conditions. In 1908 he was made superintendent of motive power for the Western Division. Three years later he was assistant general manager of Western lines, then general manager of Western lines, and now vice-president of the company, in charge of the Western Division.

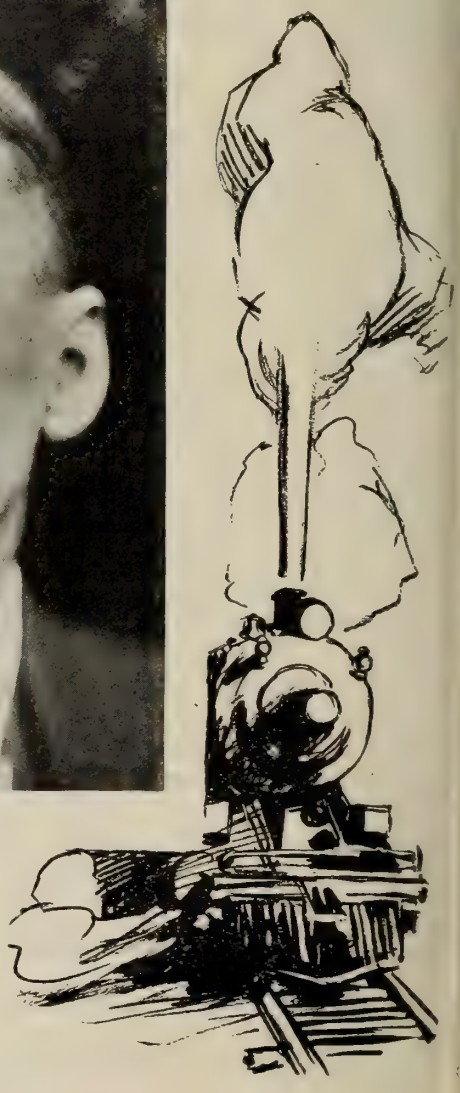


GRANT HALL
Vice-President C.P.R.

The Mahogany Desk at Last

There you have the mahogany desk, and behind it a man who has done about everything there is to do in the business of railroading with his own hands. When Grant Hall sets out to get the thing done now, he is not hampered, as so many executives are, by the smiling superiority of the man who knows the actual conditions, for he knows them himself. He has had his own fingers nipped throwing switches in a crowded freight yard in mid-winter, and he knows that it can be done. He knows, too, that throwing switches is hard to do, and these two facts are facts that stand out strongly in his viewpoint on the thing. It is going to be done, and the men who do it are going to get due credit.

While Mr. Hall was in charge at Revelstoke, some dozen or more years ago, there occurred one of the worst snow blockades in the Rockies in the history of the railway. Trains were tied up everywhere, and communication with the Pacific coast was cut off. It was a matter of digging a roadway through, an



almost herculean task. Grant Hall did not send men out to do it. He took them with him, and he stayed on the job every minute of the time. He is a driver; but he has his own method of driving. Probably the men who went out to dig that pathway for a transcontinental railway through the drifts had never worked as hard in their lives before, but there wasn't one of them who wouldn't have admitted that they had nothing on Hall in that regard. When the first gang went off duty, stiff and weary from the back-splitting work, Grant Hall stayed.

"I'll get the relief started," he declared.

He not only got the relief started, but he stayed with them to the end of the turn, wielding a shovel as zealously as ever. And he saw the first crowd back on the job as well.

He was there every hour of the twenty-four for a whole week. He stuck right with it. He called the men Jim and Bill and Pat; and Jim and Bill and Pat were their names. And there were times when the men forgot formalities, and hailed him down the line as "Grant."

They cut that road through, cut it through in a week, when everyone was pretty well ready to admit that the thing couldn't be done till Nature came along with a thaw.

It is that sort of thing that has made Grant Hall a favorite with the railwaymen. He not only works them, but works with them. Moreover, for all that he is placed in authority, he hasn't let that authority turn his head, and is as ready to accept advice as he was back in the old C.P.R. yards at Hochelaga, when he was busily engaged in learning his way about a locomotive.

Rewarding One Kind of Disobedience

There is one interesting story that they tell of him in this regard. Some time ago, some yardmen in a Western yard had been discharged for breaches of the company's rules. The yardmaster, feeling that they were good men, asked that they be reinstated in the company's service. He got a very definite statement from Mr. Hall, who was then general manager, that such a thing could not be done. Some time later, an assistant yardmaster was dismissed for drunkenness, and the switchman went on strike in an effort to force his reinstatement. The yardmaster was in a quandary. The wheat rush was on, and his yards were crowding up. Given a few more hours of inactivity they would be in a hopeless tangle that would take days to unravel. Then he remembered the men who had been discharged some time before and whom the general manager had refused to reinstate. They were all experienced men, the sort he needed badly. He called them together.

"Get on the job," he said, "and get those cars moving. I'm putting you on against orders, but I need you and I think you can do the trick. I'm going to take the chance of making the G. M. see it my way."

They went to work and untangled that yard in a way that was a delight to watch. Then, the yard cleared, the yardmaster reported to the trainmaster, and the trainmaster to the superintendent, and finally the voluminous report reached Mr. Hall. Under it the superintendent had written:

"What shall I do with a man who disobeys orders to the extent of putting men to work when the General Manager has refused to do so?" Without a moment's hesitation, the General Manager wrote after the query the laconic reply:

"Promote him the first chance you get."

That is Grant Hall. It didn't hurt his vanity that the man had disobeyed his orders. The yardmaster had been deputed to attend to certain duties. He had used his own judgment in carrying them out, and he had kept the yard clear. That was the main point, and the answer was: "Promote him the first chance you get."

Something About the Man

Grant Hall, for all that he was born in the East and got his early training there, has all the marks of a Westerner. A big man, upwards of six feet in height and tipping the scale at something a trifle over 200 pounds, with big hands and a square-set jaw, and a big voice that comes from the depths of his chest, he is the sort of man that is supposed to thrive better in the West than elsewhere. Anyway, he has been long enough in the West to learn its free and open-handed ways. Probably there is no man on the whole system who knows more men personally, or can call more by their first names than Grant Hall. That is no mean gift in itself. Call a man by his first name without patronage or boasting, and you have gone a long way toward reaching his heart. Mr. Hall does it because he likes men, and likes to know them and the men know it, and that is the reason he is pretty generally known as "Grant" from one end of the system to the other.

He is a big-hearted, kindly man of the most approachable kind, with a stability of brain and muscle that is suggested by his size. He is a man of swift judgments and as swift action. Petty difficulties don't embarrass him to any extent, because he pays them only a very passing attention. He has something to do, and he is at it all his waking hours. While in Winnipeg, he walked every morning from his home to his office, in order to keep himself in trim. It was quite a little step, about three miles; but every mornng he was at his desk well before nine o'clock, having stepped that three miles in well under an hour.

His appointment as vice-president pleased pretty well everyone on the road, for he is about as generally liked as anyone could be, and it was a most satisfactory appointment, as far as the business and agricultural interests were concerned, for they believe in his sincere desire to serve not only the interests of the railroad but of the people as well. It is claimed for him also, that when you get down to brass tacks, there isn't a man in Canada who can equal his positively uncanny knowledge of the motive power of a railroad, or has a wider knowledge of the mechanical features of the operation of a great transcontinental line.

It is this actual understanding of the details of the thing to be done, combined with his approachableness, that has made him such a favorite with the men of the railway. They are ready to grant his superior wisdom and vision; he not only knows his own work, which is beyond their horizon, but he knows their work as well. For that they are ready to yield him an unstinted respect. They know he is not going to ask of them more than a man can expect of a good worker, for he knows what the limits are. He is not going to ask less, because he measures men by the same standards he has set for himself.

THE INDUSTRIAL SUPERMAN

At a recent meeting of the Montreal Young Men's Canadian Club, Dr. H. A. Garfield, formerly United States Fuel Controller, spoke on a subject that is having a vital bearing on the stability of modern commercial evolution. The title of the address was: "The Industrial Superman," and the substance was based on the pitfalls of prosperity with which we are surrounded at the present time in the shape of exaggerated labor demands, particularly where such is accompanied by cessation of work that reduces the production of the necessities of life. This present form of industrial tyranny, the speaker said, is taking the place of that which was so pronounced a short generation ago, when the large trusts and corporations threatened to disrupt the peace of America. After dwelling on the serious effects of present day tyranny, the speaker said that the need of the hour was not a method of settling industrial disputes but rather a permanent means of prevention. The machinery to effect this should, in his opinion, be a consultative or advisory body composed of equal representation of capital and labor engaged in the industry, together with public representatives appointed by the Government. Mr. Garfield thought that a distinction should be made between the finding of the facts and administration policies, and that each of these duties should be handled by separate agencies.

"I'm going to the ball game this afternoon. I'm anxious to see our new ball player."

"My dear, it won't do you a bit of good to go. I saw by the paper that he died trying to steal third."



DEVELOPMENTS IN SHOP EQUIPMENT



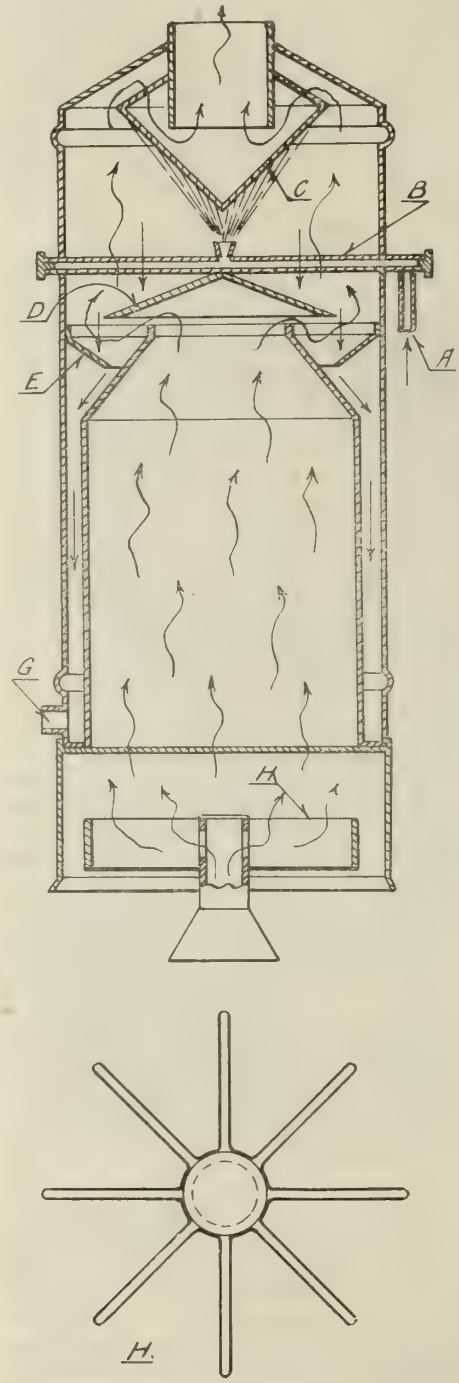
INSTANTANEOUS WATER HEATER

THE accompanying cuts illustrate a new type of water heater that is being made for the trade by the Dominion Welding Mfg. Co. of Montreal. The principle used in heating the water is that of bringing the heat from the burning fuel into direct contact with the water in its passage from the inlet to the outlet of the container. This method provides for the utilization of every heat unit produced by the gas, and when properly regulated there is absolutely no loss of heat. The flow of the water and the consumption of gas can be easily regulated and the control of both is obtained by the single lever shown directly in front and a little below the container.

This water heater requires no cumbersome tank, and can be supported by the fittings that are used to secure it in position on the wall or any other convenient location. The water does not lie stagnant while not in use, as there is practically no water in the tank at any time, the outlet being at the lowest portion of the water chamber. Even when in use the water passing through is virtually in suspension, weight is ever placed on the appliance. This permits the container to be made of light sheet steel that permits of instantaneous heating of the water when heater is operating.



GENERAL VIEW OF THE HEATER.



SKETCH SHOWING CONSTRUCTION OF HEATER.

The construction of the heater is shown in the line sketch. The cold water enters at A and passes into the cross pipe B and out at the opening in the middle where it is sprayed against the inverted cone C, thence dropping in succession to the baffle plates D and E and on to the inclined roof F of the inner portion, from where it flows down the side to lower level to the outlet G. It will be seen that the heat—shown by the staggered arrows — must pass directly through the sheet of water as it drops from one baffle to another, thus absorbing all the heat of cumbustion.

The burner is of special type, being made of strip steel, bent to the shape shown at H and welded along the bottom edge and to the central pipe connection, which has small openings leading into each radial section. The thin edges of the sheet steel burner permits of free mixture of the air and gas, resulting in good combustion. These heaters are being made for the trade both in domestic and factory use and are being distributed through the Welding and Supplies Co. of Montreal.

NAMCO BAR POINTING MACHINE

The National Acme Co., Cleveland, O., have placed on the market their Namco bar pointing machine to meet the requirements of manufacturers in general.

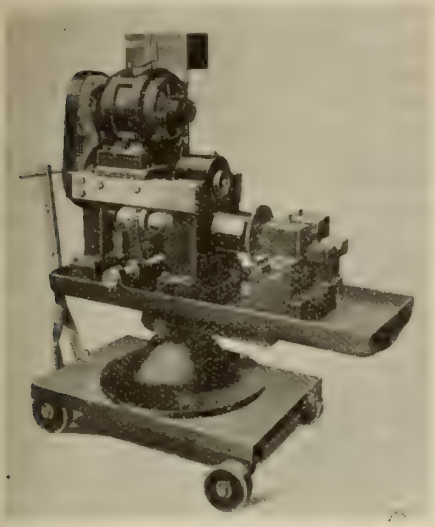
This machine was first built to meet the requirements of their own screw machine business which comprehends the cutting from the bar hundreds of millions of pieces yearly, and is therefore the logical result of their experience in a constant endeavor to discover faster methods where quantity production is sought.

The operating mechanism is very simple—consisting mainly of a gear-driven spindle carrying a plain turning tool in a revolving cutter head, a chuck and a hand lever. The chuck is provided with jaws which are quickly adjustable to accommodate practically all diameters and shapes of bars.

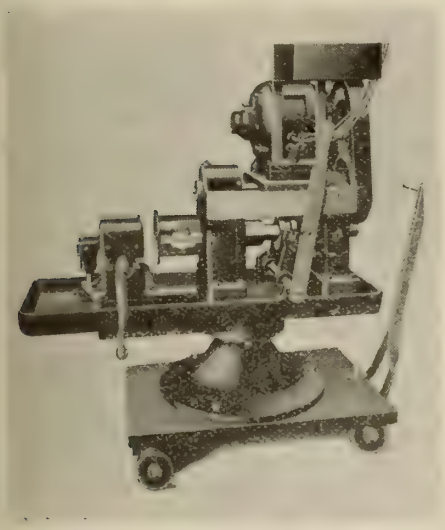
Round bars are pushed into the chuck,

gripped and the tool fed to the bar by the hand lever.

Hexagon and square stock are even



REAR VIEW OF THE MACHINE.



FRONT VIEW OF THE MACHINE.

easier to handle as no gripping is required. They are simply pushed against the tool which revolves in one position and withdrawn, requiring only one movement of operator.

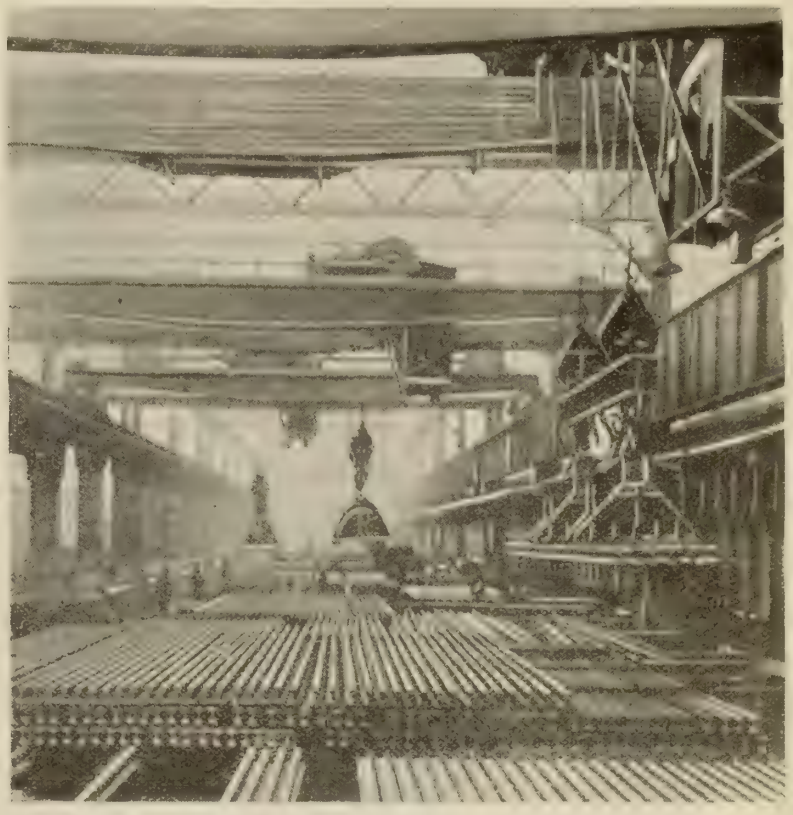
Where quanties of stock are handled, two machines, operating end to end, as shown, are used to advantage. Two laborers, each holding the bar near the ends, lift it to one machine and then to the other, and in two movements point both ends. On heavy work, two men on two machines, point nearly twice the number of bars that could be done on one machine.

Aside from the saving of time, several advantages of machine pointing over wheel grinding are important. The ends of the bars are evenly pointed—no high spots. Bars with particles of emery ground into the ends are damaging to machines, tools and bearings—eliminated entirely. Reduced grinding wheel expense, and no dust for operators.

The machine is mounted on a truck for convenient hauling from one stock bin to another, and is frequently used as the stock is taken from the freight cars, thus saving much of the expense of second handling.

It is driven by one horsepower motor which may be connected up to any convenient electrical circuit.

Dimensions of the machine are: Four feet long; four feet high, with motor, two feet wide.



USING MAGNETS IN CONJUNCTION WITH ELECTRIC CRANES.



TWO MACHINES OPERATING END TO END. THIS ARRANGEMENT WORKS VERY ADVANTAGEOUSLY.

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We Might Grow Hungry

IN the Western States a certain section of farmers got together and threatened the people in the city that they would grow just enough for their own use, and no more.

The beauty about those threats is that we don't believe them.

At the same time, they give one something to think about.

The farmers claimed that they were working from 12 to 16 hours a day, while the people in the city were working about half that time. They claimed that the short hours people worked in cities shoved up prices of everything they had to buy.

Let it go at that. It serves no good purpose here to argue that the farmer is dipping into the high prices the same as the rest of the profiteers. The point is this—we lose sight too readily of the fact that there's a great group of us camping on the trail of the man who grows things to eat.

We like to sit back and talk, and figure out why people are leaving the farm and going to the cities and towns. We can figure it all out that the thing is wrong. It's as easy as mud for us to show why the other fellow should stay on the farm, or why the other fellow should leave the city and go back to the farm.

But with all this argument—and against all this very good reasoning—we fail to see any excursion parties leaving the cities or the towns and heading for the farms.

And so it is that we still have in increasing volume the spectacle of a lot of people standing around waiting for some other chap to gouge a hole in the ground and plant seeds or roots, and finally bring forth something for the mob to eat.

No Other Obligation?

THE Supreme Court in Montreal has handed out a decision that is interesting. Olivier Decarie was sued for $432. He bought a car of tomatoes, part of which he claimed were bad. He deducted $432 for the ones he claimed were bad and paid $600 for the balance. Suit followed and defendant was ordered to pay the remaining $432, the judge holding that the goods were open to inspection, and the purchaser could have found the condition of the goods before accepting them.

Chances are that the decision is right enough, as far as the interpretation of the law goes, but is there no moral obligation in connection with such a matter? Is there any good reason why a dealer should seek pay for tomatoes, or anything else, which were not good, and the handling of which meant a loss to his customer?

Years of Service

THIS is an age when people are supposed to remain in the employ of one firm only a short time. Wanderlust has become quite an industrial disease. Good times and lots of work may help this along.

In a recent issue of the "North-Eastern Railway Magazine" there is a list of pensioners' deaths. Here are some of them showing the length of service:—

J. Sanderson, 46 years' service; S. Burniston, 43; C. Orman, 32; T. H. Birch, 29; J. Mitchison, 27; R. Hutchinson, 38; Hy. Ashford, 30; Wm. Preston, 46; J. Catchpole, 45; E. V. Lambert, 46.

The average length of service of these 12 pensioners was a little over 38 years, certainly a rarity in these days when employees have the hop, step and jump notion of employment so thoroughly developed.

The Good Old Styles

THERE'S not much end to ways and styles that folks is usin' now, and some is awful common like and lowly in the brow. While others aim at higher planes, a most delightful thing, and of them now let's string our lyre and raise a voice and sing.

There's lots of folks wear dinky hats what squat upon their head, in temperatures that make the snout turn most alarmin' red—they walk along the streets they do, in manner quiet and smug, a hangin' to their nose a spell and wackin' at their lug.

And on their hands they wear, they do, gloves of some dainty hue, what let their fists become at onct both numb and freezin' blue.

Upon their feet they grow silk socks, yes pleasant things in June, but ugly things, my lad, by heck, when frost hangs on the moon.

And there they strut both to and fro, rigged out in truck like that, silk socks, and gloves to torture them, likewise a cardboard hat.

Bring back, my son, the armament, we wore in days of yore, them days what's fled and gone, my boy, yes gone to come no more. 'Twas then we had the woollen mitts, the fuzzy knitted kind, the old wool scarf around the neck that hatched fine peace of mind.

And on our head there rested sweet a cap both deep and wide, with fur and wool entwined, by gum, and restin' side by side. And ear-tabs, too, was sprouted there, the things was built to last, and save my brains from being exposed to every wintry blast.

Ah, yes, bring back them things once more, that I may walk about, without a frozen set of feet, without a chilly snout. Yes, let me put those wool socks on, wool mitts upon my paws, a scarf about my chilly neck in either frosts or thaws, and on my dome then place that cap, so I'll raise up my song unto the comforts of the lid what has the ear-flaps on.—ARK.

HARD FOR U.S. FIRMS TO ABSORB EXCHANGE

Coal Co. Had Been Facing a Peculiar Situation—What it Would Mean to Take Up the Exchange

IT IS interesting to know how certain American lines view the exchange situation. CANADIAN MACHINERY had an interesting interview with the Ohio and Michigan Coal Co., Detroit, in which they went into some detailed figures to show the problems they were facing at the present moment, and the difficulties they had in making collections. Their view, in part, amounts to this:—

"We value highly our Canadian trade, but must say a word in defense of the coal industry insisting upon collecting the exchange rate in full, and we wish you would give the reasons for this, from the standpoint of our industry, as much prominence and publicity as you can so that Canadian coal consumers, now unfortunately penalized by this outrageous exchange rate, may understand why we cannot absorb the exchange or any part of it.

"On November 1st, the union coal miners went on a strike, because of which the Government commandeered and diverted all coal loaded at non-union mines and fixed price on such coal which barely cover operating costs.

"In some cases the Government agents, in charge of the matter, notified us that they confiscated and diverted our coal. We then invoiced said coal to the divertees. These invoices, for the most part, have not yet been paid. We are outstanding, as is every other coal concern, thousands of dollars on this coal. Some day we will get our money, but we know not when.

"In other and perhaps more numerous instances, our coal was simply taken and sent to various sections of the country by Government agents without any notification to us whatever, and we had no knowledge of the facts until asking our customers to pay for coal, many of whom, by the way, were Canadians. We learned that they had not received it, and we have thousands of dollars tied up in this manner and in coal for which we do not know to whom invoices should be rendered, and will not know until we go through the tedious process of tracing these cars individually, which will take weeks and months.

"The coal industry, by reasons of conditions above explained and also reasons which follow, is so extremely short of ready funds, that the financing problem is one which requires vigilant and constant attention. Understand, we are not allowed interest on our money tied up as above explained, in diverted coal, but we have to pay interest on loans from the bank and money borrowed to conduct our business in this emergency.

"The Government, as above explained, on current shipments are allowing the mines a meagre profit, so that it barely covers expenses, while to the wholesale jobber they allow only a gross margin of 15c per ton.

"Further, by reason of the run-down conditions in which the railroads now find themselves after between two and three years of Government control, the equipment is wholly inadequate and they are giving the mines only 40 to 50 per cent. car supply, so that they are running only approximately one-half time, thereby greatly increasing our overhead expense per ton produced, while they still are allowed only the Government maximum price which was based on costs figured on 100 per cent. production.

"Taking these things into consideration and the fact that from our standpoint as wholesalers, we only make 15c per ton, no matter what the cost price of the coal may be, you can readily see that there is nothing left after we pay our ordinary expenses, and that we would have a loss if we undertook to assume the exchange rate or any part of it. For example:—We make 15c per ton on coal that costs $3.00 per ton at mines. On basis of the present exchange rates if we were to assume same it would cost us about 48c per ton. To-day's rate is 16 per cent.

"We have gone into this matter at length because we fully appreciate that our Canadian trade, who not understanding the conditions affecting our business, are inclined, in many instances, to feel that we should protect them on the exchange rate either in whole or in part."

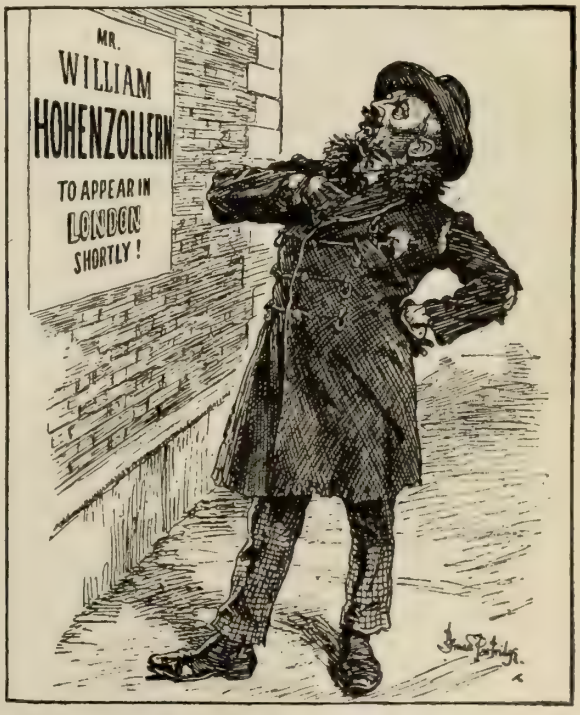
From the high prices of the year the aggregate market value of the common stocks of 20 leading industrial corporations has slumped approximately $560,000,000. A Wall Street compilation puts the combined market value of these stocks at the recent highs at $2,662,966,346. That figure is now around $2,100,000,000. That gives an idea of the extent of the decline in Wall Street security values. This does not take into consideration the fall in railroad stocks, in Liberty bonds, in railroad bonds, in fact, in all issues. General Motors common stock has slumped close to $250,000,000 in market value from the high price of 1919. This stock is not included in the 20 used in the compilation.

BY THE time a young man figures out the cost of a kitchen table, and stove, and a few sticks for the dining-room and bedroom, and still persists in the drift of matrimony—let us arise and shout: "There is a man!"

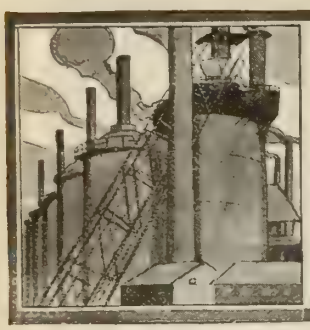
THE head of a New York grocery concern says prices will stay up for two years yet. If that chap ever predicted anything else he'd lose his job as the drum major in the grocery league.

A MAN who slants toward figures reckons it costs $1 a week to keep a house cat now. That makes $52 purr year.

BRICKLAYERS in Windsor get $1.25 per hour now. All of which will mean that the average house will now sprout a mortgage about as high as the gable window.



The Old Actor—"I'm afraid I'm past playing the hero; but it's something to know that I will have a star part as the villain."
Partridge in "Punch" (London).



MARKET DEVELOPMENTS



Price Increases Are as Frequent as Ever

High Speed Cutters and Carbon Drills Are Listed Higher This Week—Tin is Going Up Following the Trend of the London Market—Premiums Asked on Several Lines

THERE is a feeling that, although deliveries are not improving, an improvement will come before long in the steel situation. It cannot arrive any too soon for a large number of Canadian consumers. Shortage is just as acute in United States, and it is worth noting that a number of American buyers have approached Canadian mills to see if it would be possible to secure any tonnage here.

A survey of the whole situation leads one to believe that the much-talked-of runaway steel market is not going to materialize. That does not mean that prices are not soaring. They are, but the United States Steel Corporation is still adhering to the March 21 schedule and making deliveries at that price. The premium-getters have left that price list. In fact, there is plate business being placed from Toronto at a base price of four cents per pound, against the old market figure of 2.65. The trade will pay the price now if the material can be delivered. Blue annealed sheets are being brought in at a premium that will cause the jobbers to quote nine cents per pound, which is a pretty fair price for this material.

Prices have also advanced in high-speed cutters and carbon drills made in Canada.

The fact that a firm of machine tool-makers increased their prices causes little thought in the machine tool dealers' premises now. It used to be something to talk about, but now it is accepted as one of the commonplace things of the day.

The purchases of the Canadian Pacific and the Canadian National roads have put a lot of business on the books of steel and iron firms, as some of the shops were not fully covered.

The price to which tin is soaring, following the lead of the London market, is the feature of the non-ferrous trade. Jobbers are asking 77 cents at this writing, and some of them are predicting that it will touch one dollar before it stops.

MONTREAL GETTING BETTER DELIVERY FROM THE OLD LAND

Special to CANADIAN MACHINERY.

MONTREAL, March 4.—While business in the aggregate does not seem to have suffered from the complex character of finance, there is an apparent indescribable influence affecting general activity in commercial and industrial circles. The transfer of the American railroads back to their former owners has created a temporary lull in trade in the States. It is generally believed here that the change will eventually mean an extensive refitting programme on the part of all or many of the roads. The administration of that section of the Grand Trunk which has been under the jurisdiction of the U. S. Government has again been transferred to the head office in Montreal and reorganization plans may involve the purchase of considerable rolling stock and other equipment. Heavy buying of cars has recently been contracted for by Canadian roads, and extension of plant and shop equipment is awaiting more favorable conditions in the matter of exchange.

Firmer Metal Market

There is a tendency in the metal market for higher prices. The financial difficulties that surround present trading is a factor that makes the situation one of marked uncertainty. The volume of business that is passing is, on the whole, satisfactory, but of a conservative character. Wherever possible, buying is done on this side of the line, and Canadian producers have benefited by the prevailing rate of exchange. Coppers are firm, with lake ½ cent easier at 25 cents per pound. Tin movement is not active but price quotations reflect the abnormally high figures that prevail in London. Local dealers are asking 77 cents per pound. Recent demand for lead has caused an advance in price and the quotation of 12 cents per pound. Antimony at 14½ cents is ½ cent stronger, and 34 cents for aluminum shows an advance of 1 cent over last week.

Better Delivery From England

From all reports the factor of exchange is still a deciding condition in the buying of machinery from the States, although the situation has lost some of its former oppressiveness by the attitude of many American manufacturers in providing means whereby the burden of the high exchange is distributed between the seller and the buyer. This arrangement has given some relief to the situation, but there is still a conservative policy practised by Canadian users of machine tools that must be purchased from the States. A feature that is worthy of mention is the tendency of Canadian buyers to patronize English made tools, and if delivery was assured it is believed that heavier machine trade would develop in this direction. As a matter of fact the receipt of material or goods from England is invariably more definite than similar goods coming in from the States. One dealer here stated that on a certain line of drilling machine brought in from the States the delivery was promised in "approximately" six weeks, while "definite" delivery was promised on a similar machine coming from England.

Old Materials are Higher

The old material situation has taken on strength, and prices quoted are from 1 to 2 cents per pound higher than those generally ruling for the past several weeks. The most notable advance has been in machinery cast and the average price the dealer is paying is about $32

per ton, this representing an advance of $6 per ton. A steady volume of business is carried on in most lines but the question of exchange has changed the market a little, inasmuch as steel and iron scraps going to the States are a little heavier, but the local consumption of metal scraps, particularly copper, has increased owing to the high cost of American ingot copper at the present time. The strength of the ingot market has been reflected in scrap and higher prices are effective. Dealers' present average buying prices are shown in the selected market quotations, and the average advance is about ½ cent per pound.

PREMIUMS FIGURE IN MANY DELIVERIES

Small Improvement Seen in Amount of Material Being Delivered—Increases in Small Tool Prices

TORONTO.—There is every indication that business is going to remain very satisfactory in the machine tool, supply and steel business for some time to come. Inquiries are coming in showing that new lines are being developed in different industrial centres. All this means that they are or will be in the market for machine tools and supplies, also for raw material.

Although the list of American firms that are arranging to assist their Canadian trade in exchange matters is increasing, one hears less about the matter as the weeks go by. The trade as a general thing takes it as a matter of fact that the exchange rate is simply added to the purchase price and the consumers are paying it and passing it on the ultimate buyer. A good many purchasing agents, though, are making an attempt to adhere to the plan that they are going to spend their dollars where they are recognized as whole ones. Against this there is a noticeable attempt in some quarters to get as much material as possible into the United States market as the sellers find it very much to their advantage to get payment in New York funds. In other words the sellers are pleased and the buyers are not.

Cannot Get the Machines

There are dealers in machine tools who have to sit back and see nice orders pass right before them. They are unable to do the one thing necessary, viz., deliver the machine in anything approaching the specified time. One case: A Toronto dealer got a nice piece of Montreal business for 60-day delivery. His house told him that three months would be the best they could do, so the business passed to another Eastern salesman, who took a machine in transit for another customer and supplied the man who was urgent. Now the first customer wonders when his machine will arrive, not knowing that his machine is turning out work in another shop. This is an isolated case as dealers do their utmost to come as close as possible to deliveries.

POINTS IN WEEK'S MARKETING NOTES

Pittsburgh believes that there is more stability to the steel market this week than has been shown for some time, and that the threatened runaway has been held in check largely because the Steel Corporation adhere to the old schedule of March 21.

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New York says that the machine tool trade is not very brisk, because foreign buying has fallen off to a great extent owing to the adverse exchange.

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The scrap metal dealers are making quite a noticeable effort to get as much material in the United States market, in order that they may sell and get the advantage of the exchange, which makes up for the comparatively low prices offered there now.

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The Canadian trade is speculating whether, with the U. S. roads turned back to the private owners, they will get any better service in regard to shipments from the other side of the line.

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Blue annealed sheets, bought at premiums, are coming on the market in Toronto, and the price will be 9c per pound, a fairly high figure.

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Increases are announced in Canadian carbon drills and Canadian high speed cutters. Drills used to be 40, 10 and 5 off and are now a straight 32 per cent. off. Cutters were net to ten off, and are now quoted at net to plus ten.

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Orders have been booked from Toronto district for plate at 4c per pound, against the March 21 schedule price of 2.65.

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An effort is being made by American buyers to secure tonnage from the Canadian steel mills.

It is a poor day's mail coming to a machine tool dealer that does not announce a 10 per cent. increase in some line or other. It has come to be regarded as quite ordinary, and the out of the ordinary thing is a line that remains without an increase being announced.

Small Tools Increased

It was intimated in these columns last week that there was an increase coming through in carbon drills and in Canadian high-speed cutters. The new figures are in the hands of the dealers and they amount to a fairly stiff increase. Carbon drills have for some time been selling at 40, 10 and 5 off the list. This is done away with now and the new price is 32½ per cent off. It works out this way on the basis of $100. Forty off makes $60. Ten off leaves $54, and 5 off that leaves $51.30 as the actual price with all the discounts allowed under the old figure. In the new list, when a straight 32½ is allowed it brings the sale price to $68.50, or an increase of $19.80 on the basis of a $100 purchase. Canadian high-speed cutters are also changed from net to ten off to net to plus ten. The range in prices is given that way because it is understood, of course, that the price varies somewhat, depending on the extent of the purchase. In the past the large buyer has been getting ten off the list, while in future he will pay net list. The small buyer will pay list plus ten instead of net list.

Asked for an explanation of the increases, one dealer who handles a large volume of trade in this district stated that the makers had been selling too low for some time and had cut prices below the margin where they could make a profit on their operations. He went on to state that under the present arrangement the Canadian consumer was paying about the same for Canadian high-speed cutters now as the American manufacturer is paying for American made high-speed cutters.

There is a nice amount of business moving in the small tool field, not one of the dealers seen this week admitting that he was not perfectly satisfied with what was coming his way.

Some Steel Arriving

There is, if anything, a slight improvement in the amount of steel that is arriving at the Toronto warehouses this week. One firm has invoices showing a good tonnage of sheets on the way. These were secured from a premium mill and will in consequence carry a pretty fair price by the time they pass out to the trade.

There are isolated cases of 9.50 being offered at the mills for sheets. Of course these incidents are not given as showing the market prices but simply indicating how scarce some lines of material are and how anxious manufacturers are to secure supplies. It is understood that buyers from the States have approached Canadian mills several times to see if there were any chances of them getting on the order books. One report has it that inquiries from as far as 'Frisco have come in for this purpose.

Premiums are still being asked for plate with any chance for a ready delivery. One Toronto dealer was asked to pay 4 cents at an American mill when the price was still 2.65 at most of the mills. He replied that he considered the price was unwarranted and that a 4 cent price would make the figure too high for the trade here. Add duty, war tax, exchange, and freight, and it would cost 5.60 to put this plate in a Toronto warehouse. That would mean 7 cent plate for resale. The mill came back with an answer a few days ago which said that the best justification of their price was that a number of orders had

been placed from Toronto at the 4 cent rate. Warehouses are not very keen to admit that they are paying that much premium, but they must be coming pretty close to it in a number of cases otherwise they would stand small chance of getting any delivery unless their business had been placed months ago, and it must be remembered that placing business a few months ago was not a favorite occupation.

The large orders that the National Railways have placed with Canadian plants in the last few days will mean a bigger demand for many lines of steel. Some of the companies that have accepted these tenders are fairly well protected, but in other cases they will have to come into the market for large tonnages.

Scrap Business Better

Dealers state that there is quite a decided improvement in the general tone of the scrap metal market. Apparently some of the yards have become weary of holding on to brass and copper, for there is quite a volume of this being offered now. In one place about 500 tons was offered during the week, which is a very fair amount for this district.

Cast iron and stove plate continue very scarce. Speaking of the prices of these two lines the firm that corrects the prices for CANADIAN MACHINERY each week stated this morning: "Any figure that we could give you on cast iron and stove plate would be more or less nominal. Show us a fair tonnage in either of these lines and we will soon come to terms with the man who has it for sale at figures well above the quotations in your paper."

There is quite a marked tendency on the price of a good many dealers to get as much stuff as possible to the United States market to take advantage of the exchange. Prices are not particularly good, but this is more than offset by the favorable exchange rate for any who have bills coming to them in United States funds.

HOW PRICES GROW IN OLD COUNTRY

Increases Very Pronounced and They Occur in Several Lines

Advices from the Old Country show how prices are increasing in the iron and steel field.

The advance in railway rates has led to Scotch steel-makers raising their prices for steel ship-plates and all sectional work by 25s. to 30s. per ton. Ironmasters, in turn, have advanced their price for pig iron for export to £11 and £11 5s. per ton, and £11 12s. 6d. for hematite, f.o.b. steelworks.

It is now possible to give the new Sheffield quotations for iron and steel. The advances are, approximately: Pig iron, 15s. to 20s.; billets, 30s. to 35s.; iron bars and hoops, 30s.; manufactured steel, 30s. to 40s.; wire rods, £3 to £3 10s. A comparison with the last pre-war year (1913) will enable one to realise how enormous has been the rise of values: Derbyshire foundry pig iron, £10 2s. 6d., against 54s. 8d.; East Coast hematite, £11 10s., against £3 10s.; bar iron, £24 10s., against £8; basic billets, £19, against £5 15s.; Bessemer acid billets, £21 15s., against £7; Siemens ditto, £22 5s., against £7 10s.

U.S. ROADS COUNTED ON TO DO BUYING

Returned to Private Owners and It is Expected They Will Seek Equipment Now

NEW YORK, March 4.—Machine-tool business in the last two weeks has not been up to the mark established in January and early in February. Taking stock of the situation, dealers and factory representatives note a falling off in both inquiries and orders, but the lull is by no means momentous, there still being a fair volume of business.

With the return of the railroads to private ownership there is bound to be considerable demand for equipment for car repairs. In the past week there have been numerous inquiries for second-hand plate-working machines, which can be had for prompt delivery.

The Willys Corporation, Elizabeth, N.J., continues to buy for its automobile plant, its latest purchase being about $150,000 worth of multiple spindle drilling machines.

Export trade in machine tools is not large on account of the foreign exchange situation, but some orders are being placed. A Japanese exporting firm has bought about $75,000 worth of tools, and a Mexican iron works has bought about the same quantity for making repairs to oil tanks, ships, etc.

THE UNCERTAINTY IS BEING TAKEN FROM THE STEEL PRICE SITUATION

PITTSBURGH, March 4.—Steel market skies are beginning to clear, and consumers of steel products are obtaining ideas as to prices they will have to pay for future supplies, the prices running far less to extremes than was prognosticated a few weeks ago. In other words the "runaway" in the steel market is proving to be rather a tame affair. While the steel producers may attempt to claim credit for preventing a runaway, they would experience difficulty in explaining why they have waited until now to name prices to regular customers for second quarter deliveries instead of selling a few weeks ago when buyers were so anxious to cover and when stabilizing influences were so needed. The Steel Corporation, indeed, sold for the present half year, not a few weeks ago, but in November and December. The corporation's policy remains that it will adhere to the March 21 or Industrial Board prices. While the shares of the Steel Corporation may have declined on the Stock Exchange in the past fortnight the stock of the Steel Corporation management has gone up in trade circles, where the wisdom and courage of the management in sticking to the old steel prices is receiving considerable more commendation than a couple of months ago.

Wall Street "News"

So called "news" circulated in Wall Street is not usually a good guide for men in the steel trade, but by careful analysis some good may be derived from what is there circulated. Of particular interest are statements recently published in the financial organs, with earmarks of being inspired by the trade to the effect that "reports from Pittsburgh" that the steel market is not in as strong a condition as was supposed are altogether wrong, and that it makes no difference anyhow, because practically all the steel producers are sold up very far ahead. Except with respect to the Steel Corporation, which is sold up far ahead because it has adhered to very moderate prices, nothing could be further from the truth. For weeks past it has been a matter of comment in steel trade circles how little actual tonnage of actual orders the independents have on their books, and when a precisely opposite statement is made, the fact is worth noting. The condition of the independents as to small order books arises thus: less uniformity, as one large independent ents, those who sought the highest prices obtainable, and thus were able to sell at such "premium" prices, only for early deliveries, and those who followed a pseudo-conservative policy of not advancing prices but at the same time of not selling at all. They were waiting for a time when they might be able to announce greatly advanced prices and still not become unpopular with their customers, the customers being better satisfied to be able to buy at the greatly advanced prices than not to be able to buy at all.

Second Quarter Prices Announced

The more conservative of the latter class of independents are now naming prices to customers for second quarter, and while the prices represent very substantial advances over March 21 Industrial Board of Steel Corporation prices, they are not "runaway" prices by any means, nor are they at anything like the level of prices that have been obtainable for small lots for early delivery. On merchant bars the price now quoted by several important independents for second quarter settlements is 3.00c, while on shapes the price is 3.10c. These two prices are each $2 a ton above the war control prices and $13 a ton above the March 21 prices. On plates there is less uniformity as one large independent has named 3.25c for second quarter shipments to regular customers, which is just equal to the war control price and is therefore $12 a ton above the March 21

price, while some others are asking about 3.50c. For early deliveries bars have been commanding as high as 4.00c, while plates have been bought rather freely, though in relatively small lots, at 4.50c. Consumers are accepting these prices as just put out and specifying for second quarter, but there is little if any disposition to cover at them for third quarter or second half.

Automobile Trade Domination Renounced

Among the rank and file of steel buyers there is in progress what may be described as a revolt against automobile trade domination of the steel market. That trade has been lavish in its expenditures and has freely bid up prices, apparently being interested solely in deliveries and not at all in the cost of materials. The condition has applied not only to steel but also to lumber, plate glass, and some other commodities. Ordinary buyers of materials are willing to admit that the automobile industry is an important one and that the people would have to quit living if they did not get a few million automobiles more every year, but they are unwilling to admit that they have to pay as high prices as the automobile trade will pay when that trade can consume only a small fraction of the total output of steel, lumber, glass, etc.. The automobile industry may possibly use up to about a quarter million tons of steel a month, but the steel industry's capacity is more than three million gross tons of finished rolled steel a month. The agricultural implement makers, the railroads, and other industries hitherto regarded as contributing to the country's prosperity, cannot and will not bid against the automobile trade when it bids such fancy prices.

For illustration, about four weeks ago sheet bars sold at the then new record price of $65, the buyers purchasing for the purpose of having the bars converted into sheets by conversion contracts with sheet mills. Such conversion contracts can be made on moderate terms because some of the sheet mills, including even the Steel Corporation sheet subsidiary, have idle rolling capacity through being short of steel. Then, less than a fortnight ago, $70 was similarly paid for sheet bars, and a few days ago $80 was paid for 1,000 tons of open-hearth bars, $75 being paid for 1,500 tons of Bessemer. Ordinary consumers of sheets simply can have nothing to do with such a market, when this $80 price compares with $42 by the March 21 schedule and less than $26 as the ten-year pre-war average price of sheet bars, and essentially they are in revolt, waiting for this thing to blow over.

Transportation Still Poor

On the whole, transportation conditions are still poor, and it is now the common belief that general relief will come only with the advent of milder weather, the winter having been unusually severe and prolonged. A month ago the Carnegie Steel Company had between 150,000 and 160,000 tons of its finished products piled, on account of car shortage, and this accumulation has now been cut in half, but on the other hand the American Sheet & Tin Plate Co.'s accumulation has grown to about 50,000 tons, equal to approximately ten days' production. A third subsidiary of the Steel Corporation, the National Tube Company, has been operating at an average of over 90 per cent. of capacity since the first of the year, yet has been able to ship its product as fast as made. Accordingly there is no general rule. Car shortages are a local matter, depending not so much upon the general supply of cars and locomotives, as popularly assumed, but rather upon yard and terminal facilities, which need much expansion, particularly in certain districts.

As to coal car supplies, the condition of the past ten days is reported as the worst yet, but little actual curtailment in steel production results, there being rather a prevention of the expansion in output that would otherwise occur.

First Drop in Pig Iron

For several months pig iron has been going exclusively one way, and at a rapid pace. In the past few weeks some have been predicting $50 pig iron, and some still higher prices, while a few producers expressed the opinion that the top had been reached and did not conceal their satisfaction that such was the case.

Basic pig iron had been pushed up to $43 valley, with some important sales made at that figure, but a few days ago a producer sold a round tonnage of prompt at $41.50, valley basis, and that is now the quotable market. This may possibly mark a general turn in pig iron.

PURCHASING AGENTS WILL INSIST ON 100 CENTS FOR THE CANADIAN DOLLAR

The Purchasing Agents' Association of Toronto, affiliated with the National Association of Purchasing Agents of New York, and representing a buying power of over $100,000,000, passed the following resolution at their meeting held in the King Edward Hotel last night:

"That, owing to the abnormal rate of exchange now prevailing between Canada and the United States, the Toronto Purchasing Agents' Association are resolved to favor wherever possible those firms who, appreciating these conditions, agree to relieve the situation by accepting Canadian funds in payment of our purchases."

Copies of this resolution will be sent to the National Headquarters in New York and to United States firms doing business in Canada. Copies will also be sent to the Minister of Finance at Ottawa and to the Bankers' Association. It is expected that the Ottawa and Montreal Associations will take similar action.

Mr. A. B. Kerr, who addressed the meeting, was of the opinion that many United States firms were adopting a policy of drift. "The exchange situation has reached such serious proportions that it is time for drastic action, and we should do everything within our power to correct an intolerable situation," said Mr. Kerr. "If United States firms are unwilling to accept Canadian funds in payment of our purchases, then we would suggest three alternatives. Let them either open a Canadian bank account, accept payment in war bonds, or take long-term notes."

"A long list of United States firms have signified their willingness to open Canadian bank accounts; others have notified their Canadian customers that they will accept fifty per cent. of the exchange. It is the firms who will not make any concession that must be brought into line by some concerted action."

Mr. W. S. Leckie, of the Government War Purchasing Department at Ottawa, also addressed the meeting, and referred to the present difficulty the Government had in doing business with United States firms, owing to the high rate of exchange.

The following officers of the Association were nominated for re-election: J. I. Nicholson, Gunns Ltd., president; W. F. Dodd, Canadian Kodak Co., vice-president; G. P. Beswick, secretary; W. McG. Brown, Brown's Copper and Brass Rolling Mills, treasurer.

BIG ORDERS GIVEN BY THE C.N. ROAD

Particulars of Where the $25,000,000 Business Has Been Placed

EQUIPMENT orders involving an expenditure of approximately $25,000,000 have been placed by the Canadian National Railways. An announcement was made by the Canada Car & Foundry Company, of Montreal last week that orders aggregating $7,000,000 had been placed with that company by the C.N.R. and $5,000,000 by the C.P.R. It was stated at the same time that other orders on the company's books would bring the grand total of business on hand to fully $20,000,000.

The Canadian National Railways' placements are as follows: Canadian Locomotive Co., Kingston, Ont., 45 locomotives; Montreal Locomotive Works, 67 locomotives; Canadian Car & Foundry Co., Montreal, Que., 18 sleeping cars, 12 dining cars, 20 baggage cars, 1,000 box cars, 600 refrigerator cars, 80 cabooses; Eastern Car Co., Trenton, N.S., 500 box cars, 1,150 coal cars, 6 snow plows; National Steel Car Co., Hamilton, Ont., 1,500 box cars; Preston Car & Coach Co., Preston, Ont., 20 cabooses; Hart-Otis Car Co., Montreal, Que., 350 ballast cars.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	40 00
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 00
Steel bars, base, Toronto	5 00
Iron bars, base, Montreal	5 00
Steel bars, base, Montreal	5 00
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Band steel, No. 10 gauge and 3-16 in. base	5 25
Chequered floor plate, 3-16 in.	8 00
Chequered floor plate, ¼ in.	7 50
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	78 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	6 50	7 25
Plates, ¼ up	$ 6 00	$ 6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$13 75
Copper, crucible	18 00	17 00
Copper, heavy	18 00	17 00
Copper wire	18 00	17 00
No. 1 machine composition	16 00	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 50	9 00
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	6 00
Tea lead	4 50	3 50
Aluminum	19 00	18 00
	Per Ton	Gross
Heavy melting steel	18 00	16 00
Boiler plate	15 50	11 00
Axles (wrought iron)	22 00	20 00
Rails (crap)	18 00	16 00
Malleable scrap	25 00	20 00
No. 1 machine cast iron	32 00	25 00
Pipe, wrought	12 00	9 00
Car wheels	22 00	20 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	21 00
Cast boring	12 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

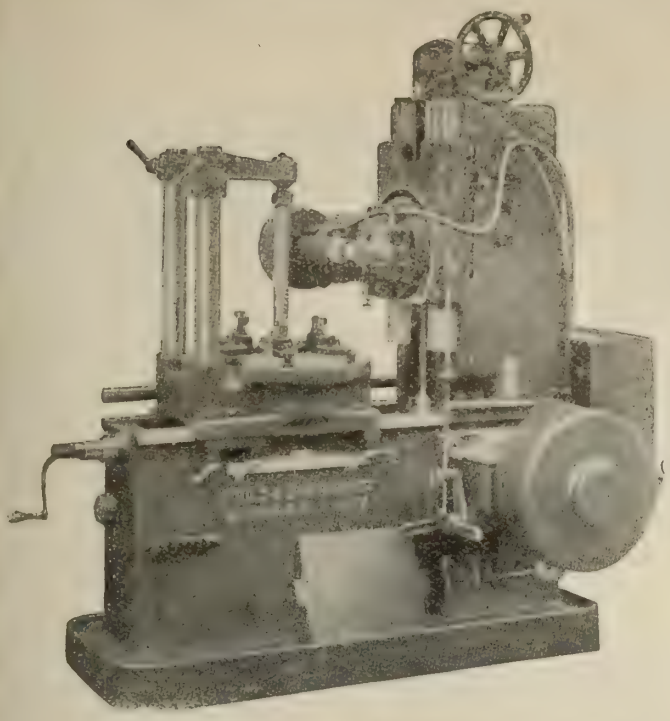
Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net



Gould & Eberhardt
GEAR HOBBERS
are
Automatic therefore Economical

If you cut gears in quantities they can be cut with advantage on G. & E. Gear Cutting Machinery.

For gears up to 120" dia.

Catalog describing full line of Gear-cutting, Hobbing and Rack-cutting machines on request

Write for prices and deliveries.

The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

64 Front Street West
TORONTO

Acid Electric
STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal

Head Office: 187 Delisle St. MONTREAL

Phone Victoria 1492



Results Count

We have just received an order for files from the largest Twist Drill Factory in the United States. These files are for testing the temper of their drills, and have been adopted after exhaustive experiments in competition with all other brands of files manufactured on this continent. This is the first known instance of Canadian-made files being exported for use in the United States, and we are naturally proud of the achievement.

Like most Canadian firms this company found that

"They cut faster and wear longer"

Be file-wise.

Ingersoll File Company Limited
John Morrow Screw & Nut Co., Limited
Sole Distributors
Ingersoll, Ontario

P H

IMPERIAL

INGERSOLL

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED SHAFTING

At mill ..... list plus 5%
At warehouse ..... list plus 25%
Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 25	$ 8 50
Sheets, black, No. 10	7 75	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	....	9 50
Premier, 10¾ oz.	....	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	28 50
2 in.	30 00	26 75
2¼ in.	35 00	29 00
2½ in.	42 00	53 00
3 in.	50 00	42 00
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	58 75

Above prices advanced 5%.
Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

GEOMETRIC



SELF-OPENING DIE HEADS

"YOU CAN'T BEAT 'EM"

It is not the manufacturers of Geometric Self-Opening Die Heads who make this statement, but the users of the tools.

This is the reason that besides being the originators, we are known as the

LARGEST AND BEST KNOWN MANUFACTURERS OF AUTOMATIC THREADING TOOLS

The big question is: Have you applied Geometric Screw Thread Cutting Tools to your threading work?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.

If interested tear out this page and place with letters to be answered



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

To Erect School.—The York County Building Department issued building permits for work aggregating $30,000. A portable school house will be erected on Danforth Heights at a cost of $3,500.

Factory Changes Hands.—The building at 187-189 Parliament street, which was first occupied by the New Method Laundry and later by the Antiseptic Bedding Company, has been sold to the Eze Manufacturing Co. for $25,000.

Niagara Rail Men to Strike.—Employees of the Niagara, St. Catharines and Toronto Railway may strike in the near future. The award of the Conciliation Board has been unanimously rejected, and a committee named to arrange the date of the strike.

Foundry is Burnt Out.—The Reid & Brown Foundry, Esplanade street, Toronto, was severely damaged by a fire which raged fiercely for over an hour, causing a loss of $20,000. A large number of valuable patterns were destroyed, the loss being divided between contents and property.

Contracts Received. — The Mackinnon Steel Co., Ltd., Sherbrooke, have received orders from J. Edward Ogden Co., Ltd., New York, N.Y., for 48 lower section doors and 48 upper section doors for harbor sheds at Montreal, and the structural steel for the hardware store being built on King St., Sherbrooke, Que., by Jos. Gagne.

Toronto Building Permits. — Permits have been issued by the City Architects' Department for the following buildings: The Board of Education to build an addition to Osler Ave. School, and the Adams Furniture Company to build a six-storey stone and brick store at the corner of Yonge and Shuter Streets.

Clay Workers' Association Meets.—At the annual convention of the Clay Workers' Association of Western Ontario helid at London, Ont., The president, Mr. C. S. Parker, urged the members to keep up with the times in the use of machinery, thus reducing costs and raising production. Addresses were also delivered by members of the committee.

New Foundry for Brockville.—A by-law authorizing the raising of $20,000 for the purchase of land and the construction of a siding for Machinery and Foundries, Ltd., a company recently organized with a capital of $250,000, has been carried. The plant will be located on the Murray property, and operations will start in the spring.

Belgian Orders for Canada. — Large orders for Belgian locomotives are expected to be secured by Canadian firms in the near future. Senator Nicholls, of the Canadian General Electric Co., stated that he had received a long cable communication on this subject, but declined to say any more at the present stage of the negotiations.

Big Increase in Customs.—The eleven months of the fiscal year show a big increase in the Customs receipts. A statement issued by the Department gives the following figures: $163,527,100, as against $143,564,204 for the corresponding period last year. For the month of February alone the increase was $3,481,688.

Plans Big Improvement.—Extensive improvement tending towards increasing the capacity of the Consolidated Mining and Smelting Company, Trail, B.C., is making rapid strides. The plans call for improvements in the copper refinery estimated at $250,000, the erection of a rod mill to cost $200,000 and the erection of a large addition to the machine shop.

To Build a Dam.—The municipality of South Vancouver are making application to the Provincial Comptroller of Water Records for authority to construct a storage dam at the outlet of Loch Lomond. The proposed reservoir will have a capacity of 3,000 acre feet and will flood about 20 acres of land. The reservoir will be used to supply South Vancouver with water.

Fuel Board Continues.—The President of the United States has, by a special order, continued the existence of the Fuel Administration, its powers being lodged in a committee of four. The Railroad Administration, which is being discontinued from March 1, has been exercising the functions of the Fuel Board, but the situation is considered so serious as to warrant the continuance of the Fuel Board.

Government Approves Drydock.—The application of Messrs. Coughlan & Son for the construction of a drydock at Vancouver has been approved by the Federal Government, under condition that work is started within 30 days from the concluding of the subsidy agreement. The dock will be 725 feet by 110 feet with a depth over sill at high water of 30 feet.

Steel Company Extension.—The Brantford Board of Works have again had under consideration the building of switches for the Steel Company of Canada, and the rights of the property owner whose land is required. The Steel Co. claim that no damage will be done to the property, and further, it was pointed out, that a railway built through property when necessary, and the Railway Board award damages to the property shut off. It was arranged that a meeting of all parties concerned should be held as soon as possible, and a peaceful agreement arrived at.

NEW LINES FOR THE INGERSOLL-RAND CO.

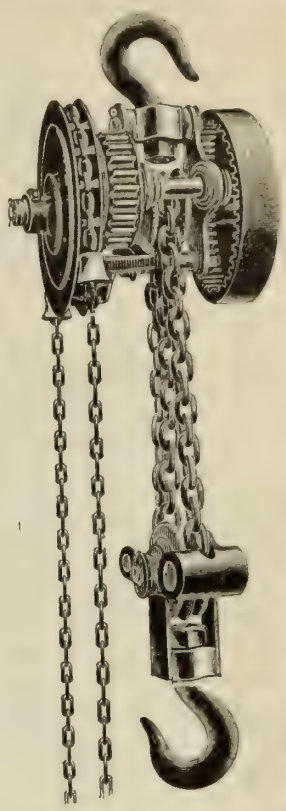
Deals Completed for Making and Selling Several Lines in this Country

Arrangements have recently been concluded between the Wellman-Seaver-Morgan Company, of Cleveland and Akron, Ohio, and the Canadian Ingersoll-Rand Company, Limited, whereby the latter firm are now making and selling in Canada the Wellman-Seaver-Morgan line of Rubber Mill Machinery. The latter comprises crackers, washers, mixing and warming mills, grooved rolls, refiners, calenders, reduction gears, fabric dryers, vulcanizing presses, tire rimming and applying presses, tubing machines, accumulators, high-pressure pump, etc. The Canadian Ingersoll-Rand Company, Limited, will also take up the manufacture in Canada of Wellman-Seaver-Morgan hydraulic turbines, and a department for this work is now being organized.

The Canadian Ingersoll-Rand Company have also been appointed Canadian agents for, and manufacturers of, the Ryther and Pringle line of wood preparing machinery, for use in ground wood and chemical fibre mills, consisting of slashers, swing saws, kickers, loaders, log hauls, splitters, chip screens, shredders, etc., including the Barienger Braking Device for lowering heavily loaded sleighs or other vehicles down steep slopes, and will also manufacture and sell the Bird Machine Company's pulp and paper mill specialties, comprising Bird Inward Flow, Rotary Screens, Walpole Screens, Beating Attachments and Save Alls.

Aikenhead's

"Simplex" 2-Speed Hoist



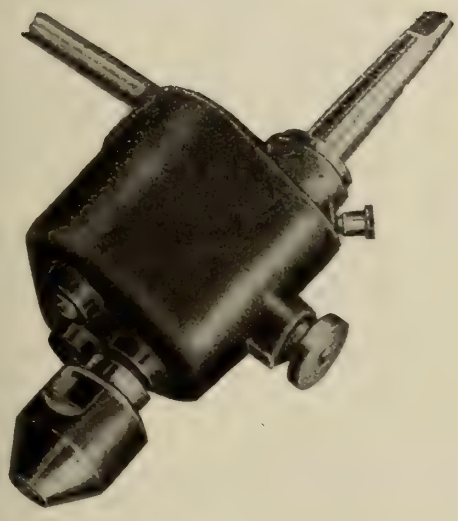
A valuable addition to any shop. It handles the largest machines and castings with ease and precision, and greatly reduces the labor costs for fitting and erection.

This hoist operates at two speeds. Small loads are lifted at twice the speed of larger loads. The chains are properly guided. There is no tendency for them to jump the sprocket or stick in the guides.

Made in 12 sizes. Blocks with capacities up to 1600 lbs. handled by one man. With blocks of capacities up to 40,000 lbs., two men can lift full load. Write for particulars.

Aikenhead Hardware, Limited

17 Temperance St. - Toronto, Ont.



Aikenhead's

Wahlstrom Tapping Attachment

The answer to your tapping problem.

Most taps are broken because they jam in the hole. With the Wahlstrom tapping attachment the tap doesn't jam because its oscillating motion frees the chips. It imitates the simple to-and-fro motion of hand tapping. This feature reduces tap breakage to a minimum.

You can change this oscillating movement to a continuous revolution for use in soft materials. Also the tap reverses when the spindle is raised. All of these features are absolutely indispensible in economical tapping by power.

The Wahlstrom fits any drill press. It is made in two sizes. No. 1 takes taps of all sizes from 5-40 to ½ inch standard. No. 2 takes taps from ¼ inch to ¾ inch. It has nothing to get out of order. Sent on 10 days' trial.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered

The Week's Events in Montreal Industry

The Elder-Dempster Steamship Line expect to inaugurate a direct freight service from Montreal to South Africa about the middle of May. The steamer Gaboon, of 3,300 tons gross, has been selected for the service. The initial enterprise will be export business, but it is hoped that sufficient trade can be developed to put the service on a reciprocal basis.

* * *

The Canadian Spinner, of the Canadian Government Merchant Marine, which had such a trying time in the lower ice fields of the St. Lawrence a couple of months ago, has been repaired and is now taking on a cargo at Halifax. When completed loading this vessel will sail for South America on what may be termed her belated maiden voyage, which originally was intended should take place early in December.

* * *

ployees of ian Car and Foundry Com- and T ared of a busy year in 1920. n were secured last week which roximate $12,000,000 for railroad equipment for Canadian roads. This business is apportioned in the ratio of 7 to 5 for the Canadian National System and the Canadian Pacific respectfully. With business already on the books the Car Company have orders on hand for nearly $20,000,000.

* * *

Orders to the extent of about $3,000,000 have been secured by the Nova Scotia Steel and Coal Company for car equipment for the Canadian National Railways. This business calls for the construction of 500 box cars and 500 general purpose cars, and this present order may be augmented by further business, which will require the car interests of the Nova Scotia S. & C. Co. to operate at capacity throughout the present year.

* * *

Due to the continued cold of the present winter, many marine officials anticipate more or less serious flooding along the St. Lawrence when the ice begins to break up in the spring. The danger in this respect is further emphasized by the fact that the Government ice-breaker, Lady Grey, will be working alone during the early part of March in the lower portion of the river, owing to the fact that the Montcalm will be at Halifax undergoing needed repairs, following her strenuous efforts in the Gulf early this year.

* * *

The Transportation Bureau of the Montreal Board of Trade has taken action to combat the recent ruling of the Canadian railroads to the effect that, commencing March 1, prepayment of freight rates on commodities going from Canada to the States would not be accepted, but that charges would be collected at the destination, where the high exchange rate prevails. Officials of the Board of Trade here claim that the decision of the railways is illegal and contend that such a policy cannot be made effective by simply notifying shippers. The matter will be dealt with this week by the Railway Commission, and, pending a decision, the former method of prepayment will remain in force.

To Form Trust?—Considerable speculation is abroad as to the visit of Mr. J. P. Morgan to Europe at the present time. Some British industrial leaders believe that an international agreement of steel makers is in the air, or in other words, a trust of world-wide proportions. Although opposed to the idea of a trust of such magnitude, these manufacturers thought it was quite possible.

Big Orders for Scotia.—The Canadian National Railways have awarded the Nova Scotia Steel and Coal Co. contracts for cars that will keep the car plant at New Glasgow busy for some months to come. The orders include 500 box cars and 500 general purpose cars, the total value of the order being $3,000,000. The company have also secured orders for their steel works, and this department will be working at capacity for the balance of the year.

New Director for Iron.—At a recent meeting of the Dominion Steel Corporation, Mr. J. W. Norcross, president and managing director of the Canada Steamships Line, was elected a director to fill the vacancy caused by the retirement of J. K. L. Ross. Two members of the London Advisory Board were present, Maj.-Gen. Sir Newton Moore and Col. Grant Morden, and plans for the extension of the company's export trade were discussed.

Fear Big Strike.—The two large building trades organizations in the Province of Quebec are at loggerheads. They are diametrically opposed in their aims and ideals, and are preparing for a struggle which will result in the survival of only one of them. It is feared that they may involve the building trade in an upheaval just a tthe time that a big building boom is on, with disastrous results. The international conference board is sending officers to Washington to lay the full facts before the international president of the building trades.

Chatham Needs New Waterworks.—At a meeting of the Water Commissioners of Chatham the question of a new water plant was brought up. At the last election the Chamber of Commerce favored the rearrangement of the present plant, and postponing the building of a new plant till conditions were more favorable. The city engineer pointed out that to repair the present plant would cost $309,000, while a new plant would cost only $336,000. He strongly recommended a new plant.

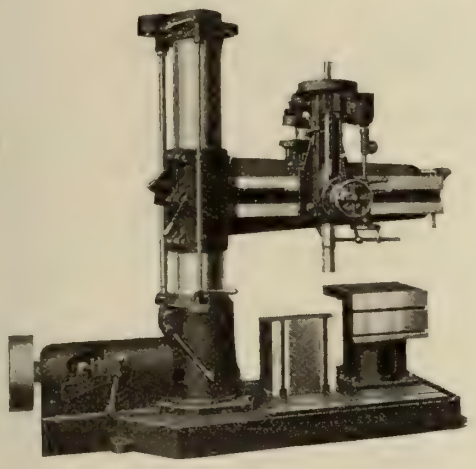
Big Building for Winnipeg. — The Mayor of Winnipeg, in the course of a recent interview, stated that Winnipeg had a big building programme ahead. The T. Eaton Co. have started on their $6,000,000 building, and the Hudson Bay Company are expected to start the construction of their mammoth square block store on Portage Avenue, this being their 250th anniversary. Several aviation companies have stated under the direction of returned war aviators, and they have started a large advertising programme.

Book on Babbitt.—"New Truths and Old Fallacies" is the title of a booklet just being issued by the Magnolia Metal Company. It discloses intimate and instructive information concerning babbitt metals not generally known or divulged. It is revolutionary in its departure from the generally accepted idea and practices regarding babbitt metals. Commencing with this issue, and in the first issue each month thereafter, until completed, the content of this booklet will be published serially and in the meantime anyone interested in procuring the booklet, containing the complete article, can do so by applying to the Magnolia Metal Co., 225 St. Ambroise St., Montreal.

Making Drop Forge Dies.—The Kimber & Hillier Mfg. Co., St. Catharines, makers of drop forge dies, may be said to have launched upon an industry which is in the pioneer class at least so far as Canada is concerned. They claim in fact that thiers is the first plant in Canada to be devoted exclusively to the production of drop forge dies. W. A. Kimber and Ernest Hillier, members of the company, are young men who have had a wide range of experience in this class of work by reason of their connection with such firms as Dominion Forge & Stamping Co., Walkerville; Billings & Spencer, Welland, and Whitman & Barnes, St. Catharines. They are equipped to handle blueprints and specifications of any kind, and since they began business a few months ago have had a very encouraging patronage, which will undoubtedly improve with the expansion that is taking place in Canadian industry. This plan is located in St. Catharines, on the Thorold Road.

RYERSON

New Machines in Stock



4-Foot Plain Radial Drilling Machines

The Ryerson 4-Foot Plain Radial Drilling Machine is massive and of very rigid construction. The feed is of the positive all geared type and has four changes which can be varied by a conveniently located lever. The tapping, starting and stopping mechanism is operated by a horizontal lever.

Drilling cap. 3½″; Tapping Cap.; 4″ pipe tap; Travel of arm, 34½″; Travel of Head, 40¼″.

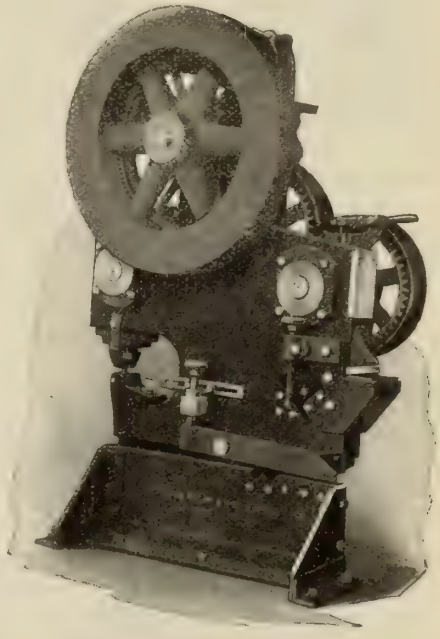
Quadruple Combination Punching and Shearing Machine

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We can furnish this machine arranged for either belt or motor drive. If direct electric drive is required, the machine is supplied with motor bracket, gear and rawhide pinion.

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Prices Very Firm in Old Country Industry

Varying Reports Tell of Rising Prices and Scarcity—But the Basic Conditions Are Sound in All Cases and Splendid Business is Being Done in Many Lines

TRADE conditions in the iron, steel and machinery fields of the Old Country are set forth in the following despatches, which have been culled from various sources:

The steel trade is far from satisfactory. At Workington there is activity in the rail and some other branches, with orders in hand on Colonial and Indian account. At Barrow the whole of the steel-producing plant is standing idle, and there is no immediate prospect of the mills restarting. An improvement, however, is looked for in the new year. The strike in the founding trade has also had serious effect on the steel trade. At the Barrow Steel Works certain alterations and improvements are being carried out, but it will take some time before new plant can be set down and worked. The general demand for steel is easy, and heavy rails are at £17 10s. to £18 per ton, with light rails at £19 5s. to £21 per ton, and billets are at £17 per ton, with ship plates at £18 15s., and boiler plates at £24 per ton.

The Sheffield Steel Trade

The past year is destined to stand out as a landmark in the history of industry, as in the social and political life of the country. From the trade point of view it has been a year of surprises, and in several important matters it has justified once again the proverb that it is often the unexpected that happens. Prophecy has been woefully wrong in these cases. For instance, most people anticipated that the ending of hostilities would be followed instantly by a slump in the prices of materials and commodities, and a period of bad trade, widespread unemployment, and general distress among the working classes. The result has been exactly the reverse of these prophecies. Prices have steadily, but continuously, gone up since the signing of the Armistice, and while the turnover from war to peace industrial activity naturally involved some dislocation of the wheels of industry, causing a certain amount of unemployment, there has been during the greater part of the twelve months a trade boom, the like of which has never been seen before. Those who based their buying policy on an anticipated drop in prices have been badly bitten. They held off the market as long as they were able to do, and had to come in at last on the top of several substantial advances. The revival of foreign competition which many people predicted has also turned out to be a mere bogey. As regards nearly all descriptions of metal products, competition from abroad does not exist, at any rate sufficiently to affect adversely the interests of the home manufacturers.

In the Middlesbrough District

The staple industries of Cleveland have rarely been in such a strong position as at present. Every section of the iron and steel, engineering and allied trades are without exception overwhelmed with work. In regard to pig iron, conditions at the moment are rather adverse to an expansion of business. The present output is in fact hardly up to the requirements of the home trade, with the result that traders are in the unhappy position of having to turn down important business from overseas. This is particularly unfortunate in view of the fact that the export trade is the prime factor in that all-important matter of improving the financial status of the country. Foreign customers are clamoring for iron. Increase in output is the only possible solution to the present period of undue stress, but ironmasters are handicapped in many ways. The abolition of the export licensing system has certainly granted greater freedom, but shortage of suitable rolling-stock for quickly removing goods, the expected increase of railway rates, shortage of materials, and the lack of certain labor are amongst the influences which are having an adverse effect on production.

Marked Bars Dearer

The announcement some time ago that "in the event of any shortening of hours of labor, increase in wages, increased cost of material or railway transport charges during the currency of this contract the price will be increased by an amount to cover all such charges," indicated an upward tendency which is now operative in some department of the iron and steel trades. The recent advance of wages under the sliding scale has advanced marked bars by 10s. to £25 10s. per ton, while unmarked bars are quoted £23 to £23 10s. South Staffs pig-iron prices are unchanged — part mine, forge, £9 5s.; foundry, £9 12s. 6d.; cold blast, £14 5s. Strip iron, which had been reduced previously by 30s. per ton, is now £24, and galvanized corrugated sheets, which are scarce, are selling at £39. Steel is dearer, and supplies of constructional varieties are not equal to the demand. Production in both iron and steel is hampered considerably by shortage of fuel and lack of transport facilities.

South Wales and Monmouth

Although production is steadily improving, only a small proportion of the mills are working in comparison with pre-war times. Moreover, the works are handicapped by the difficulties of transport and the high cost of materials. In November shipments only totalled 22,337 tons, against 69,456 tons in November, 1913. In the case of India and Australia alone there was a decrease of over 30,000 tons, but it is satisfactory to note that substantial orders have recently been placed from both countries as well as from the Argentine. Japan has also been in the market for thin gauges, large quantities of which have been exported during the last few weeks. Prices continue to advance, and 24-gauge corrugateds are now £42 to £42 10s. per ton. Spelter is dearer at £54 5s. to £55 per ton. The demand for blackplate remains below normal.

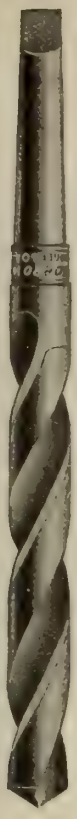
Running at Capacity

Middlesbrough's manufactured iron and steel trade never appeared to have rosier prospects than at present, and it seems pretty clear that, given a return to industrial stability, the district is in for a period of unexampled prosperity. There is a large demand for almost all kinds of structural materials both from home and foreign sources, and the principal concern of manufacturers at the moment is as to the dependability of that all-important factor—labor. The position of firms is well described in a statement made recently (December 16) by Sir Arthur J. Dorman, K.B.E., of Messrs. Dorman, Long & Co., Ltd., who observed, "The employer must know that he can look ahead for a reasonable period and be able to rely upon his estimate of cost and production. Thus only can prices and cost of living be expected to steady themselves, and thus only can our trade be carried on in a manner which will ensure a maintenance of a high standard of wages." All the works engaged in the manufacture of structural materials were never better employed. During the war new plants sprang up in almost mushroom-like fashion, and the normal output was more than doubled. It was thought at one time that there would be an excess of output on a post-war trade, and it was feared that, in consequence, a good deal of the plant brought into existence for war purposes would have to be scrapped. But the position to-day happily is this, that no scrapping has taken place and the works are running at their fullest capacity.

Some Interesting Tables

South Wales Tinplates

It is interesting to compare the prices prevailing for various staple commodities produced in South Wales for January, 1914, and the quotations ruling in the last week of December 1919. The following table at a glance shows the enormous disparity in the figures:



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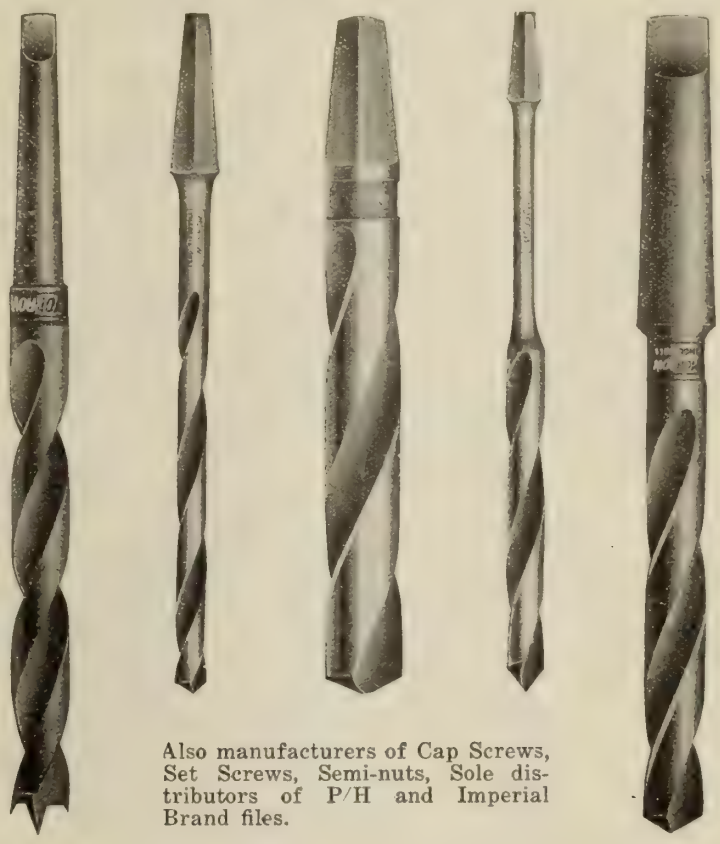
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	Dec., 1919 £	s	d	Jan., 1914 £	s	d
Block tin	325	0	0	146	0	0
Tinplates (standard)	50/- to 51/-			12/- to 12/1½		
Ternes	...	82	6	..	22	0
Galvanized sheets	42	0	0	11	0	0
Steel bars	16	10	0	4	10	0
Hematite	11	0	0	...	61	0
Spelter	55	0	0	21	12	6
Rails	18	15	0	6	10/- to £7	
Iron ore	...	43	6	18/3 to 18/9		

Middlesbrough

The following table provides an interesting comparison between the prices of pig iron at Middlesbrough before the war and those in operation at the present time:

	1914 s	d	1919 s	d
No. 1	56	3	167	6
No. 3	54	3	160	0
No. 4 foundry	53	9	160	0
No. 4 forge	63	3	160	0
Hematite (mixed numbers)	70	0	200	0

The remarkable rise in prices for structural materials at Middlesbrough from those of pre-war days may be gleaned from the following table:

	1914 £	s	d	1919 £	s	d
Common iron bars	8	2	6	23	0	0
Iron ship angles	8	0	0	23	0	0
Steel ship plates	7	10	0	18	15	0
Steel ship angles	7	5	0	18	5	0
Steel joists	7	5	0	18	5	0
Steel strip	7	5	0	22	0	0
Heavy steel rails	6	5	0	17	10	0
Steel sheets	8	10	0	20	5	0

PIG IRON TRADE

Furnaces are engaged pretty heavily, and this is affecting the buying, which is lighter than has been the case lately. Following are reports from various contres:

CHICAGO.—The price of pig iron, which is in fair demand, is holding at $43 Chicago furnace. Southern furnaces are quoting $42 Birmingham, for first half, and $43 for third quarter or last half. Furnaces have little capacity open, present bookings running well into last half.

PHILADELPHIA.—The lowest price for No. 2 plain Eastern Pennsylvania furnace is $43, with 2.25 to 2.75 silicon quoted at $44.25.

PITTSBURGH. — Tonnage for first half is booked up to nearly the capacity of the producers. The basic grade of foundry iron is quoted at $42 to $43 furnace, while basic is at $43.

CLEVELAND.—There has been some large orders closed during the week, and prices remain firm. 1.75 to 2.25 silicon is quoted at $42 to $43 Cleveland, while Southern Ohio makers are quoted $45 for this grade. Basic is at $42 furnace.

BOSTON.—Spot iron is practically not to be had. Prices for West Pennsylvania iron have been $48.70 delivered, No. 2 X, while Buffalo iron of the same grade brought $50.15 delivered.

NEW YORK.—The demand has been lighter, with prices remaining firm. Eastern Pennsylvania foundry, 1.75 to 2.25 silicon is at $43 furnace, and $44.25 for the next grade.

BUFFALO.—With a total sale of about 15,000 tons during the week, several producers sold up their capacity for the remainder of the year. The price generally was $45 from 1.75 to 2.25 silicon, the next grades bringing $46.25 and $48 respectively. Some basic was sold at $44.

ST. LOUIS.—The price for 1.75 to 2.25 Southern iron is firm at $42 Birmingham, but many consumers are of the opinion that the next change will be a downward one.

U.S. SCRAP METAL

The scrap market is uneven, a stiffening of prices being evident in some districts, while in others prices are receding. Following are reports from various U. S. points:

PITTSBURGH.—Heavy melting steel has recovered from the slight weakness shown last week, and has sold up to $29 delivered. Foundry grades are strong and turnings have been sold to blast furnaces in fair quantities.

NEW YORK.—There has been little movement of scrap due to embargoes on shipments. Some grades have shown an advance, old steel shafting going from $31 to $32 f.o.b. New York.

PHILADELPHIA .— Weather conditions and embargoes are weighing heavily on the market, and little business is being done.

BUFFALO.—There is a good demand for heavy melting steel, foundry cast, and stove plate. Transportation conditions have improved.

CLEVELAND.—Heavy melting steel has gone back a few more points from $26.25 to $25.75, and several other grades have also been affected, including axle turnings, drop forge flashings, machine shop turnings and cast borings.

CHICAGO.—There is a general downward trend to the scrap market here, the recession being at the rate of $1 per week in some grades. Cast scrap, from being the strongest grade in the market, has declined considerably. Steel grades have held their own.

BOSTON.—Embargoes are exercising a restraining influence on the situation here, it being impossible in many cases to make shipments. Heavy melting steel is from $20 to $22 delivered dealer's yard, while No. 1 machinery is from $41 to $42 delivered.

ST. LOUIS.—After the heavy selling of last week, the market is quiet again. Yard stocks are much reduced, and mills and foundries are active, so that prices remain firm.

ANNOUNCEMENT

The American Chain Company, Inc., of Bridgeport, Conn., has purchased the control of the Page Steel and Wire Company, with mills at Monessen, Pa., and Adrian, Mich. It is the intention of the American Chain Company to continue the business of the Page Steel and Wire Company as heretofore, taking only its surplus product. The Page Steel and Wire Company's plants consist of open hearth furnaces, rolling mill, wire mills, as well as fence factories. The new officers elected under the re-organization of the company are: Walter B. Lashar, president; William T. Morris, vice-president; Wilmot F. Wheeler, treasurer; John E. Carr, assistant treasurer, and William M. Wheeler, secretary. E. C. Sattley, general manager of the Page Steel and Wire Company, will continue in that capacity with offices in Pittsburgh, Pa. The American Chain Company has its general sales offices in the Grand Central Terminal Building, New York City, and district sales offices in Chicago, Boston, Philadelphia, San Francisco, Portland and Pittsburgh.

British Trade Review: Trade with Canada is rapidly recovering, and in many respects has now assumed old-time proportions. Private advices make clear that Canada is not only anxious to purchase British goods, but is pressing that British houses should also purchase more extensively in Canadian markets. The door of Canada's vast markets has been opened wide to British enterprise; indeed, she is holding out both hands, just as she did during the fateful years of war. It might be well if our so-called leaders of labor at home were to be informed of the wonderful air of prosperity at present ruling in Canada and the remarkable absence of discontent in the Dominion. Her post-war ambition and reconstructive energy are not mere talk. Never was the time more opportune for the establishing of a British-Canadian trade entente.

The reopening of trade with Russia seems to be imminent. Vast quantities of Sheffield tools are wanted by that country, but as Sheffield's output is already insufficient to meet the demand, nobody is very enthusiastic about the prospect of a new market. Russia can only be supplied at the expense of other markets. The exhaustion of tools for the land and all other purposes in Russia is so complete and the need so vast, that it is said to be sufficient to keep the Sheffield works occupied exclusively for a year or two. Already some consignments of saws, files, edge and farm tools have been sent to that unhappy country, and these have been paid for in cash by the great Russian Co-operative Societies. —British Trade Review.

EXPANSION REAMER

The New Britain Tool & Mfg. Co., New Britain, Conn., have placed on the market a new "Critchley Improved" expansion reamer.

The cutting blades of this reamer are made from highest quality steel, and are (as usual with such type reamers) interchangeable.

These reamers have an even number of blades, making the setting to size by micrometer an easy matter. They have an expansion limit of 3/16 inch and are made of such design as to eliminate chatter.

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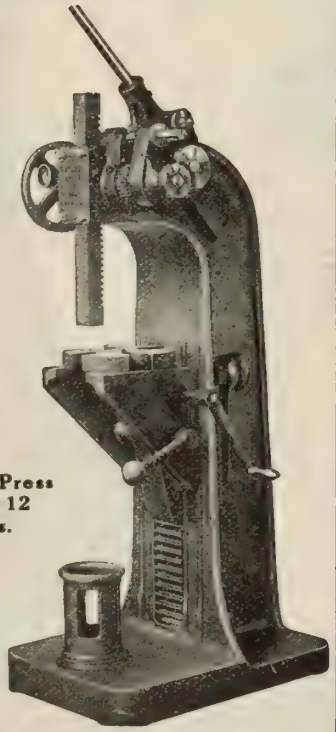
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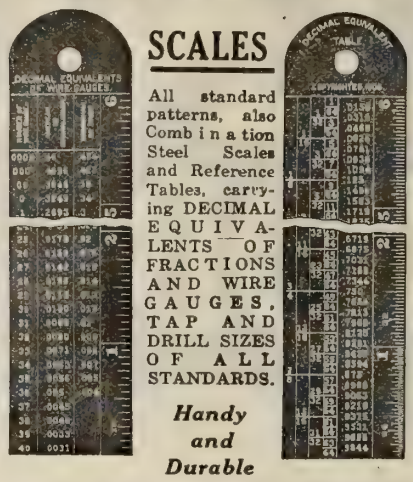
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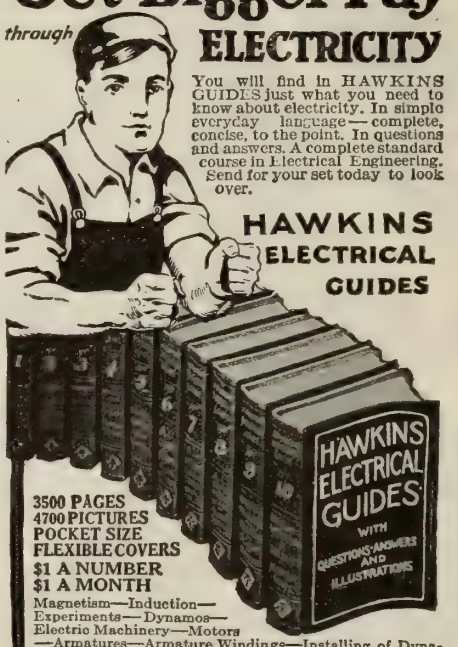
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New Tractor Plant.—The Chase Tractors Corporation has been formed to carry on the manufacture of the Chase tractor for the Canadian market. The company will have a capital stock of $1,000,000 7 per cent. preference stock, of which $750,000 will be issued at present and $1,000,000 common stock, all of which is now issued. The company has secured a large plant adjoining the Canadian National Exhibition grounds, which will give it facilities on the main line of the Grand Trunk and C. P. R.

To Manufacture Oxygen.—A $5,000,000 corporation has been formed by Montreal and Toronto capitalists for the manufacture of 100 per cent. pure oxygen. Plants are being established all over Canada. The Toronto branch, known as the National Electro Products, Ltd., has been making oxygen for some time at the plant at 297 Dufferin Street. The Toronto directorate includes W. J. Cluff, president; W. W. Nearn, R. J. Cluff and A. J. McDougall. The Montreal group are represented by H. W. Beauclerc, G. H. Duggan and W. F. Angus.

Canada Forgings Meet.—The meeting of Canada Foundries and Forgings was held at Brockville with Capt. Weir in the chair. A very favorable statement was shown on the year's operations. After providing for repairs, depreciation, and ad debts a profit of $149,623.52 remained. Income from investments was $13,219.72. Interest on outstanding bonds and administration expenses were $72,146.62, leaving a net surplus for the year of $169,915.92. After paying dividends of 7 per cent. on preferred and 12 per cent. on common stock, a balance of $1,285,222.23 was carried forward to the credit of profit and loss.

Meaford Strike is Compromised.—The Seaman Kent Company, of Meaford, in consultation with the representatives of the striking employees, have decided to run the factory on a ten-hour basis, time and one-quarter being paid for the extra hour involved. A number of the men were in favor of this arrangement, and a notice was posted on the board stating that anyone who was not content with it should seek employment elsewhere. A sufficient number of the men turned up to work to warrant the starting of the plant, and as the shipping room and yard men had been working right along the company anticipate no further trouble.

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NEW CATALOGUE

The Beaudry & Company, Inc., have issued a very attractive catalogue on their line of power hammers. Both belt and motor driven types are shown; together with the various features peculiar to this line of tools. To anyone interested in power hammers this catalogue should especially appeal.

When a liquid is heated in the vessel which contains it, there is an apparent expansion which varies with the nature of the vessel, so that, in order to determine the absolute expansion, a double measurement must be made, the apparent expansion of the fluid being modified by the previous measurement of expansion of the container.

The "Revue de Chimie Industrielle" gives the following report of a much more direct process evolved by M. Jean Escard, which requires only one operation.

He makes use of an apparatus composed of two concentric cylindrical containers, the inner one of copper and the outer of glass. The inner container has a volume which is exactly half that of the outer one. But it is a known fact that the co-efficient of expansion of copper is 0.000,0172, while that of glass is only 0.000,0086, i.e., exactly half. Consequently, when the two containers are heated at the same time there is no change in the volume of the space between them, since the inner one has an expansion which is double that of the outer vessel having a double volume. Thanks to this ingenious compensation, a single reading enables us to calculate the co-efficient of expansion of any liquid whatever occupying the space comprised between the two vessels.

The combination is placed in a water-bath, which is heated from the outside. This has a ring-shaped cover containing two holes, in one of which is inserted a thermometer which fits tightly and which indicates the temperature attained by the liquid being tested. In the other hole is placed a graduated tube welded to the glass and having a very narrow channel so as to make it extremely sensitive. The liquid expands into this, and its expansion is measured directly and without significant error.



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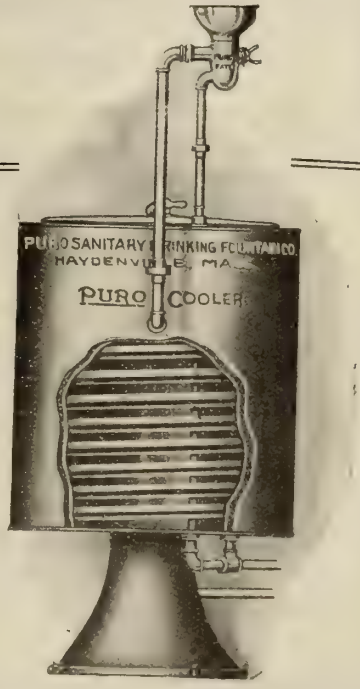
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CLASSIFIED ADVERTISING SECTION

Rates (payable in advance): Two cents per word first insertion; one cent per word subsequent insertions. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

HELP WANTED

WANTED — FOREMAN FOR TANK SHOP, thirty men, Western Canada. Apply Box 660, Canadian Machinery. (c11m)

Mechanical Draughtsmen

WANTED—EXPERIENCED IN MACHINE DESIGN and detail, preferably in connection with paper-making machinery, or crane and conveying machinery. Must be first-class men capable of handling work through the office with despatch; permanent work for the right men. Apply, stating age, nationality, detail experience and salary required, to Dominion Bridge Company, Limited, Montreal. (C 11 M)

POSITIONS WANTED

MECHANICAL ENGINEER—WITH COLLEGE education, having full charge of machinery in large shipyard on Atlantic Coast, desirous of making a change. Wants position with engineering or contracting company; has the handling of men; age 44 years. Salary $85 per week. Box 661, Canadian Machinery. (C 10 M)

ESTABLISHED ENGLISH AGENT, HEADquarters London, visiting Canada, desirous of representing or distributing Canadian manufactured goods in the British Isles. Box 662, Canadian Machinery.

MACHINERY WANTED

WANTED — LARGE LEATHER BELT MAKers' power-driven Scarfing or Splicing Machine, capable of scarfing belt straps up to 14 in. or 18 in. wide. State price and particulars. Box No. 89, Brown's Advertising Offices, 166 Buchanan Street, Glasgow, Scotland. (C. 10 M)

DISC OR RING WHEEL GRINDER WITH lever feed tables; exhaust fan 8" opening; small plating dynamo, and tank circular saw table metal top. Hand or small milling machine. Lever feed drill press. Box 656, Canadian Machinery. (c10m)

WANTED — TWO BARBER COLMAN GEAR Hobbing Machines, new or second-hand size No. 2 or 3, or other similar machines. Box 658, Canadian Machinery. (c12m)

FOR SALE

FOR SALE — THE FOLLOWING REBUILT Machine Tools, in condition nearly equal to new: 1—24x10-in. New Haven Engine Lathe, Q. C. gears, 20-in. Universal chuck, $800.00. 1—Petrie heavy duty manufacturing lathe, $550.00. The A. Bernard Industrial Company, Fortierville, Quebec, Canada. (C 12 M)

FOR SALE—110 FEET 46" 3-PLY LEATHER belt in fair condition. Firstbrook Bros., Ltd., 283 King St. E., Toronto. (c10m)

CROSSLEY GAS ENGINES — USED. GOOD condition. Two. Built in Manchester, England. Complete with mufflers, gas scrubbers, air compressor for starting. Four Cycle Trunk Piston Type. 20" bore, 30" stroke, 160 R.P.M. Aproximate net weight, each engine, 21 tons. Further particulars on application. Canada Foundries & Forgings, Limited, Brockville, Canada.

FOR SALE

Slightly used welding and cutting outfit of the following manufacture: Davis Bournonville L'Air Liquide, Prest-O-Lite Oxweld.

Carter Welding Co. of Toronto
7 Sheppard St., Toronto

THE "WANT" AD.

The "want ad." has grown from a little used force in business life into one of the great necessities of the present day.

Business men nowadays turn to the "want ad." as a matter of course for a hundred small services.

The "want ad." gets work for workers and workers for work.

It gets clerks for employers and finds employers for clerks. It brings together buyer and seller, and enables them to do business though they may be thousands of miles apart.

The "want ad." is the great force in the small affairs and incidents of daily life.

Where Do You Live?

We are going to put a representative in every town in Canada. Be the one in your territory.

We teach you how to build a permanent, substantial business. Whole or spare time. Write for particulars to-day.

Department B, Agency Division
153 University Avenue
Toronto - Ontario

SAY YOU SAW IT IN CANADIAN MACHINERY

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (cfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

SAY YOU SAW IT IN CANADIAN MACHINERY

Full line of
Honestly Rebuilt Machine Tools at bargain prices.
Special price on 20 inch x 8 ft. C.M.C. Lathe.
STANDARD EQUIPMENT & TOOL WORKS
179 St. James St. - MONTREAL

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next week's issue.

Canadian Machinery
143-153 University Ave., Toronto

THE U.S. GOVERNMENT

Has a large quantity of surplus manufacturing

Equipment and Supplies For Sale!

Canadian Manufacturers are presented with an opportunity to secure at low prices good quality new and used Miscellaneous Machinery, Shop Equipment, Miscellaneous Tools, Electrical Equipment, Testing Equipment, Miscellaneous Hardware, Etc.

For Immediate Disposal

comprising

Accumulators
Air Compressors
Belting
Blowers
Brinell Machines
Chucks
Circuit Breakers
Dies
Drilling Machines
Forges
Furnaces
Generators
Grinders
Hoists
Lathes
Millers
Motors
Presses
Pulleys
Pumps
Pyrometers
Reamers
Scales
Scleroscopes
Screw Machines
Shapers
Switch Boxes
Taps
Tensile Machines
Thermometers
Transformers
Trucks
Vises
Welding Equipment

Toronto District Salvage Board
Ordnance Department U.S. Army
39 Adelaide St. East, Toronto, Ont.

If interested tear out this page and place with letters to be answered

SALE OF MILITARY AND OTHER GOVERNMENT STORES

Equipment and Supplies for Hospitals, Institutions, Bunkhouses, Camps, Dining-Rooms, Kitchens, etc.

Bedsteads, Furniture, Hardware, Dry Goods, Rubbers, Overshoes and other Footwear, Blankets, Sheets, Pillows, Baskets, Woodenware, Brushes, etc.

CONSTRUCTION EQUIPMENT AND MACHINERY—AMBULANCES.

The Stores are located at various places throughout Canada

Instead of or in addition to sales by sealed tender

PRICE LISTS WILL NOW BE ISSUED

for most articles—the goods being offered in lots for purchase by wholesale houses, jobbers, and the trade generally.

TRADE ONLY SUPPLIED

except that arrangements previously announced for sale to returned soldiers and sailors and widows and dependents of same through the G. W. V. A. and similar organizations and to hospitals and philanthropic institutions will be continued.

SALES WILL CEASE IN MARCH. Any balances left will be cleared by public auction shortly thereafter. This advertisement will not be repeated. Those interested should therefore apply AT ONCE for price lists and other information to the

SECRETARY OF THE WAR PURCHASING COMMISSION, BOOTH BUILDING, OTTAWA

February, 1920

D.F.&Sc. Co. Quality & Service

DROP FORGINGS

ONE of the largest and best equipped forge plants anywhere is at your call for drop forgings of any kind, particularly in large quantities.

Dominion Forge & Stamping Company, Limited
Walkerville, Ont.
Toronto Office: Excelsior Life Bldg.

International

SPECIALISTS
in
Railway, Marine and Industrial Supplies

Duntley Dayton Pneumatic Tools.
Daniel's P.P.P. Packing.
Ebonite Packing.
Pump Valves.
International High Pressure Sheet Packing.
International Red Rubber Packing.
Plastic Metallic Packing for Piston Rods and Valve Stems.
Paxton & Mitchell Locomotive Rod Packing.
Rapid Hose Coupler, for all Hose Connections.

Write or Wire Your Requirements

International Machinery and Supply Company, Limited
421 St. James St., Montreal

PARTIAL LIST OF TOOLS

2—60" Bullard Vertical Boring Mills
1—60" Niles Vertical Boring Mill
No. 4—B. & S. Plain Miller
1—36" x 36" x 8' Gray Planer, two heads
No. 3—Cincinnati Universal Miller
5—No. 0 Steptoe Hand Millers
13" x 5' 6" New Carroll-Jamieson Quick-Change Lathe
14" x 6' New Carroll-Jamieson Quick-Change Lathe
15" x 6' New Sidney D.B.G. Quick-Change Lathe, swing 17"
15" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 17"
17" x 8' New National Quick-Change Lathe
3—17" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 19"
17" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 19"
18" x 24" New Rahn Larmon Lathe, D.B.G. Quick-Change
19" x 10' New Sidney D.B.G. Quick-Change Lathe, swing 21"
9—19" x 8' New Sidney D.B.G. Quick-Change Lathe, swing 21"
25" x 14' New Sidney D.B.C. Quick-Change Lathe, swing 27"
33" x 14' Putnam, arranged for Motor Drive
6' Western Radial Drill
5' Bickford Single Pulley Drive Radial
100-lb. New Little Giant Hammer
50-lb. New Little Giant Belt Hammer
25-lb. New Little Giant Belt Hammer
30-ton Watson & Stillman Hydraulic Press

FRANK TOOMEY INC.
27 North Third Street PHILADELPHIA, PA.

MACGOVERN & COMPANY INCORPORATED POWER MACHINERY

Oil Engines

H. P.	Cyl. Dimensions	Make	H. P.	Cyl. Dimensions	Make
18	3-cylinder	Meitz-Weiss	85	13 x 15	Jacobson
37½	3-cylinder	Stationary	225	16 x 24"	Diesel
50	13" x 18'	Bessemer crude	225	15" x 24"	Diesel
50	2-cylinder	Jacobson	225	Vertical	Diesel
80	Vertical				

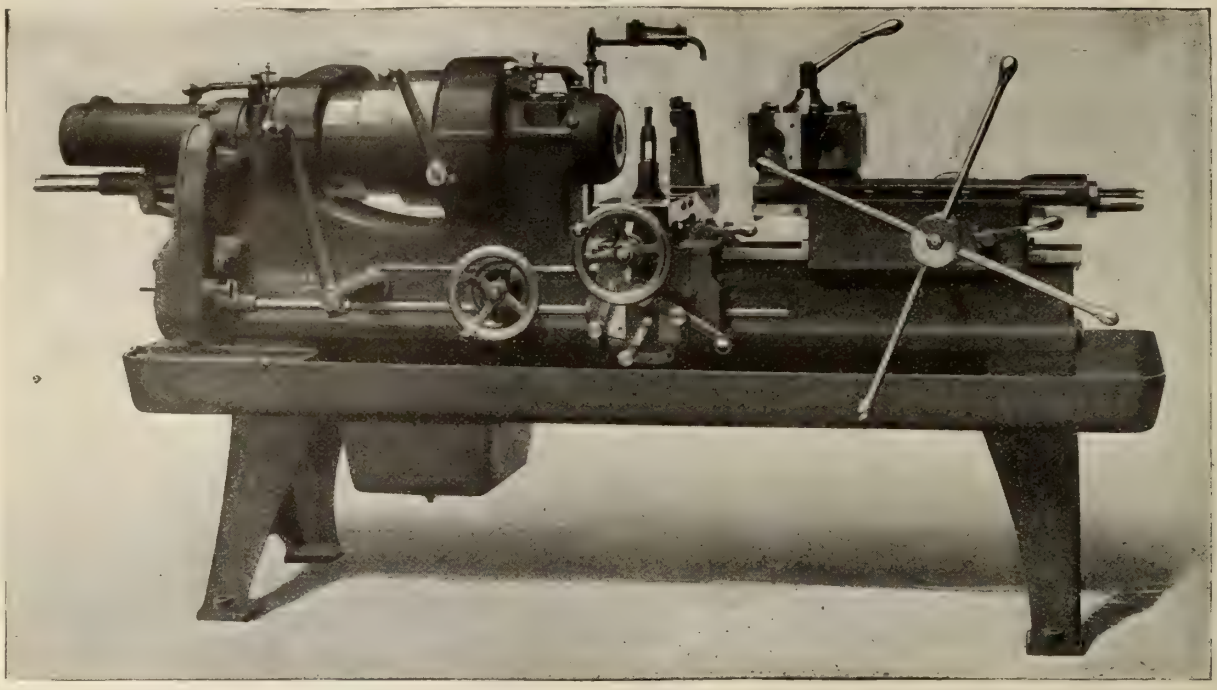
Gas and Gasoline Engines

H. P.	Cyl. Dimensions	Make	H. P.	Cyl. Dimensions	Make
2½		Fairbanks-Morse	18		Laval
3½	Type C	New Way	25	2-cylinder	Nash Company
10		Fairchilds	22		Pierson
10		American	27		Jacobson
10½	6¾ x 10"	Jacobson mach.	50	9½ x 14"	Premier Gas
12	8 x 10	Fairbanks-Morse	75	15" x 21"	Premier Gas
12		Lair	110	16" x 24"	Foose
16	8" x 22"	Foose	200		Hornsby
				Twin-cyl.	Miller.

MacGOVERN & COMPANY, INC.
285 Beaver Hall Hill Montreal

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New W & S Turret Lathe
is more powerful yet easier to operate



THIS NEW No. 6 TURRET LATHE is welcomed by manufacturers who finish gear blanks, forgings and tough alloy steel parts. As powerful as the large and more expensive machines used on this work, the No. 6 increases production and is easier to operate.

Capacity:
2¼" thru automatic chuck
9¼" swing over carriage
20⅜" swing over bed

Write for a catalog.

The Warner & Swasey Company
Cleveland, Ohio, U.S.A.

Buffalo Office: Iroquois Building
Detroit Office: Ford Building
New York Office: Singer Building
Boston Office: Oliver Building
Chicago Office and Showroom: 618-622 Washington Boulevard

Canadian Agents: Williams & Wilson, Ltd., Montreal
A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver and St. John

For Roofs—old and new

Scores of buildings need roofing
Scores of roofs need repairing

BRANTFORD
Asphalt Slates

Made of the same material as Brantford Crystal Roofing, but in individual size shingles. Crystal Roofing has a crushed slate surface of red or green, 80 lbs. per square. Brantford Asphalt Slates are in great demand.

ASBESTOS FIBRE
***(Liquid)* CEMENT**

—a rubberlike adhesive and tough preparation made from finest asbestos fibre, creosote and durable oils. Makes any roof, no matter in what condition, absolutely proof against climatic conditions. Easily applied over any kind of roof, metal, gravel, paper or composition.

Asbestos Sheathing

With fire prevention uppermost in the minds of everybody from the school-boy up there is no doubt a growing tendency to fireproof buildings. Asbestos Sheathing is a recognized fire-prevention material. Recommend it to builders.

Jewel Roofing

Comes in 1, 2 and 3-ply, guaranteed respectively for 3, 5 and 8 years. We think it is the best value on the market for this quality of roofing.

Excello Roofing

—a better grade roofing with a longer guarantee. Comes in 1, 2 and 3-ply, guaranteed for 5, 10 and 15 years respectively. Place your orders early.

We also carry a full stock of regular lines of plain and tarred felt in 10, 12 and 16-oz. weights.

WRITE FOR PRICES

Rice Lewis and Son, Limited, Toronto



STORAGE TANKS
AIR TANKS
Electric Weld
PNEUMATIC TANKS
GASOLINE TANKS

RANGE BOILERS AND EXPANSION TANKS

Canadian John Wood Mfg. Co., Limited
TORONTO, ONTARIO

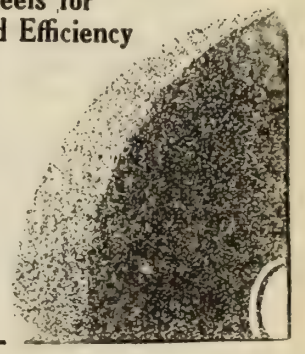
Buy Your Grinding Wheels Direct!

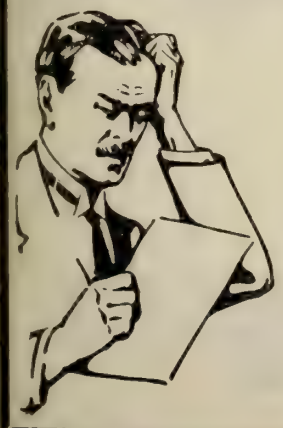
Brantford Wheels for Durability and Efficiency

Remember this when you are considering an order for Emery Wheels: We sell direct to the user—you save the middleman's profit. Then you can depend upon our wheels giving the most efficient service—our wheels represent highest quality in raw materials and manufacture.

Give them a trial.

Brantford Emery Wheel Co.
Brantford, Ontario





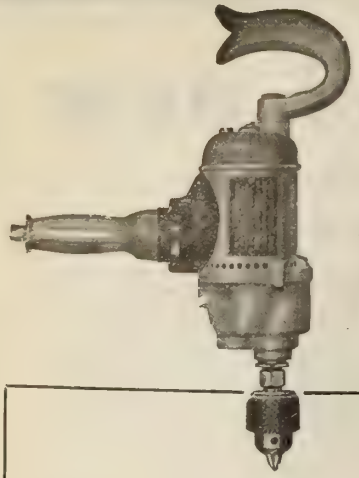
Power Transmission Expenses Reduced by
"Renold" and "Morse" Patent Silent Chains
AS
No Slip Minimum Journal Friction
Maximum Efficiency, Increased Production

Sole Canadian Agents

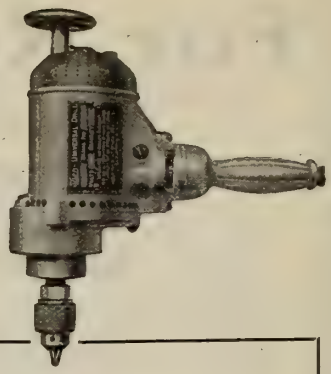
JONES & GLASSCO, Reg'd
ENGINEERS
TORONTO MONTREAL



250 H.P. Renold
Silent Chain Drive



Thor
ELECTRIC DRILLS



For Continuous Service Under Severe Conditions

Light, powerful and non-stallable, "Thor" Portable Electric Drills have offset spindles—which permit operating in close quarters—a variety of speeds, S K F Ball Bearings, four contact point switches, D.C. or Universal Motors and other distinctive advantages to recommend them. It will pay you to investigate the "Thor" line. Standard equipment on all classes of work.

Independent Pneumatic Tool Co., 334 St. James Street, Montreal

TORONTO, 32 Front Street West WINNIPEG, 123 Bannatyne Ave. East VANCOUVER, 1142 Homer Street

STEEL CASTINGS

Mild Steel, High Carbon Steel, Manganese Steel, Chrome Steel

We are manufacturers of Steel Castings running from ½ lb. to 5,000 lbs. each and are in good position to furnish prompt deliveries at moderate prices. Try us with your next order.

The William Kennedy & Sons
Limited
Owen Sound
Established 1860

Manhattan

Universal Tool Grinder

Capable of handling cylindrical or internal grinding with speed and accuracy.



An invaluable tool to the machine shop where there is a large variety of grinding to be done.

Complete equipment.

Manhattan Machine & Tool Co.
Grand Rapids, Mich., U.S.A.

Foreign Representatives: "Aux Forges de Vulcain," Paris, France. Farmer & Co., Clerkenwell, London, E.C.



"Caustic Burned Their Hands"

A LARGE western plant now uses Oakite materials instead of caustic soda for cleaning crude oil and sand from pipe fittings, valves, etc.

This Advertisement is one of a series based on actual occurrences.

The parts are thoroughly cleaned in 3 hours instead of 24 hours—or ***eight times faster.***

Only 8 pounds of Oakite is required for weekly tank upkeep—***instead of 100 pounds of caustic soda*** formerly employed.

Workmen no longer have to wear rubber gloves—***nor are their hands burned***—as when using caustic.

Oakite ***again*** proved its superiority and economy for metal cleaning.

In seeking advice on cleaning problems, look for broad experience and ability. It is the surest, safest way to find sound counsel.

How May We Serve YOU?

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK

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Hoyt Babbitts, particularly Frost King, represent maximum value at minimum prices, possessing all the qualities and overcoming all the usual Babbitt faults found in ordinary bearing metals. We've been making Babbitts for nearly half a century.



MANUFACTURED BY

HOYT METAL COMPANY

MONTREAL TORONTO WINNIPEG

DIAMOND TOOLS

FOR TRUEING GRINDING WHEELS

QUALITY SERVICE SATISFACTION

INDUSTRIAL GEMS

Tools For All Mechanical Purposes

FURNISS CLARKE & COMPANY

364 University St.

MONTREAL

Sole Canadian Agents for

THE JOYCE-KOEBEL COMPANY, INC.

Formerly Geo. A. Joyce Co., Ltd.

NEW YORK LONDON

TRAHERN PUMPS

You Can Rely on the Trahern Rotary Geared Lubricating Pump to Give Superior Satisfaction.

Throws heavy stream of coollant at will of machine operator into deep cuts and bores. Has large capacity, low speed and long life—all superior essentials!



Tool manufacturers find that machines equipped with Trahern Rotary Geared Lubricating Pumps sell to better advantage. It's the ideal pump for speedy, economical and efficient production. **Write for full information.**

TRAHERN PUMP DIV.

Geo. D. Roper Corp.

ROCKFORD, ILLINOIS, U.S.A.



Automatic Furnace Heating Shafts

UNIFORM HEATING AND COOLING

One is at the start and the other at the finish of the heat-treatment operation. **Both are essential** to a uniformly heat-treated product.

Automatic Furnaces, by heating and cooling each piece to the same temperature, for the same length of time and in the same manner, **insure uniformity of finished product.**

Increase in production and **decrease in fuel and labor** are among the other advantages of Automatic Furnaces.

We have a variety in type and size of Automatic Furnaces, for different heat-treating requirements. Let us work with you in deciding which of these is best suited to your conditions.

Can. Rep. R. J. McLean

604 Southam Bldg., Montreal, P.Q.

W. S. ROCKWELL CO. INDUSTRIAL FURNACES NEW YORK

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

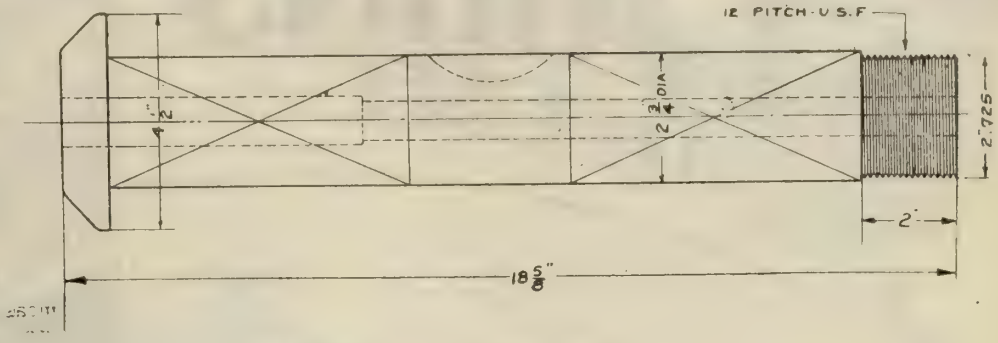
Thread Milling would mean big profits here—although there is nothing very difficult about this job

It's 12 pitch U.S.F. to shoulder, diameter 2.725 inches. It's the sort of job that's done well by a good man on an engine lathe. Probably you have a skilled lathe hand on work like this in your own shop.

If you have, take a tip and put your clock on that job. With ordinary labor the

Smalley-General Thread Miller

takes 4 minutes floor to floor. If your lathe takes only 30 minutes to turn out threads of equal accuracy and finish you have a good man on the job.



MATERIAL—.40 Carbon Steel.
LATHE TIME—30 minutes, approx.
THREAD MILLER TIME—4 minutes, floor to floor.

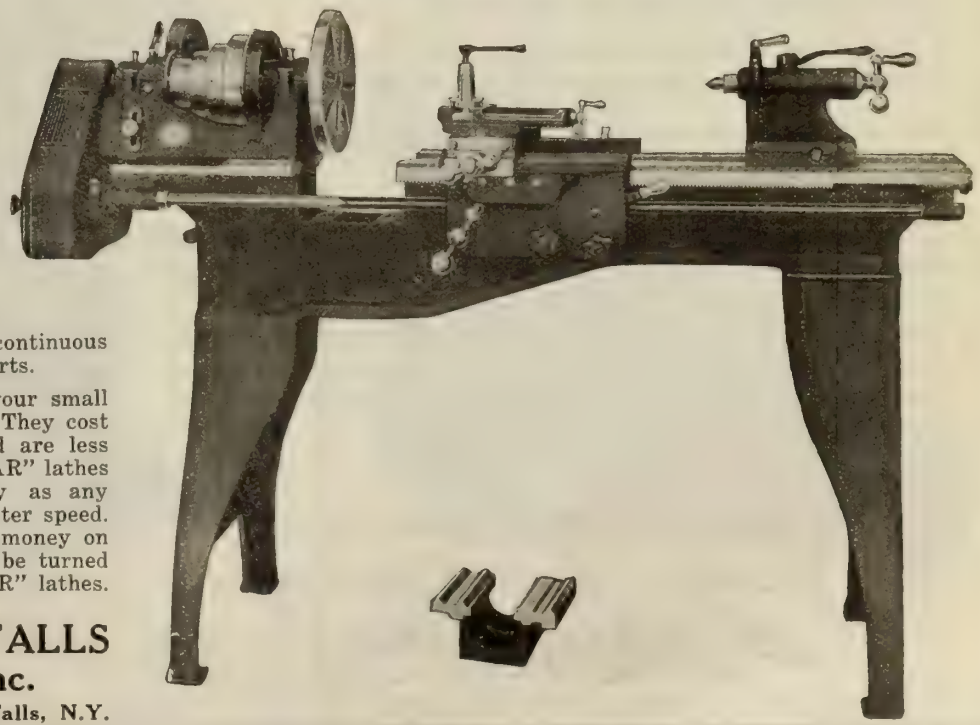
We are ready at all times to give you a guaranteed production estimate of the Smalley-General on your work. Just send us your blueprints. If possible, send us samples of the work also and we'll show you the quality and accuracy of threads milled in the guaranteed time.

SMALLEY-GENERAL CO., Inc., BAY CITY, MICH.

Canadian Agents: Rudel-Belnap Co., Ltd., Montreal and Toronto

Two New Sizes of "STAR" Gap Lathes

11" - 18"
13" - 21"



These new models combine the many points in construction that have made "STAR" lathes the standard of efficiency and economy for manufacturing small parts.

"STAR" lathes are rigid in construction and specially suitable for both the finest toolroom work and continuous manufacturing on small parts.

You can figure closer on your small jobs with "STAR" lathes. They cost less, occupy less space and are less expensive to operate. "STAR" lathes operate just as accurately as any larger lathes, yet with greater speed. You are wasting time and money on your small jobs that could be turned into profits by using "STAR" lathes.

THE SENECA FALLS MFG. CO., Inc.

366 W. Falls St., Seneca Falls, N.Y.

If interested tear out this page and place with letters to be answered

The Mecca of Manufacturers

ST. JOHNS QUEBEC



ST. JOHNS is ideally situated on the Richelieu River, which gives direct connection with the docks at Montreal and unsurpassed ocean shipping advantages. The Richelieu River is a link in the chain of canals, furnishing the city with a direct water route to the Great Lakes and the Eastern seaboard of the United States.

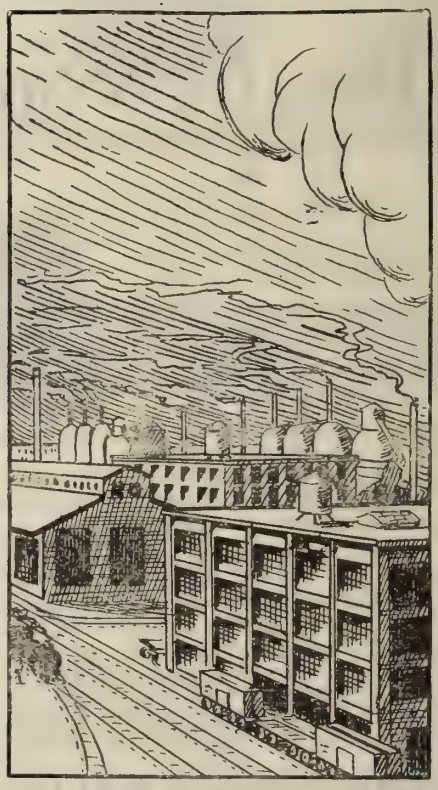
Railway transportation facilities are unequalled. Seven railroads, including the Canadian Pacific and Grand Trunk pass through St. Johns.

Skilled and unskilled labour is always cheap and plentiful, and owing to an unusually low cost of living, labor troubles are unknown.

Cheap and abundant electric power is developed at Chambly, eleven miles north-east of St. Johns.

St. Johns offers extraordinary inducements to new industries.

Exemption from taxes for fifteen years, same being subject to extension. All public improvements you may require, such as streets, sidewalks, waterworks, sewers. A five per cent. bonus to you on your payroll for five years. If desired, the city will advance this to you to be applied to the purchase on construction of any building suitable to your purpose.



For more specific information write to

The Secretary of the City Council

St. Johns, Quebec

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

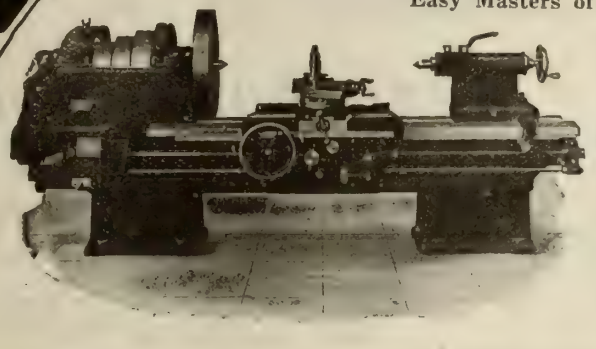
SIDNEY

Heavy Duty Lathes

FOR SERVICE

The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

Easy Masters of Big Jobs.



Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good—with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

The Sidney Tool Company

SIDNEY, OHIO

CANADIAN AGENTS:

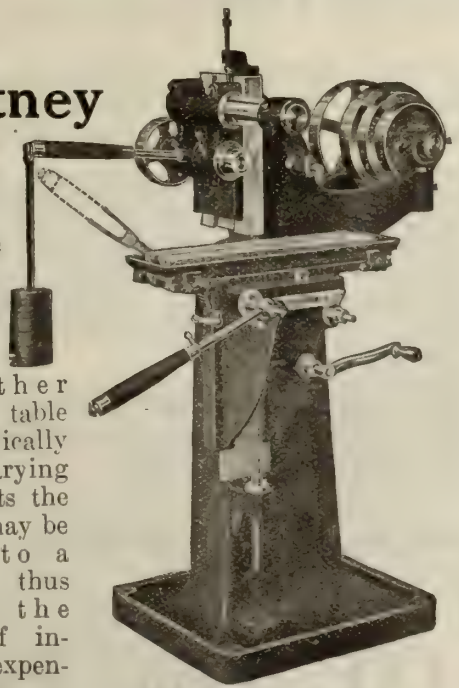
The Geo. F. Foss Machinery & Supply Co., Montreal, Quebec. H. W. Petrie, Limited, Toronto, Ontario.

Thousands in Use

The Whitney

Hand Milling Machine

The Weight Attachment



feeds either head or table automatically and by varying the weights the pressure may be adjusted to a nicety, thus avoiding the danger of injury to expensive cutters.

Send for Catalogue A.

The Whitney Mfg. Co.

Hartford Conn. U.S.A.

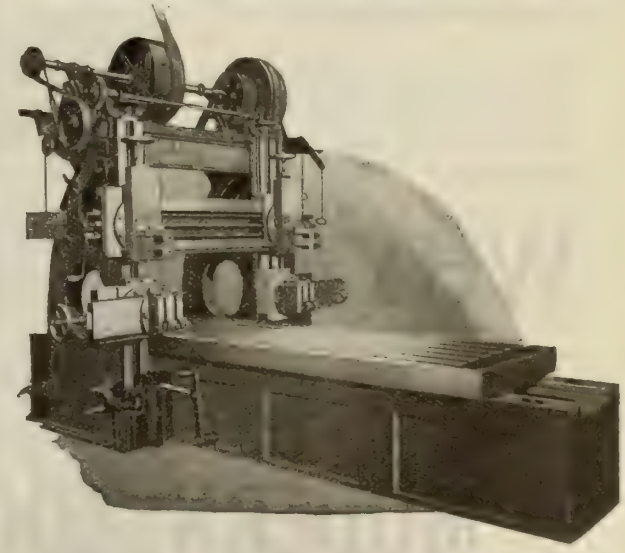
Chains—Keys and Cutters—Hand Milling Machines.

HEPBURN

A high speed, heavy duty planer of superior construction and modern design. Capable of handling the heaviest work with consistent accuracy, rigidity, and speed.

One 42-in. x 42 in. x 10 ft. machine in stock for immediate shipment.

Let us quote you on your requirements in special machinery, cranes, steam pumps, and gray iron castings of every description.



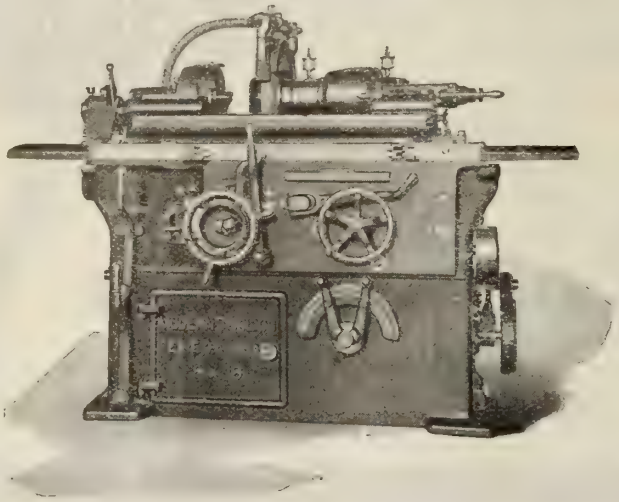
JOHN T. HEPBURN, LIMITED

Engineers and Iron Founders

18-60 Van Horne Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered

MODERN
Plain Grinding Machines



Something to think hard about

A FEW THOUGHTS FOR SHOP EXECUTIVES WHO THINK IN TERMS OF EFFICIENCY AND SATISFACTION

WHY MORE THAN 700 MODERN GRINDERS ARE IN USE IN ONE FACTORY

Eight years ago one Modern Grinder was installed in a certain factory that its capabilities might be compared with then better known makes.

In August and September last, we advertised the fact that this particular factory had in daily use "more than 500 Modern Grinders."

Shortly thereafter began a constant stream of orders for Modern Grinders—proving conclusively that Modern was best of all.

To-day in that factory there are more than 700 Modern Grinders of all types manufactured by us.

WHY ?

The answer is short, but tells a lot to executives who analyze and think. There are just two reasons: Perfect satisfaction is one. Superiority over all others is second.

What about your own Grinding problems? Moderns will satisfy you, too.

MODERN TOOL CO., Erie, Pa.

Main Office and Works: STATE and PEACH STREETS

Canadian Agents: RUDEL-BELNAP MACHINERY CO., Limited, TORONTO and MONTREAL

WHITWORTH THREAD

Chasers for the

HARTNESS AUTOMATIC DIES

Are made to gauges obtained from the originators of the Whitworth System of Screw Thread

JONES & LAMSON MACHINE CO.

(AUTOMATIC DIE DEPARTMENT)

SPRINGFIELD, VT. and **109 Queen Victoria St., London, E.C.**
503 Market Street, San Francisco

American Agents for Dies and Chasers:

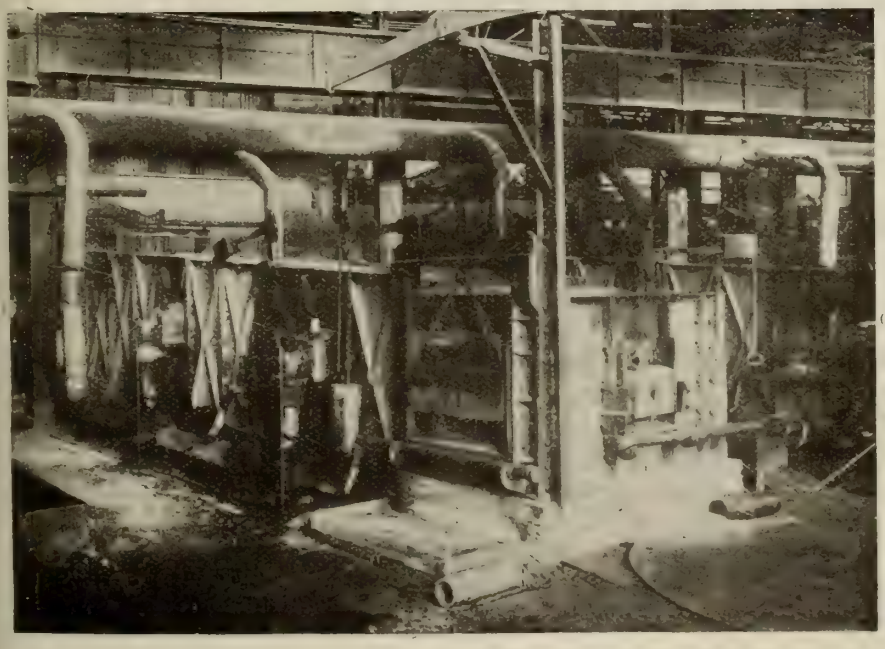
Boyer, Campbell Company, Detroit.
E. L. Essley Mchy. Co., Chicago, Milwaukee and Moline.
Robinson, Cary & Sands Co., St. Paul and Duluth.

Foreign Agents:

France, Spain, Belgium, F. Auberty & Company, 91 Rue de Maubeuge, Paris, France.
Holland, Spliethoff, Beewukes & Company, Rotterdam, Holland.
Australia, McPherson's Pty., Ltd., Melbourne, Australia.
Japan, Manchuria, Korea, Formosa, Mitsui Bussan Kaisha, Ltd., Tokyo, Japan.
Sweden, A. B. Galco, Ltd., Stockholm.

Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

Write

Mechanical Engineering

Company, Limited
Room 308, Bank of Toronto Bldg., Montreal
Three Rivers, Quebec, Canada

If interested tear out this page and place with letters to be answered

H. W. PETRIE LIMITED



The Dependable
Machinery and Supply House

The "PETRIE" policy represents the standard in high-grade tools and efficiency in service.

Prompt Service

Firms We Represent Exclusively:

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cincinnati Bickford Tool Co., Cincinnati, Ohio.
The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.
The Cincinnati Shaper Co., Cincinnati, Ohio.
The Cincinnati Gear Cutter &Machine Co., Cincinnati, Ohio.
The Cincinnati Grinder Co., Cincinnati, Ohio.
The G. A. Gray Company, Cincinnati, Ohio.
The Colburn Machine Tool Co., Franklin, Pa.
The National Machinery Co., Tiffin, Ohio.
The Rivett Lathe & Grinder Co., Bridgeton, Boston, Mass.
The Universal Boring Machine Co., Hudson, Mass.
Rockford Machine Tool Co., Rockford, Ill.
The Bellevue Industrial Furnace Co., Detroit, Michigan.

Machine Shop Supplies of all Kinds

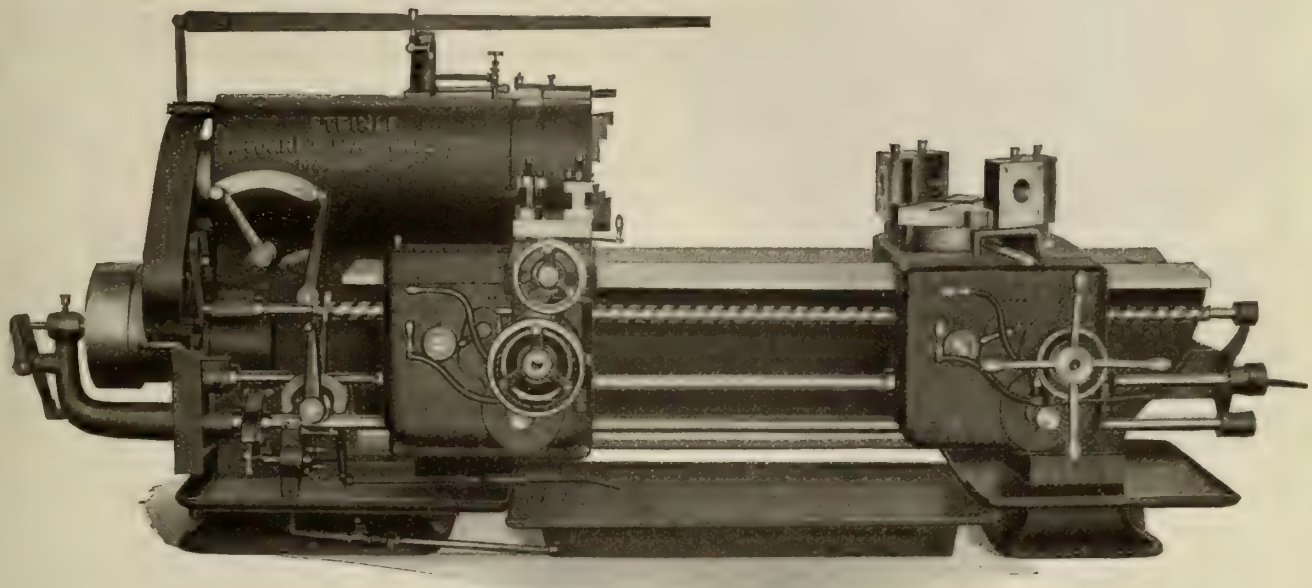
It is not only through supplying the machinery trade with dependable tools and supplies that the name PETRIE has become a national by-word throughout Canada—PETRIE SERVICE, too, is always dependable. An adequate stock and competent staff enables us to get orders through without delay. Are you in need of any of the following supplies?

Clipper Belt Lacers and Hooks
Hyatt Roller Bearings
Pioneer Steel Hangers
American Steel Split Pulleys
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Cold Rolled Shafting
Dumore Grinders
"Willey" Electric Drills and Grinders
Brown & Sharpe Machinists' Tools
Armstrong Lathe Tools
National Machinists' Vises
Parker Vises
Leg Vises
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Cap and Set Screws
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Nuts and Washers
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H. W. PETRIE, LIMITED
TORONTO HAMILTON

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

STEINLE



Full Swing Side Carriage Turret Lathes

A machine that doesn't produce is a continual thorn in the side of the efficient shop manager, who is responsible for the showing his organization has made at the end of the year, when the profit and loss accounts are investigated.

DON'T PUT UP WITH A SLACKER

Get the Machine That Gets Out the Work

The Steinle heavy duty general purpose lathe is a master producer. It is giving entire satisfaction to the scores of users who find it necessary to secure a machine which can be relied upon to boost the profit side of the ledger by consistently producing duplicate work rapidly, accurately, and economically. It can make profits for you in the same manner, so why not send us your blueprints and allow us to quote on your requirements?

STEINLE TURRET MACHINE COMPANY

Madison, Wis., U.S.A.

ORIGINATORS OF THE FULL SWING SIDE CARRIAGE TURRET LATHE

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California.
FOREIGN—Leo. C. Steinle, 53 Victoria Street, London, England.

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

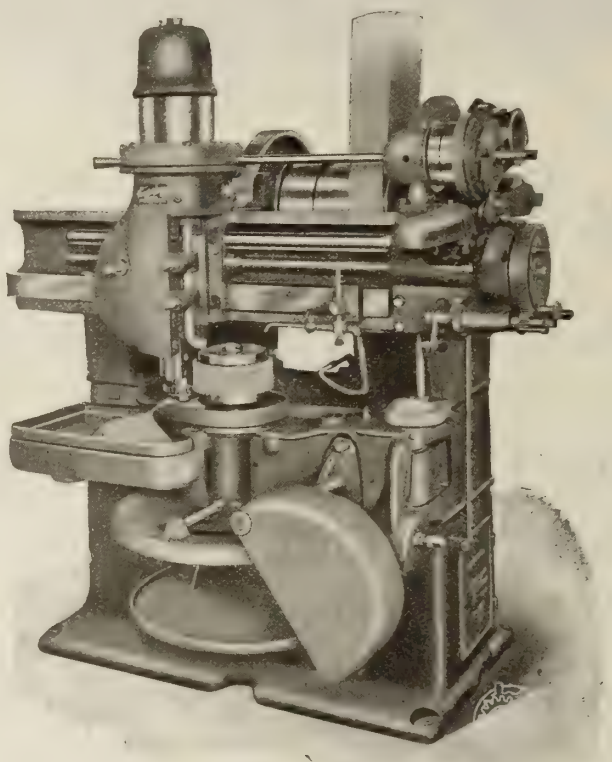
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day.



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting.

The Fellows Gear Shaper Company

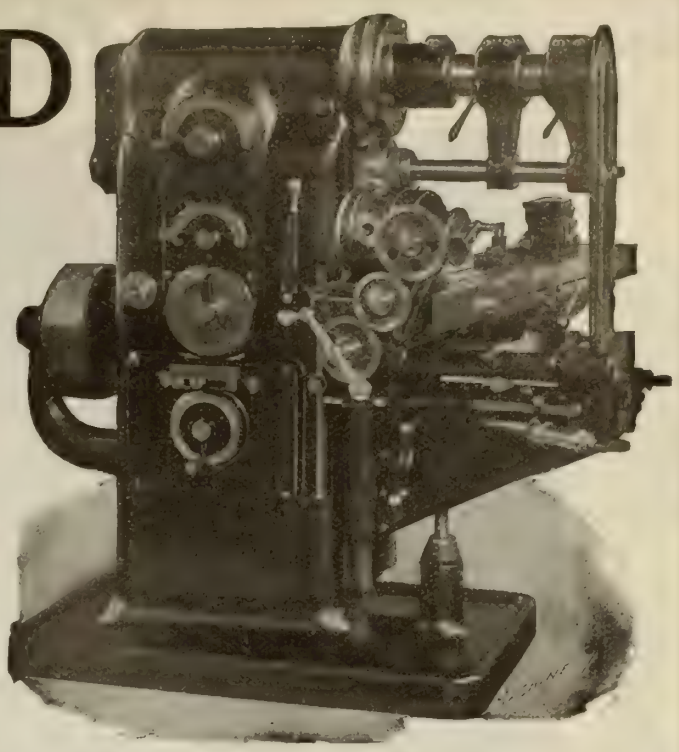
Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Société Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Limited, Calcutta, India; A. B. Galco, Limited, Stockholm, Sweden.

Saves Time, Labor, Expedites Production

ROCKFORD Milling Machine

Its speed, simplicity of operation and great utility Assures Big Profits in whatever work it is used.



And another profit-making feature of the "Rockford" Miller lies in its unusual capacity to do all classes of work.

In the tool room, in the shop, in the manufacturing or jobbing establishment this "Miller" is beyond comparison.

Has Power to Spare

Put the power of the "Rockford" to the severest tests. It's built to more than meet the demands likely to be made upon it. It is the pace-maker of the machine shop.

Look into the merits of this machine. Write to us without delay.

ROCKFORD MILLING MACHINE COMPANY, ROCKFORD, ILL.

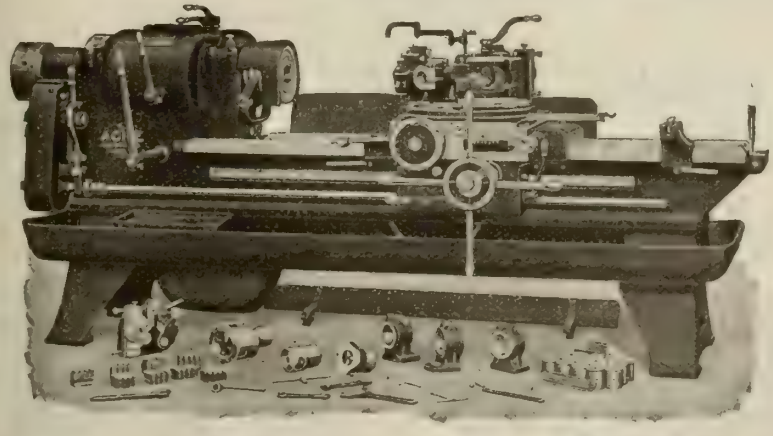
Canada: Rudel-Belnap Machinery Co., Toronto, Ont.

FOREIGN REPRESENTATIVES: Great Britain, A. A. Jones & Shipman, Ltd., Leicester, England. France and Belgium, Louis Besse, Paris, France. Italy and Colonies, Societa Anomma Adler & Co., Milano. Scandinavia, Rylander & Asplund, Stockholm, Sweden. Spain and Portugal, Casamitjana Hermanos, Barcelona, Spain. Australia, Selson Engineering Co., Melbourne, Australia. Russia, M. Mett Engineering Co., Petrograd, Russia.

Doubly Efficient—Does Both Bar and Chuck Work

This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

Write for Valuable Bulletin

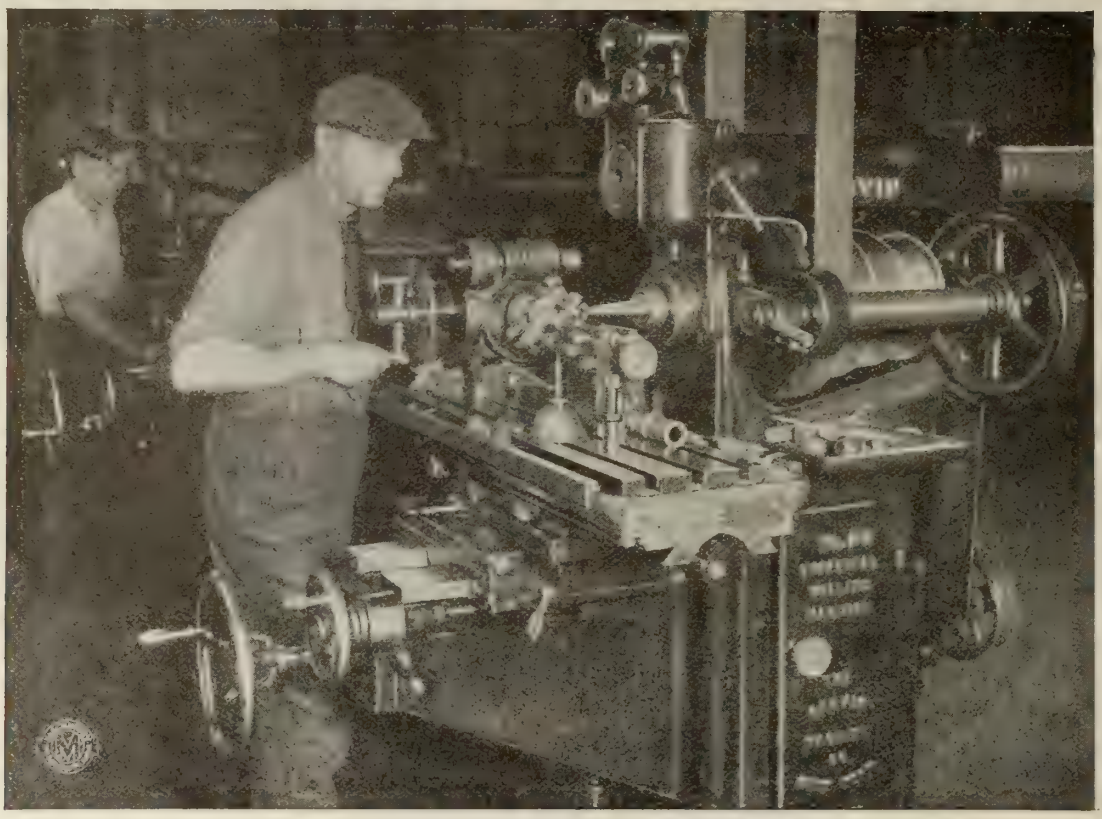
The Acme Machine Tool Co.

Cincinnati, Ohio

Canadian Agents: Rudel-Belnap Machinery Co., of Montreal and Toronto

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GARVIN MACHINE TOOLS



Dependable Toolroom Equipment

These Garvin No. 2-A Universal Milling Machines are in the toolroom of the Bowen Products Corporation, Auburn, N. Y. One machine was installed ten years ago, the other four years later. The complete line of grease and oil cups manufactured by this concern involves the construction and maintenance of a large number of punches, dies and other press tools, taps and thread cutting dies. This great volume of work keeps the tool room—and these Garvin Milling Machines—busy at all times. When photographed, the machine in the foreground was milling 60 teeth 0.025" deep on a broach; the other was machining a drawing punch. These Garvin Milling Machines are used on toolroom work exclusively.

The No. 2-A is the highest grade Universal Milling Machine. It is suited for all high class tool and fixture making and special manufacturing. Its many important features are worthy of your careful investigation.

The Garvin catalog is a good book to have. It describes our complete line, is of a handy size, and is durably bound. Send for it.

The Garvin Machine Company

Spring and Varick Streets, New York, N.Y., U.S.A.

6-15

GARVIN

BUILDER OF BETTER MACHINE TOOLS

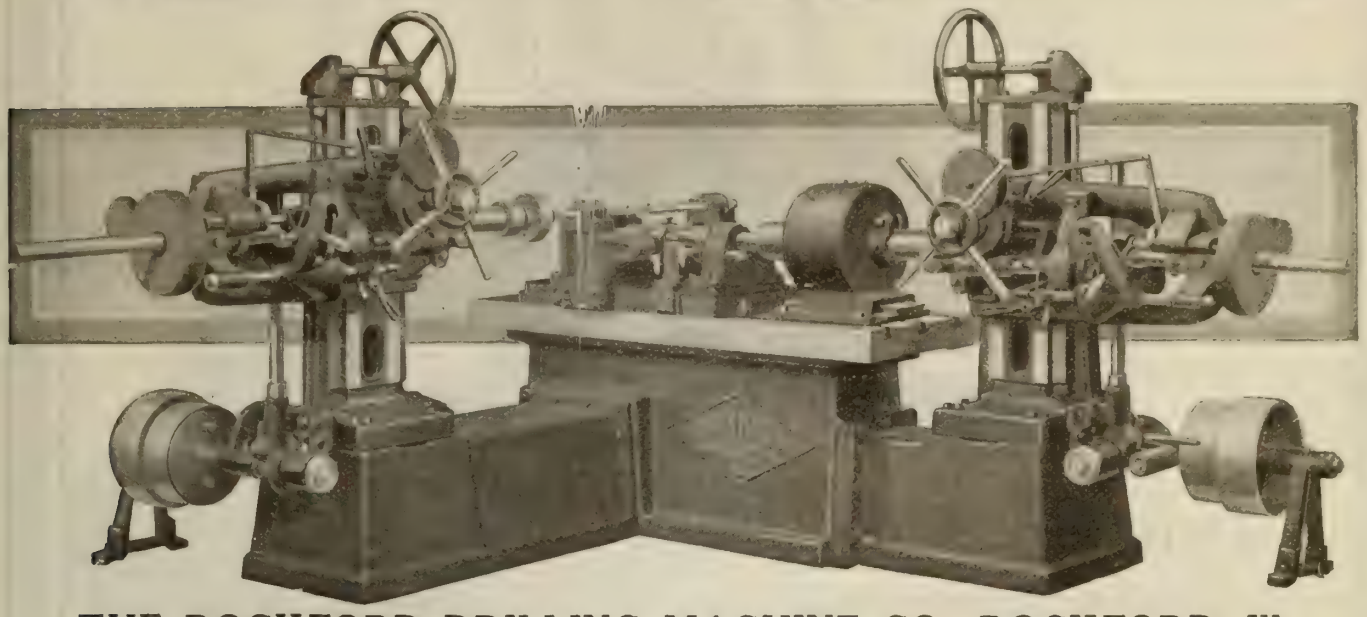
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Rockford Horizontal Boring Machine

For Automobile Manufacture

This tool is unusually rapid and accurate in the boring of crank cases, transmission cases and rear axles. Has two heads at right angles to each other. Spindles bore longitudinal and cross holes in work simultaneously.

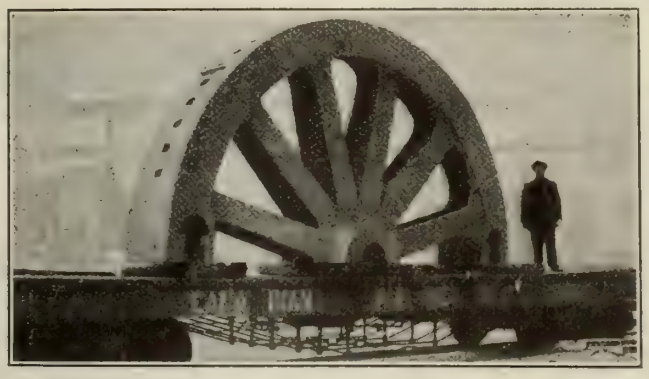
Send us blue prints of your boring work and we will give you figures on the "Rockford's" ability on it.



THE ROCKFORD DRILLING MACHINE CO., ROCKFORD, Ill.

CANADIAN AGENTS
RUDEL-BELNAP MACHINERY CO., MONTREAL and TORONTO

FOREIGN REPRESENTATIVES:—Burton Griffiths, London. Buck & Hickman, London E., England. R. S. Stokvis & Zonen, Inc., France, Belgium, Holland, Russia. Allied Machinery Co., 51 Chambers St., New York City, South Africa, China, Italy, Brazil, Portugal, Balkan States. Casamitjana Hermanos, Barcelona, Spain.



A New Canadian Record in Steel Castings

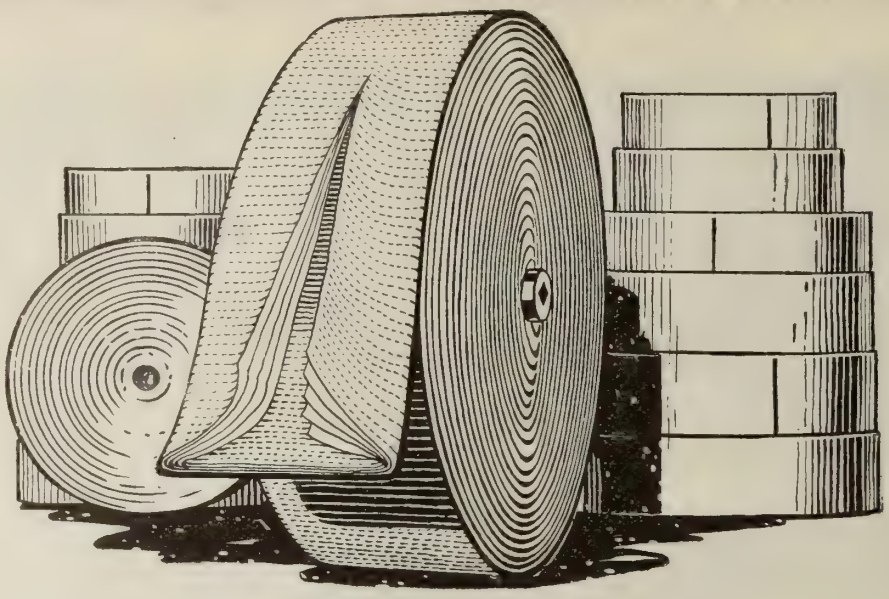
Cast Steel Half-Spider for Electric Generator

Diameter	- -	20 Feet
Face	- - -	3 Feet
Net Weight	-	64,000 Pounds

DOMINION FOUNDRIES & STEEL, LIMITED

HAMILTON :: :: ONTARIO

If interested tear out this page and place with letters to be answered



Ten-Ply Economy

You can eliminate entirely the element of guess-work in purchasing belting by specifying Dominion Friction Surface Belting, for it embodies every factor necessary in satisfactory transmission belting.

Dominion Friction Surface Belting

Conserves power by preventing slippage.
Increases production, thereby reducing cost.
Prevents idle machines and employees.
Has an extremely low upkeep cost.
Gives long and continuous service.
Careful selection of materials insures absolute dependability.
Our process makes every foot uniform.
Keeps operators contented by enabling them to produce maximum output.
Guaranteed by Canada's largest manufacturers of rubber goods.
Backed by an incomparable service of belting engineers.
Dominion Friction Surface Belting has justified every claim by more than fifty years of satisfactory performance.
Our engineers are ready to show you, without charge, how *your* transmission equipment can be put on a ten-ply economy basis.
Phone or wire our nearest branch.

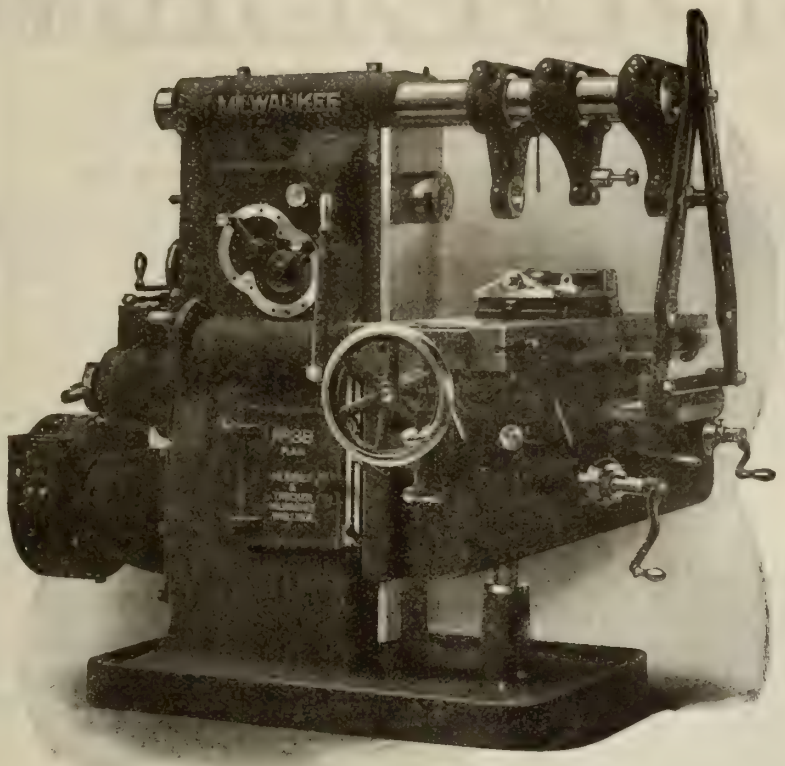
CANADIAN CONSOLIDATED RUBBER CO. LIMITED
DOMINION RUBBER SYSTEM
AND ASSOCIATED COMPANIES

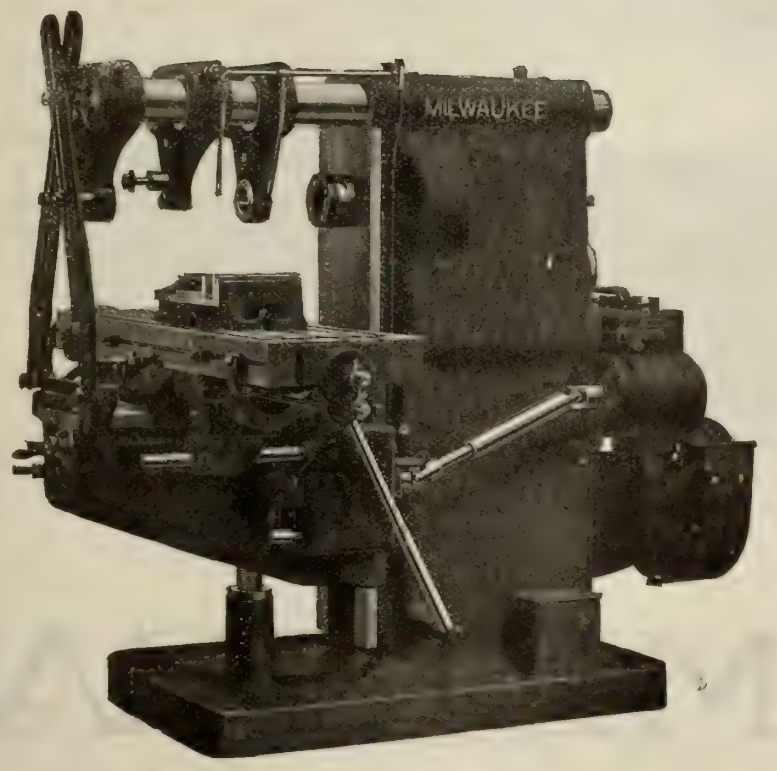
Makers of Dominion Hose, Packing and Industrial Rubber Goods and Dominion Tires, the GOOD Tires for every purpose

Service Branches:

Halifax, St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, London, Kitchener, North Bay, Fort William, Winnipeg, Brandon, Regina, Saskatoon, Edmonton, Calgary, Lethbridge, Vancouver, Victoria.

MILWAUKEE MILLING MACHINES





In Milwaukee Milling Machines we have combined carefully developed, exclusive features with high grade workmanship and the finest of materials. Nothing has been overlooked to make them rigid and accurate to accomplish maximum results.

Compare the front and rear views of our No. 3B Plain Milwaukee Milling Machine. Note its extreme simplicity, all levers and handles within easy reach of the operator, so that it is equally efficient on either light or heavy work. There are no delicate parts that need constant attention.

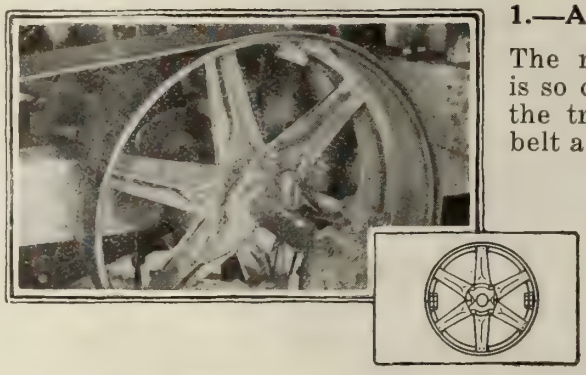
These important factors in manufacturing were taken into consideration in the design and construction of Milwaukee Milling Machines and are the reason for a portion of their popularity. They are built to accomplish more and better work with less physical effort.

Our catalog, illustrating and describing Milwaukee Milling Machines in detail, will prove interesting to you. Write for it, to-day.

KEARNEY & TRECKER CO., MILWAUKEE, WIS., U.S.A.

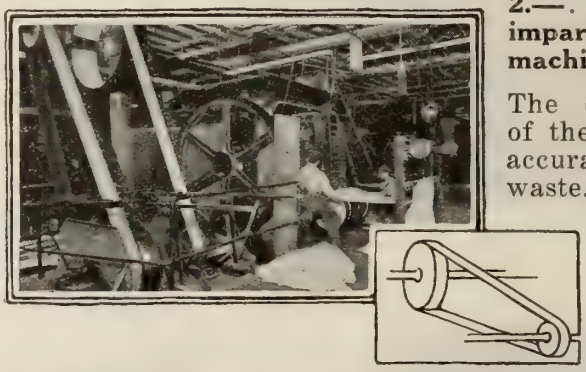
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The PULLEY:—



1.—A wheel with a broad rim.....

The rim of the American steel wheel is so correctly crowned that it increases the traction of the belt and keeps the belt accurately centered.



2.—.....transmitting power from or imparting power to the different parts of machinery.

The correct design and construction of the American, and its scientifically accurate dimensions, prevent power waste.



3.—.....and changing the direction of motion by means of a flat belt.

The American so distributes the abnormal strain caused by the change of direction that its ill effects are practically eliminated.

A 37-page book on "Ge
ting Maximum Pull
Efficiency" free on r
quest. It will help y
cut your power costs.

THE AMERICAN

-and its definition

Pulley:—A wheel with a broad rim transmitting power from or imparting power to the different parts of machinery, or changing the direction of motion by means of a flat belt.

The pulley of to-day must do more than its simple definition calls for. And yet, too many manufacturing executives are still willing to let a pulley be simply a "pulley." But those executives are growing small in number since, more than a quarter century ago, the American Pulley began to set new standards in power transmission.

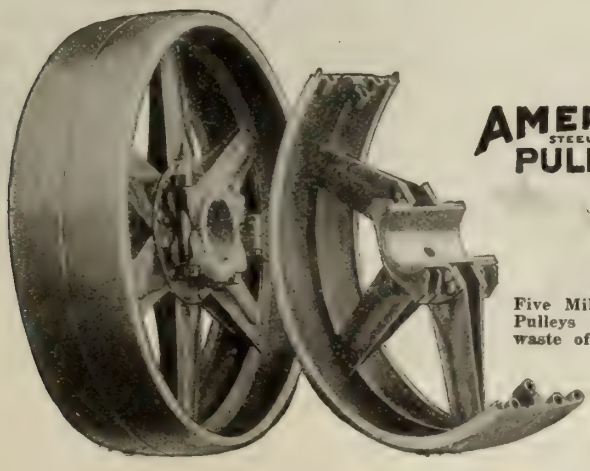
Every possible ounce of generated power is put to work—wayward slipping and drifting of power is stopped. The American's steel is strong, resisting the strain of many years. Yet it is light, and its balance perfect. And its two-piece construction makes installing rapid, easy—makes costly "stripping" of busy shafts unnecessary.

Constant study, constant tests have made the American Pulley a builder of greater and less expensive production in a thousand and more American shops. And the very forces that have made it the most efficient will keep it so.

See Donnelley's Red Book for name and address of nearest Agent

The American Pulley Company

Philadelphia New York Boston Chicago



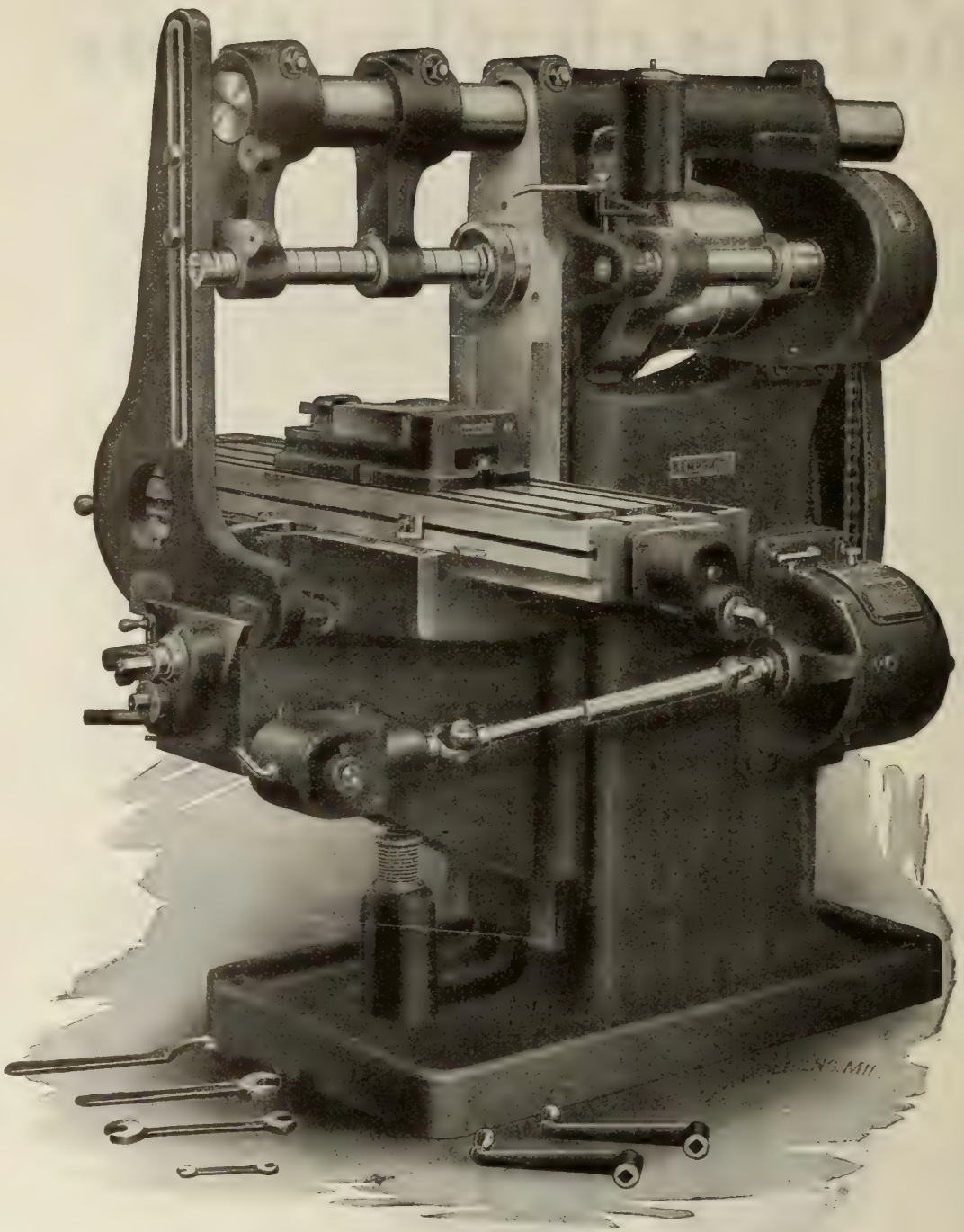
AMERICAN STEEL SPLIT PULLEYS

Five Million American Pulleys help stop the waste of power.

PULLEY

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KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared.

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U.S.A.

FOREIGN REPRESENTATIVES:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada. Barandiaran & Co., 3 Alameda, San Sebastian, Spain. Bevan & Edwards, Pty., Ltd., 117-29 King St., Melbourne, Australia. Edgar Bloxham, 12 Rue du Delta, Paris, France. D. Drury & Co., 1-2 Central House, Main St., Johannesburg, South Africa. Nielsen & Winther, Blegdamsveg, 60, Copenhagen, Denmark, Parke & Lacey Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia. Selson Engr. Co., 19 Via Botero, Turin, Italy, and 85 Queen Victoria St., London, E.C., England. Spliethoff, Beeuvkes & Co., Leuvehaven, W.Z., 159, Rotterdam, Holland.







New Truths and Old Fallacies
Announcement

For some time hereafter we shall devote our advertising space to discussing white metal alloys used for lining bearings — generically termed Babbitt Metals.

We are conscious of the limitation of our knowledge in this connection, but shall, nevertheless, attempt to clarify this somewhat hazy subject for the benefit of those who have had less opportunity to study it.

We make no pretense of undertaking this from altruistic motives, as, of necessity, many of the figures and facts that will be presented come from tests of Magnolia Metal in comparison with other Babbitt metals, both in laboratory tests and in actual service, showing conclusively the superiority of Magnolia Metal; and we shall also point out the reasons for this superiority.

At first glance some of our ideas may appear radical in their departure from long established customs, but they are supported by a strong array of figures and facts which, we think, will leave but little room for dispute and we shall try to make the presentation in a logical, unbiased way, as free of technicalities as possible.

We invite criticism, corrections and contribution of ideas, as by collaboration we may thus evolve a practical working basis; or, at least, form the ground-work upon which others, better qualified, can build.

A great deal of important work has been done already in connection with white metal alloys, but in a detached way, not usually in relation to babbitt metals, because that was outside of the scope and experience of most investigators.

Continued next month.

For copy of complete article:

"New Truths and Old Fallacies"

Address our Montreal Office.

SOLD BY LEADING DEALERS EVERYWHERE OR BY

MAGNOLIA METAL CO.

Office and Factory:
Montreal: 225 St. Ambrose St.

Heat Under Accurate Control

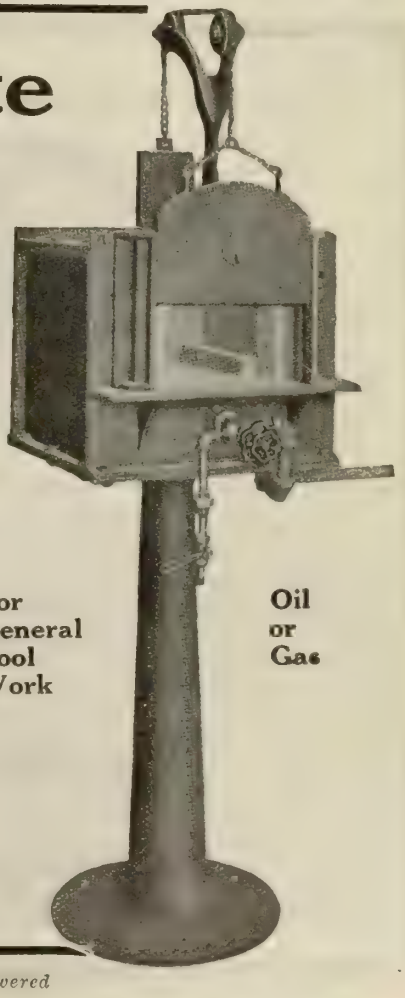
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, are features that distinguish

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems.



For General Tool Work

Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

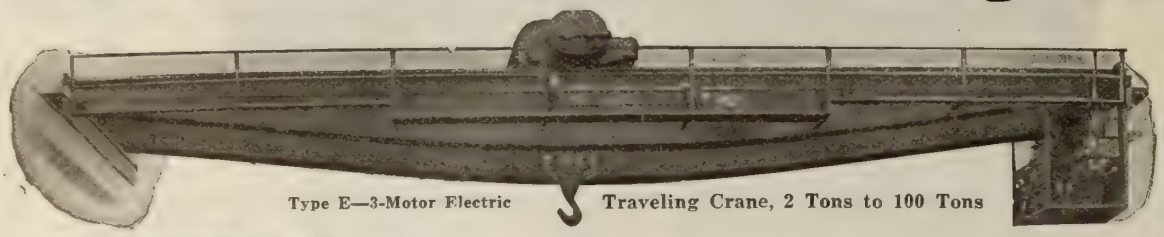
703 Bellevue Ave. - Detroit, Mich.

Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

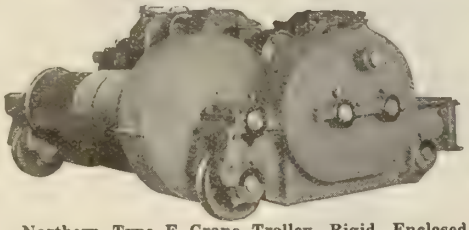
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CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes

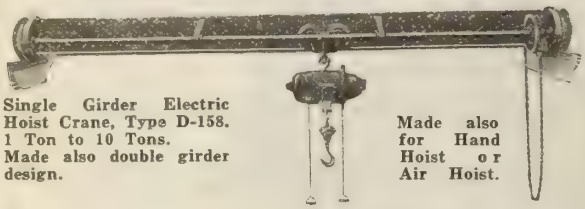


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.



Type D Electric Hoists —½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

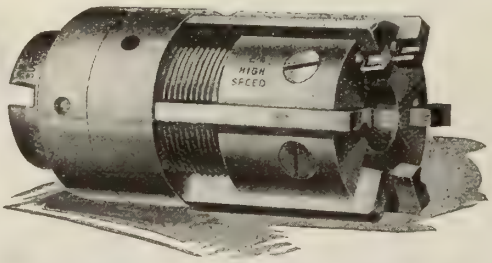


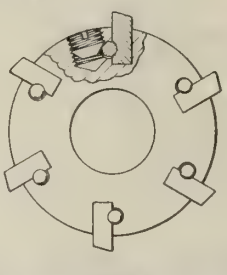
Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

If you are still using solid reamers instead of





McCrosky SUPER Adjustable Reamers

Consider the 2" High Speed SUPER:

Its original cost is $3.15 less than that of a 2" H.S.

It has an adjustment of .120 for wear. With its original set of blades it can and has reamed more holes than a dozen solid reamers.

A new set of 2" H.S. SUPER blades cost $8.10. With them you are ready to out-wear another dozen reamers.

The 2" H.S. SUPER is not an exception. Every SUPER of every size will save you money, save you time, and improve your production.

Get the details. Catalog No. 7 has them. Write for it.

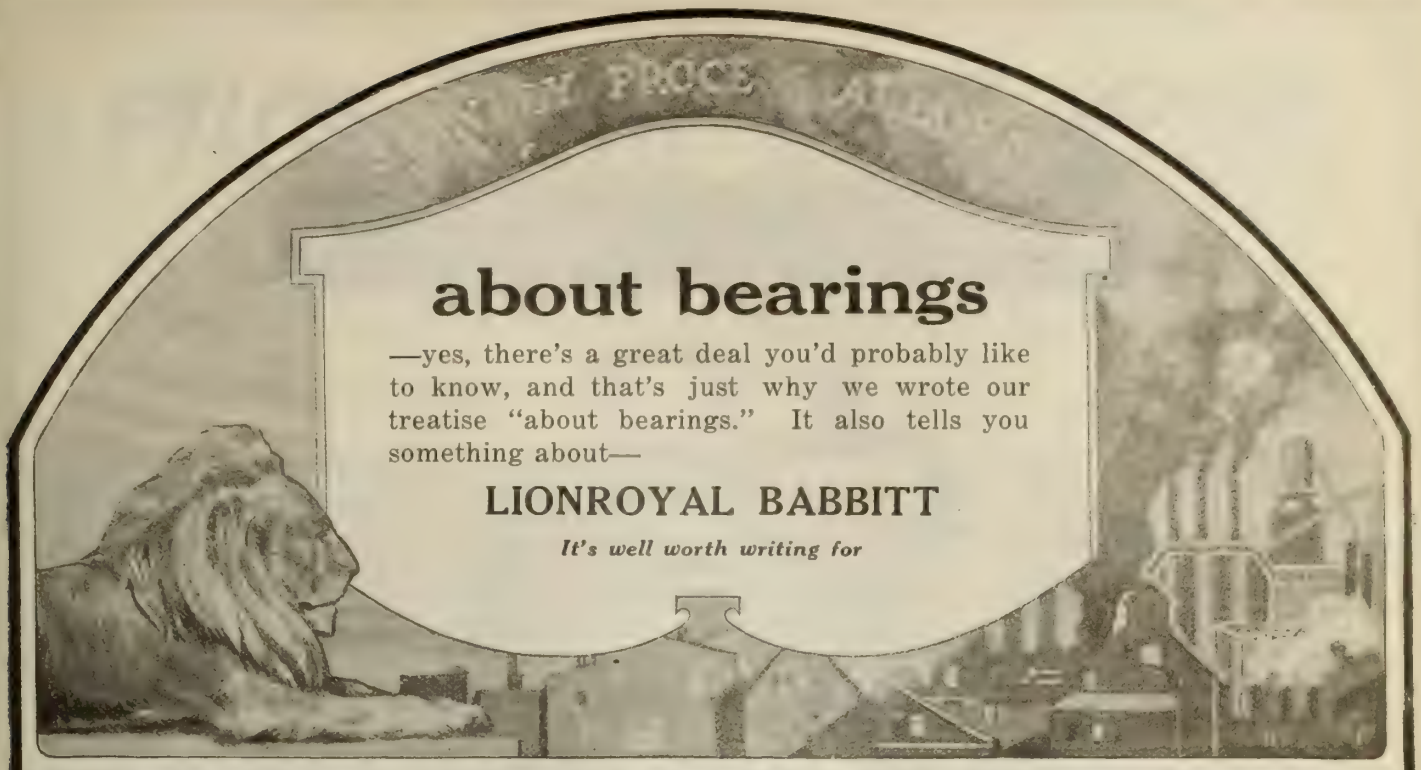
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Meadville, Pa., U.S.A.

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McCrosky COST CUTTING TOOLS

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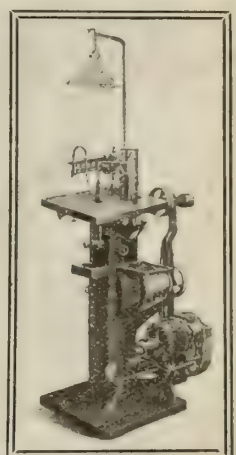
BRITISH SMELTING & REFINING Co. Limited.
Drummond Building Montreal.

"OLIVER" No. 404

High Power Filing Machine

(Rearwin Patent)

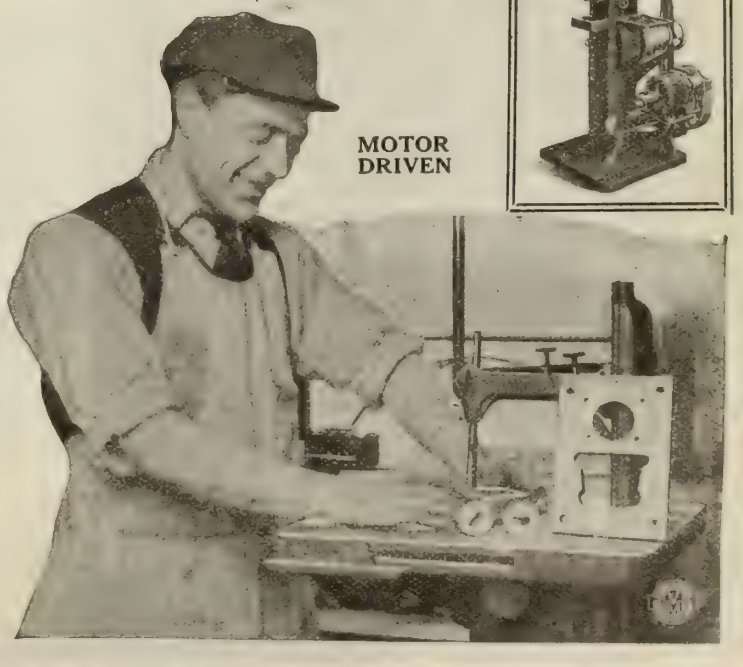
Five Years in Hard Service And No Repairs



MOTOR DRIVEN

The proprietor of the West Michigan Machine & Tool Co., Grand Rapids, heartily endorses the "Oliver" No. 404 High Power Filing Machine. He assures us that this one has been forced so hard, at times, that 8-inch cross-cut files have been broken; but in spite of exacting service, the machine has not required repairs of any kind.

This company is one of the concerns which appreciates the advantage of saving the skilled die maker's time with efficient mechanical helps. The "Oliver" No. 404 High Power Filing Machine is an economical and accurate tool which it will pay you to investigate.



Oliver Machinery Co.

GRAND RAPIDS MICHIGAN

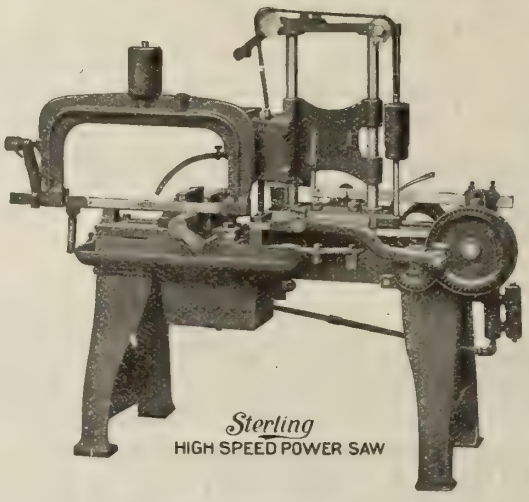
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"STERLING" Blades are worth a trial. Tell us or your dealers of your needs.

We can save you money.



Sterling
HIGH SPEED POWER SAW

To get the best results from power blades, a good machine is necessary. Try the "STERLING." The combination is excellent.

Manufactured by

DIAMOND SAW & STAMPING WORKS, 357 Seventh St., Buffalo, N.Y.



Small Rotary Table Sand-Blast

Efficiency of Big Equipment for the Small Shop—

Auxiliary Equipment for the Big Shop.

42 in. diameter Table, Self-contained—Hygienic Sand-Blast.

Cleans Steel, Grey, Malleable, Brass and Aluminum Castings, Stampings, Forgings, Heat Treated Parts, etc.

Small floor space—Small Air Consumption and Small Cost.

Ready to operate when attached to air line, uses Sand or Metal Abrasive.

It's a new one in the "PANGBORN" Line that embraces

"A Type and Size for Every Requirement."

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CORPORATION
HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS
P.O. Box 8508

Hull Iron and Steel

Foundries, Limited *Hull, Quebec*

Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

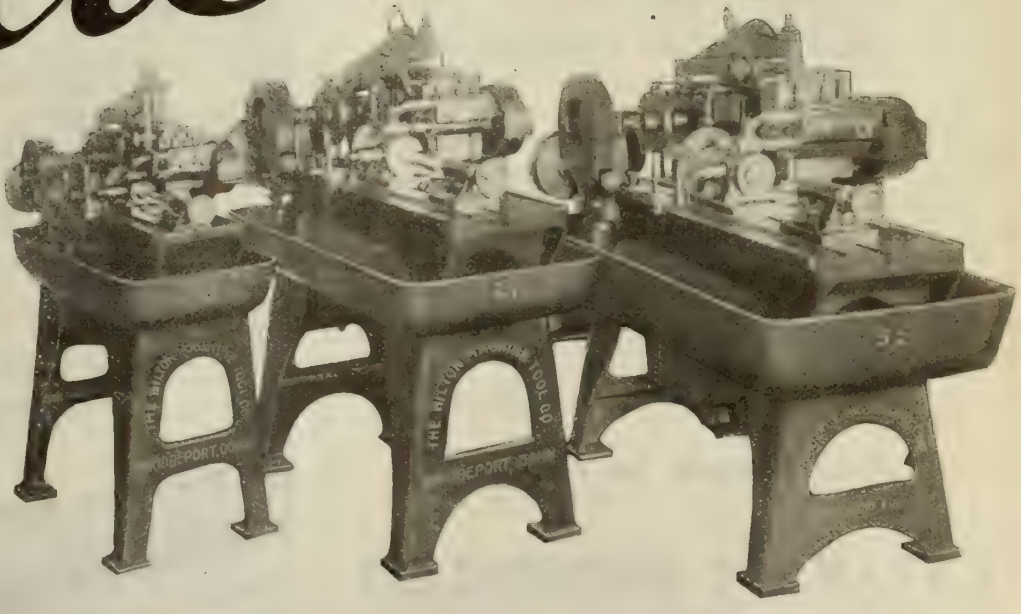
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Fully Automatic

Their adaptability is almost unlimited on small work—such as cutting spur, bevel, miter, angle gears, saws, ratchets, sprockets, cutters, knurls, taps, cylinders, form cutting, manufacturing, milling, etc.

A big time saver, as indexing takes place during return stroke of cutter—which is removing metal 90% of the time.

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Over 500 leading manufacturers now use the Bilton for high production on accurate work

Bilton Machine Tool Co. Housatonic Avenue Bridgeport, Conn., U.S.A.

Foreign Agents: Alfred Herbert, Ltd. Chas. Churchill & Co., Ltd.

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SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION

MYSTIC

Cutting Compound Increases Tool Efficiency

CUTTERS and other tools lubricated with Mystic keep right on cutting for hours, long after tools lubricated with ordinary compounds have lost their cutting edge.

Reduces the cost of lubrication one-third to one-half, as compared with lard oil.

The efficient cutting compound for high carbon and alloy steels, forgings, semi-steel castings, etc.

Free Sample on Request

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Limited
Toronto, Ont.

SCIENTIFIC LUBRICANTS for SCIENTIFIC LUBRICATION



Hexagon Guide

Why Spend 10 Hours Chipping When these Tools Do the Work in 10 minutes.

GLOBE

ANGULAR HOLE DRILLING TOOLS

The cost of equipping with Angular Hole Drilling Tools is a minor matter when you consider the time saved. Your wage list is reduced and you secure quality work in adopting Globe Angular Hole Drilling Tools.

Write for particulars.

Globe Engineering Co., Limited
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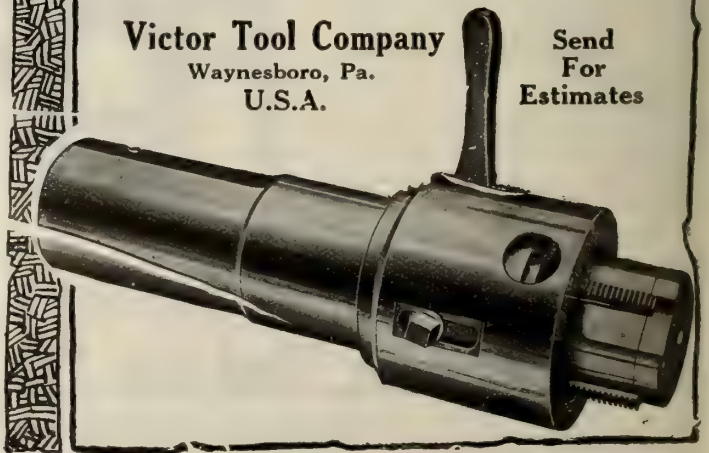
We wanted something original— this is what we got

"BOTH in these operations and half another — I'll show you later — completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

Victor Tool Company
Waynesboro, Pa.
U.S.A.

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Our Brands:
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There are two important things to consider in buying firebrick—price and quality. When you buy ELK BRAND FIREBRICK we take a keen, unprejudicial interest in seeing that you get the class of firebrick you need. If a moderate-priced brick fills the bill we never recommend a brick of higher quality at higher price.

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There is unusual strength, accuracy, speed, convenience and range in

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Drilling Machines

You can use them to great advantage on any work in your shop that's suitable for a machine tool of this kind. The operating is easy and the labor cost comparatively low.

Drop a line for full particulars and specifications.
Stationary Head Sizes 20"—21"
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The Aurora Tool Works
AURORA, INDIANA, U.S.A.

"MEAD-MORRISON"

HOISTING MACHINERY

Manufactured in Canada

Furnishes dependable service and is selected because of its efficiency, durability and minimum cost of maintenance.

HOISTING MACHINERY

FOR QUARRY MEN, CONTRACTORS, RAILROAD, DOCK, SEWER AND SUBWAY CONSTRUCTION, DREDGING, LOGGING, HAULING, ERECTING AND DRIVING, SHIPS, DOCKS, COAL WHARVES, MINES, ETC.

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Your Money's Worth

Never again will the Canadian Nation and People be the same careless improvident spenders of "ante bellum" days. "EFFICIENCY" and "GET YOUR MONEY'S WORTH" will be the popular motto and the successful machine shop manager must be able to see the advantage of making one pound of High Speed Tool Steel do the same work as ten pounds in forged tools; in other words he must and will

USE ARMSTRONG TOOL HOLDERS

No heavy "stub-ends" to throw away. No time lost with men at the grinder while lathes stand idle. No stock of heavy sizes of steel to carry, and the blacksmith as a tool-dresser is eliminated entirely.

Armstrong Tools are great favorites with the men—a good thing to consider from a production standpoint.

Our Catalogue is of handy pocket size and will be mailed to you upon request

ARMSTRONG BROS TOOL CO.
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO U.S.A.
STRONG STRONG

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

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Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
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Wire Cloth

of every description

We make **Machinery Guards** of all kinds.

Metal Lockers for Clothes.

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Drop a line for full details.

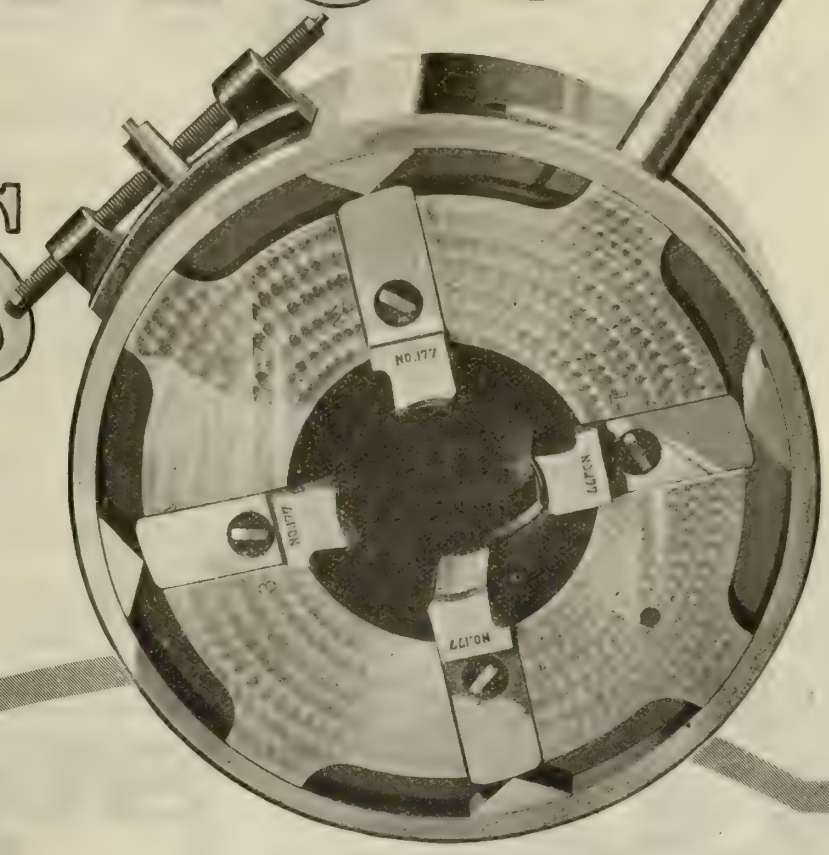
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Hamilton, Ontario

Eastern Representative:
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NAMCO

THREAD-CUTTING DIES



Production in the Long Run

Does your experience show that your thread-cutting problems are difficult or easy, just about in proportion to the simplicity of the Die Heads used?

By simplicity in NAMCO Die Heads we mean few parts, open construction. And the fewer the parts the more the opportunity to design and assemble into a sturdy, well-balanced, continuous producing tool.

These same NAMCO principles have much to do with the continuous **accuracy** of the threads cut. Therefore, consider also the element of wear and finally the number of good threads cut in a given unit of operating time.

This is the NAMCO thread-cutting basis of **production in the long run** which is really what you are after.

Catalog?

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WINDSOR, VT.

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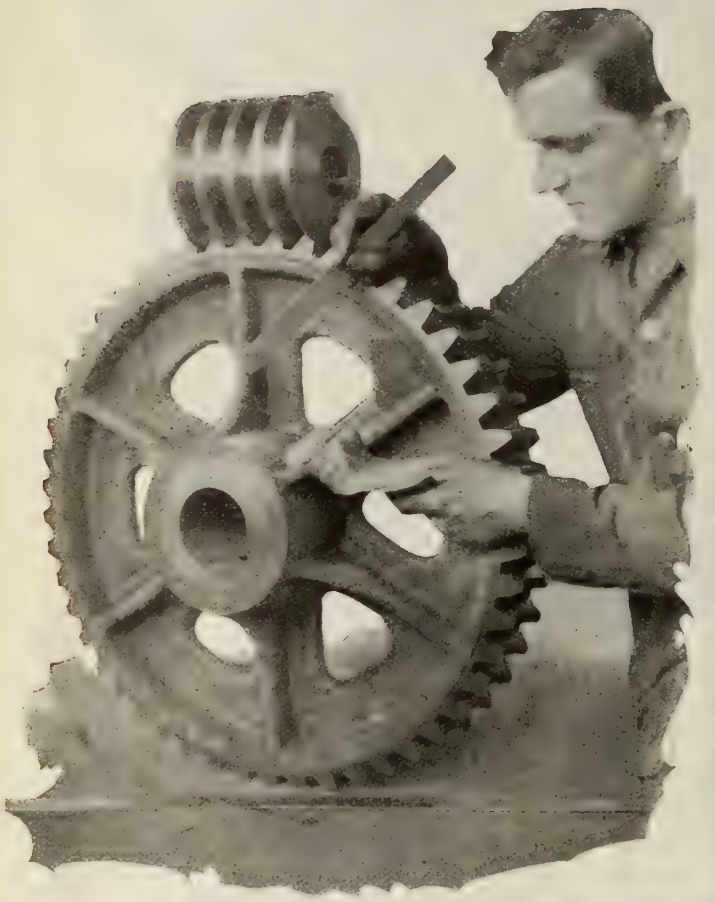
CANADIAN SCREW PLANT
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BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO
WAREHOUSES: NEW YORK AND CHICAGO WESTERN, SOUTHERN AND FOREIGN REPRESENTATIVES

Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont, and Acme Automatics, Threading Dies, Collapsing Taps and Screw Machine Products at Cleveland, Ohio

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Gears



With Care

Hamilton Gear Co. Ltd.
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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters
Files, Etc., Music Wire for Springs, Steel Balls.
Cold Rolled Tool Steel in Strips and Sheets
Circular Saws, Machine Knives.

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JONAS & COLVER, LIMITED
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STRUCTURAL STEEL WORK

Machine work of all descriptions. Send us your specifications.

WILLIAM HAMILTON LIMITED
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MATTHEWS
Pittsburgh Bevel Steel Letters and Figures

Hand Made

Matthews' Letters and Figures are hand made from carefully selected tool steel. The characters are neatly formed, producing stamps that make easily read and durable marks on all classes of products. They reduce considerably the cost of high grade marking.

Try them! Mark your next order — "MATTHEWS' Letters and Figures."

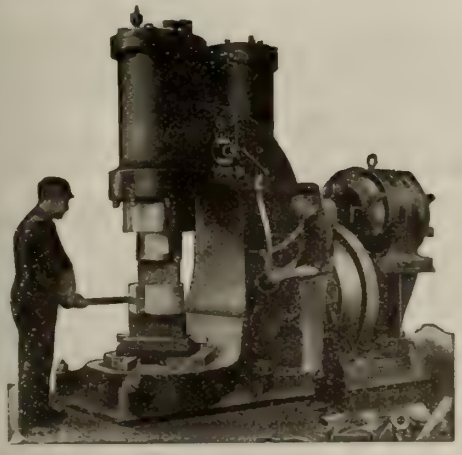
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Steel Lettering, Dies and Stamps

New Machinery For Sale

Immediate delivery from N.Y. City

2—Baker Bros. Sing. Sp. No. 216 Drills.
2 Cleveland Automatic Machines, ⅜-½" Model G.
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1—Ditto, Small Pattern Eye Machine for auto springs.
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59—Cushman Lathe Chucks, 7½-21".
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Box 659, care Canadian Machinery, Toronto, Canada.

The Nazel Air Hammer
(A Self-Contained Unit)
Noted for Its Blow and Control



The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

Nazel Engineering & Machine Works
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Don't Keep It--Sell It

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor
or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

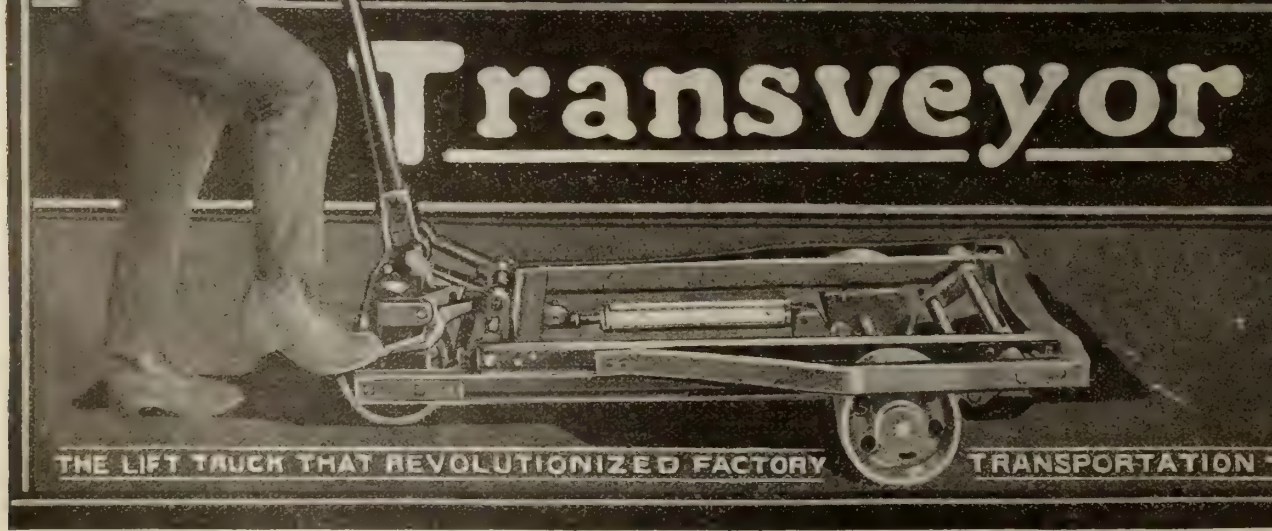
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CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue TORONTO, ONT.

More than a Factory Truck-
a complete interior handling system



Transveyor



THE LIFT TRUCK THAT REVOLUTIONIZED FACTORY TRANSPORTATION

COWAN TRUCK CO., 118 Water Street
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You may send me data regarding the saving the TRANSVEYOR System can effect in my line. This is without obligation to me.

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THE CLEVELAND TWIST DRILL CO., Cleveland, New York, Chicago

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MALLEABLE AND CAST IRON PIPE FITTINGS

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The Brand That Has The Quality

"Quality" and "Reliability" are two essentials demanded of *Cast Iron* and *Malleable Fittings*, by all sanitary and heating engineers.

Time and money are lost by improperly made fittings. All our cast iron and malleable fittings are properly recessed and every fitting bears the above trade-mark of quality.

We make a complete and full line of both flanged and threaded fittings from ⅛-inch up, and can make deliveries from stock, both standard and extra heavy.

When ordering from your jobber be sure you buy—"the brand that has the quality." They are different. A trial order will convince.

International
Malleable Iron Company, Limited
Guelph, Ontario, Canada

BEAVER BRAND
COPPER & BRASS
BROWN'S
QUALITY
ROLLING MILLS
MADE IN CANADA

COPPER, BRASS, BRONZE, GILDING PHOSPHOR BRONZE, NAVAL, MUNTZ METAL AND NICKLE SILVER

in

SHEETS, ROLLS, PLATES AND RODS

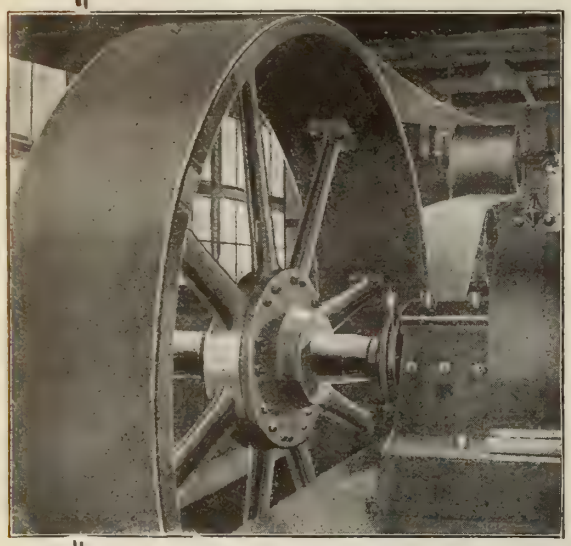
BROWN'S COPPER & BRASS ROLLING MILLS, LIMITED

General Offices and Mills

NEW TORONTO, ONT., CANADA

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RUBBER BELTING



For transmission duty in power plants on engines, pumps, compressors, etc., as well as in the machine shop for use on Grinders, Drillers, Planers, Lathes, etc.

We can furnish you with the proper Rubber Belting, regardless whether for heavy transmission duty, high speed work or conveying of materials that will show you efficiency and economy.

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Our Canadian Agents carry large stocks of Mechanical Rubber Goods, including

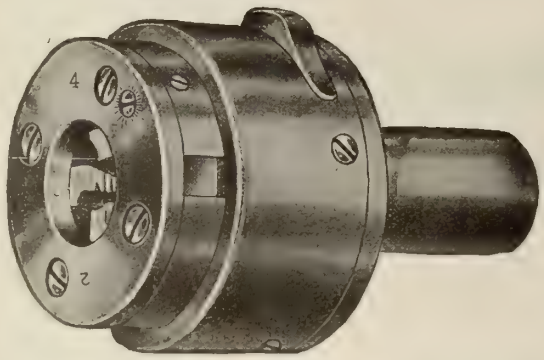
DANIEL'S P.P.P. ROD PACKING
EBONITE BLACK SHEET PACKING
HERCULES RED SHEET PACKING
RUBBER HOSE for all purposes: Steam, Water, Air Suction, Fire, etc.
PUMP VALVES—GASKETS .

QUAKER CITY RUBBER COMPANY, LIMITED, Philadelphia, Pa.

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INTERNATIONAL MACHINERY & SUPPLY CO.

421 ST. JAMES STREET, MONTREAL



H & G Die Heads

are of small outside diameter compared with the size of work they do.

The H. & G. illustrated is an automatic, self-opening Die Head designed especially for use on Gridley and National Acme Multiple Spindle Screw Machines and others that use the die in a revolving position. The four sizes of this Head cut up to 9/16", 1", 1¼" and 1½".

All parts are hardened and ground and interchangeable. In a word—it's an H. & G.

Ask for Catalog

Eastern Machine Screw Corp.

New Haven, Conn., U.S.A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

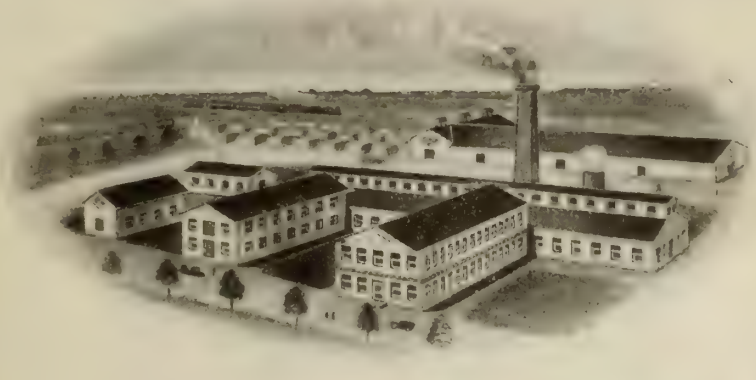
Write.

The Walton Co.

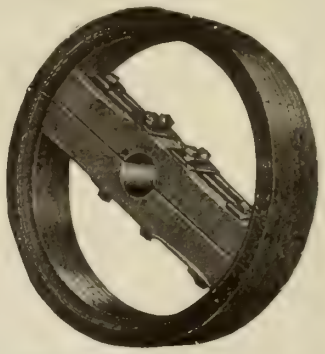
Hartford, Conn.

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TRANSMISSION APPLIANCES



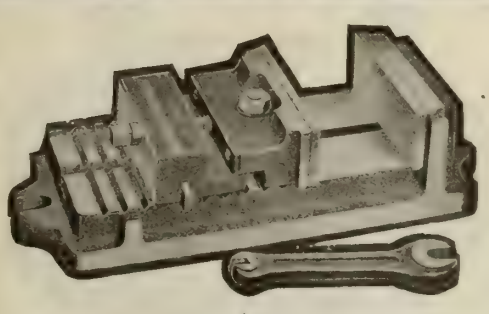
have achieved an enviable reputation in the Industrial World. Their performance under every conceivable working test has proved their dependability, and they are the most economical because of their durability.
We stand back of our products and will give Dealers every assistance.
Put them to the test.



The A. Bernard Industrial Co.

Manufacturers of High-Grade Power Transmission Appliances
Offices and Works: FORTIERVILLE, Que., Canada

SKINNER DRILL PRESS VISES

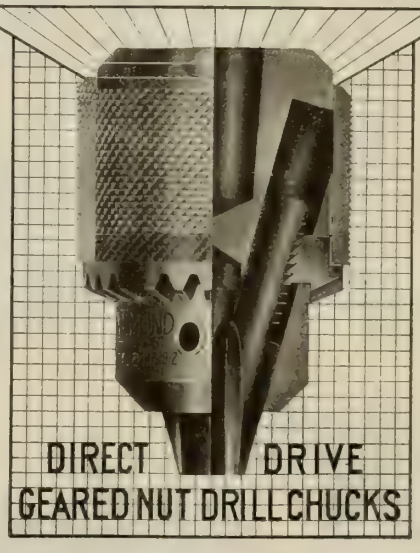


Designed for holding either straight or taper work this vise is portable, convenient and durable.
It is truly **THE HANDY TOOL.**
It may be bolted to a drill, planer, miller or shaper by the ears at both ends, clamped as desired by the flange or used at right angles.

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN.

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TEETH cut on the nut giving DIRECT DRIVE and the hardened steel Pinion Bushings which prevent wear, insure long life.

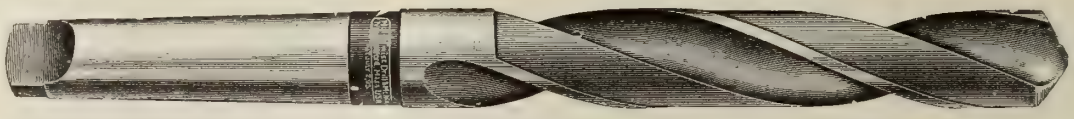
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Have always maintained a

High Grade of Efficiency

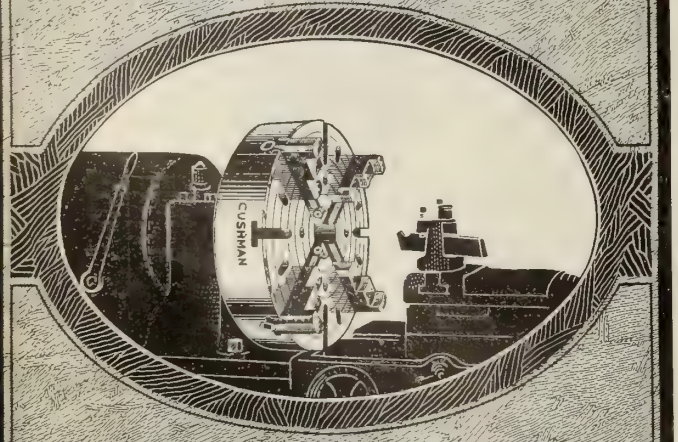


We still use the best material in their manufacture and stand back of every Drill we put out. **If you want the best, use**

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MORSE TWIST DRILL AND MACHINE CO.
New Bedford, Mass., U.S.A.

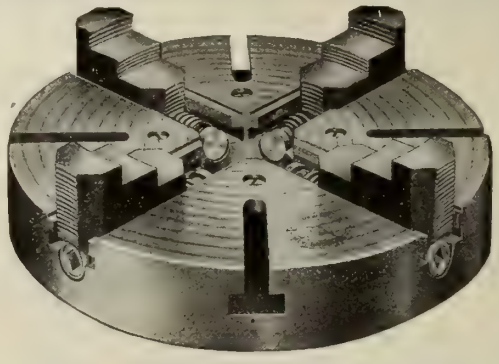
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CHUCKS
1862
GOOD THEN - BETTER NOW



THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

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INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



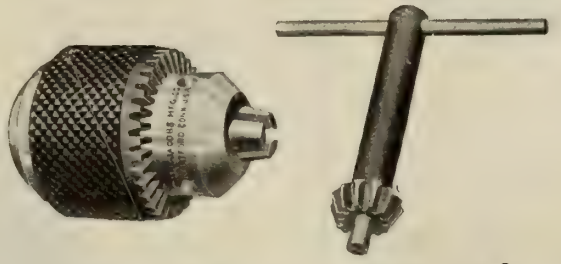
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are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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Makers of a complete line of chucks

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The calibre of an organization can best be judged by the service of its merchandise. Users of Jacobs Chucks know that to manufacture them, there must be a cohesive, contented personnel. It shows in the product.



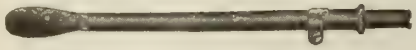
The Jacobs Mfg. Co.

Hartford ~ Connecticut.

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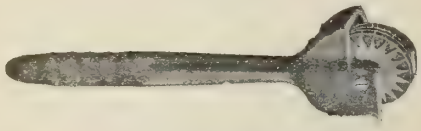
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For all ordinary shop wheels.
A perfect substitute for diamond.



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Gang Drills.—Horizontal Drills.

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Are equal in quality to the Best Imported Abrasive Wheels



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Canadians have begun to realize the importance of buying products at home. The value of the Canadian Dollar abroad depends upon it. If you are a user of grinding wheels you should follow Canadian-made Grinding Wheels exclusively. You may be doubtful of the quality from experience—but have you tried DOMINION Wheels? Dominion Wheels are proving by actual test that they are equal to any foreign-made wheel on the market.

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The **quality** that has made Dominion Wheels distinctive from other wheels is the result of manufacturing our own raw abrasive material. The **quality** is standardized. It can be depended upon in every Dominion Wheel made.

Dominion Abrasive Wheel Co., Limited
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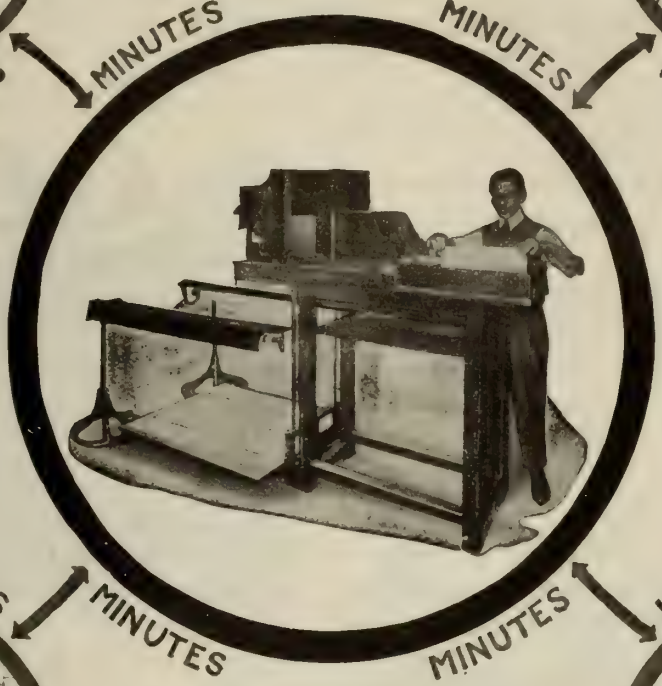


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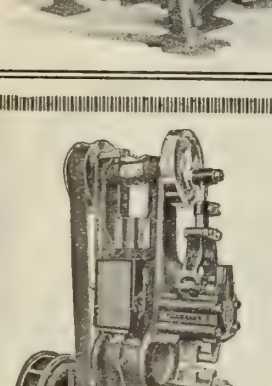


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Belt or Motor Drive

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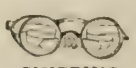
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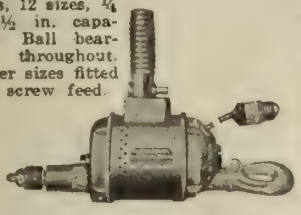

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"Cincinnati Electrics"

Cut Your Costs

Hand or Breast Drills, 12 sizes, ¼ to 2½ in. capacity. Ball bearing throughout. Larger sizes fitted with screw feed.



We make complete line of Portable Electric Drills and Grinders for all purposes. Especially built to withstand hard usage. For all currents and voltages. Catalog?

Cincinnati Electric Tool Co., Cincinnati, Ohio

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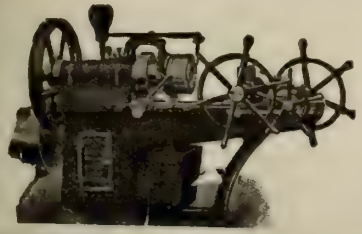
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LIMITED, TORONTO
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Founders, Machinists, Millwrights and Engineers
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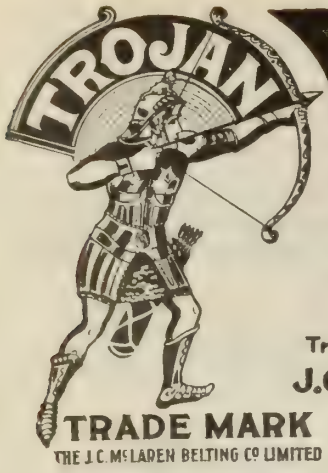
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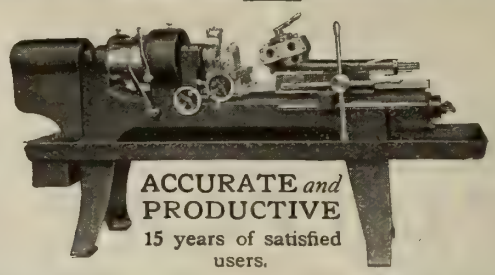
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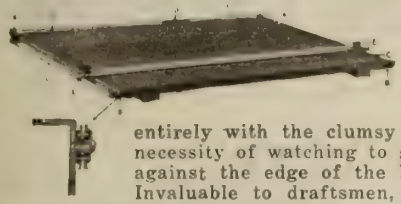
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ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.
PROMPT DELIVERY

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Watch a workman gauging the work on the ordinary internal grinder. Notice the gingerly way that he plugs the work—his hand dangerously near the wheels. Then measure the non-running time he takes for gauging between actual grindings. Are you willing to spend all this money this wasted time while the man is going through three or four operations to start the machine—and charge it to gauging?
Write for the Bryant Production Book and see how the distinctive design of the

BRYANT CHUCKING GRINDER

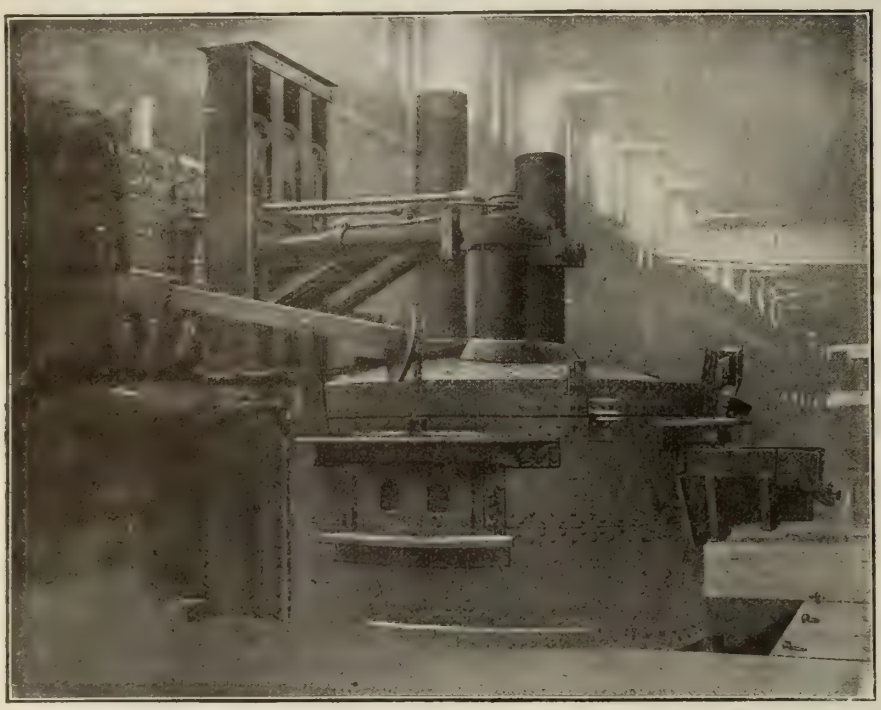


cuts the non-running time at least 20%. One turn of the handle brakes the work, withdraws the wheel and swings it safely out of the way. The reverse movement starts the wheel grinding again. This is only one of the features that explains the increased accuracy and production of the Bryant.

Bryant Chucking Grinder Co.,
Springfield, Vt., U.S.A.

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—for Quality Castings



6-Ton VOLTA Furnace in Running Position

Besides the economy involved, the production of steel castings with the electric furnace means a particularly fine grained product, with a perfect control of its chemical composition.

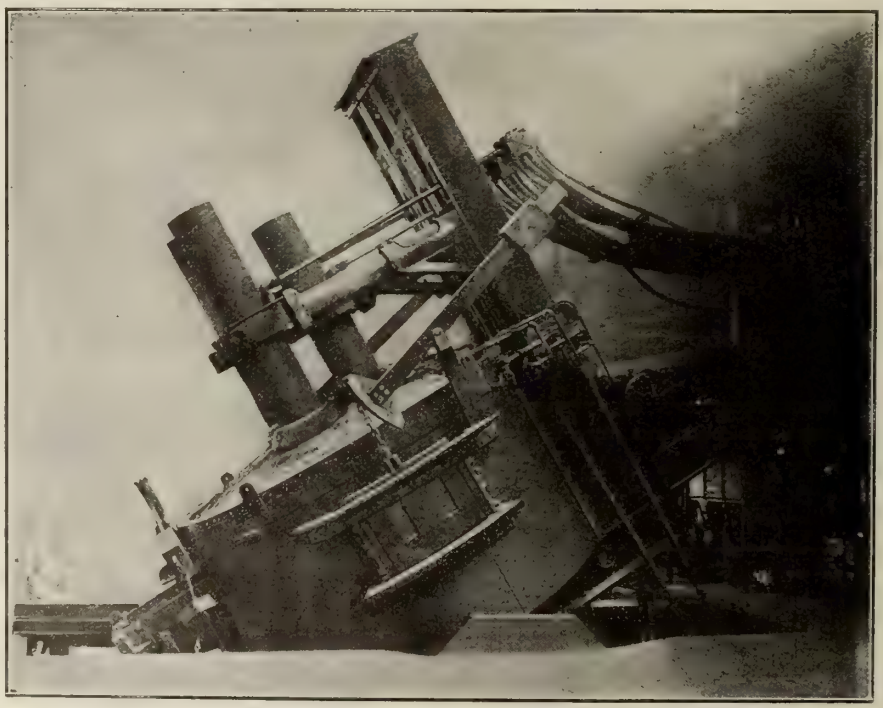
VOLTA Electric Furnace

A consistent producer of high grade steel castings of superior physical properties.

For the most economical results an electric furnace must be designed with all the modern operating devices which help in eliminating delays between heats and excessive length of time in refining.

Volta Electric Furnaces are built in capacities from one to six tons and nothing is spared in their design and equipment to make them efficient. Our ten years of extensive experience in electric furnace work has made us competent to advise you on your steel casting proposition.

The accompanying illustrations show the Volta furnaces recently installed by us for the Dominion Foundries and Steel Co., Hamilton, where the two six-ton furnaces have replaced the open hearth furnace for the production of high-grade steel castings and alloy steels.



6-Ton VOLTA Furnace in Pouring Position

Volta Manufacturing Co., Limited, Welland, Ont.

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Norton Co., Worcester, Mass.
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Canada Metal Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Tallman Brass & Metal Co., Hamilton.
Williams Mchy Co., A. R., Toronto, Ont.

ALUMINUM SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.

ALLOY, STEEL
Armstrong, Whitworth of Can., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Samuel Osborne (Canada) Ltd., Montreal.
Swedish Steel & Importing, Montreal.
Vanadium Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa, Pa.

ANCHORS
Fellows Bros., Ltd., Chadley Heath, Eng.

ARBORS
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Furniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
U. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St Lawrence Welding Co, Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke.

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co.,, J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler
Landis Machine Co., W aesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto
Warner & Swasey Co., Cleveland, O.
Niles Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
nce Welding Co, Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS
COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Nova Scotia Steel & Coal Co., New

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville
Williams & Co., J. H., Brooklyn, N.Y

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

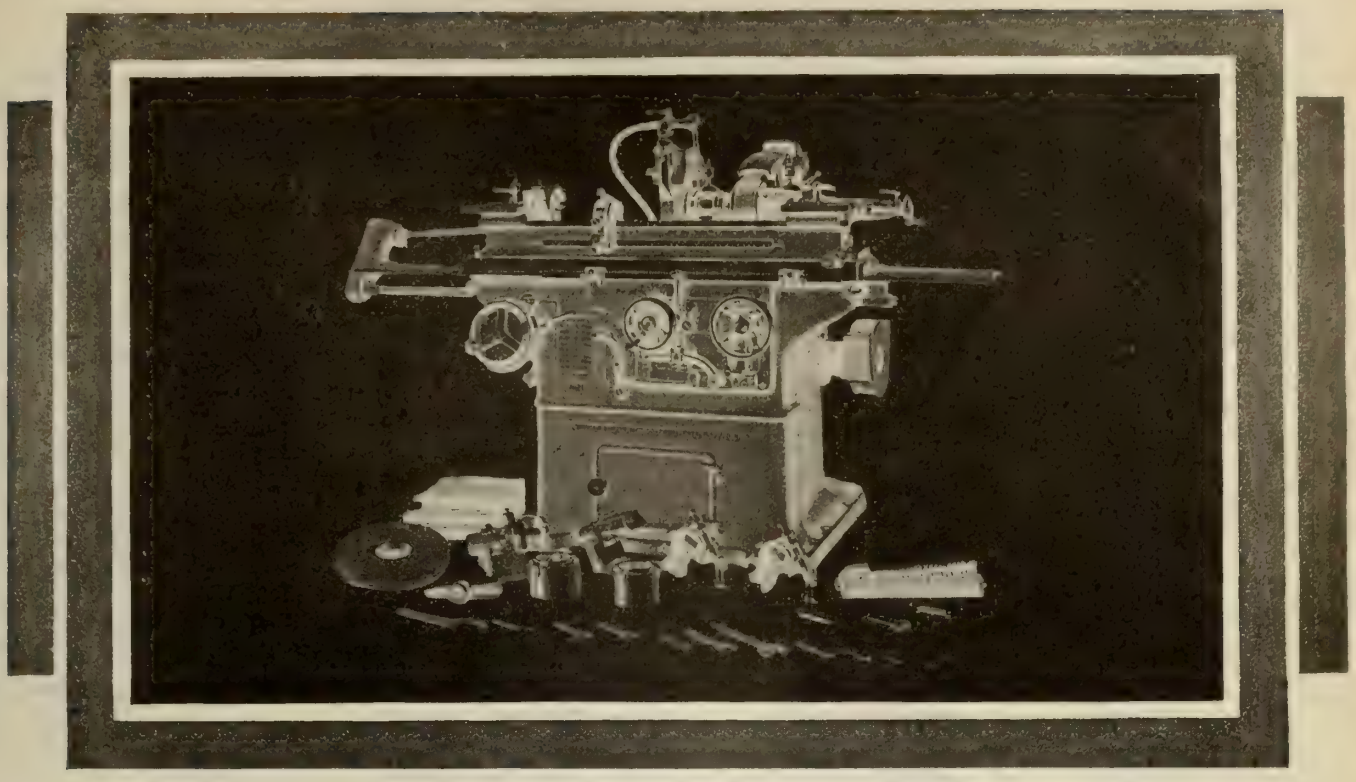
COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR
Atkins & Co., E. C., Hamilton, Ont.
Can. Ingersoll-Rand Co., Sherbrooke
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.



Let Brown & Sharpe Plain Grinding Machines

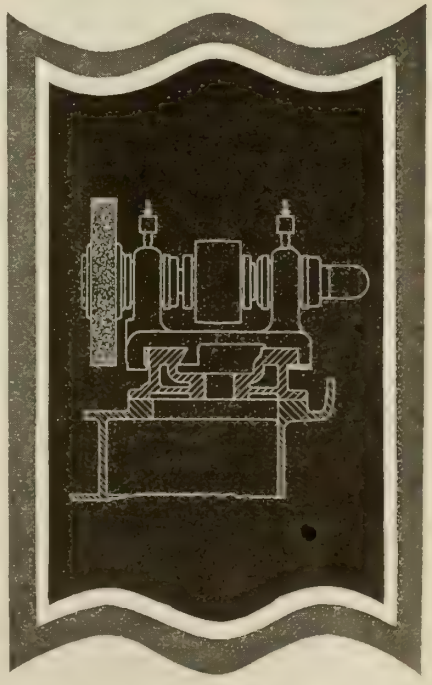
Maintain Your Standards of Accuracy

The rigid wheel spindle support with solid walls of base extending to floor, insures absence of vibration which would impair accuracy.

The location of wheel on end of spindle, facilitates the removing and changing—a great asset in production where the same machine must be used for varied set-ups.

The spindle pulleys are easily and quickly changed—one nut being the only adjustment necessary.

These and other features are vital factors to the manufacturer who must maintain a high degree of accuracy.



Brown & Sharpe Mfg. Co.

Providence, R. I., U. S. A.

If interested tear out this page and place with letters to be answered

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found'a & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Horner & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
British Smelting & Refining Co., Ltd., Montreal, Que.
Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

CORE OIL
Swan & Finch, Inc., 165 Broadway.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto

COKE AND COAL
Hanna & Co., M. A., Cleveland, O.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found'a & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
Petrie, Ltd., H. W., Toronto.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

CUTTING COMPOUND AND CUTTING OIL
Cataract Refining Co. Ltd., Toronto.
Swan & Finch, Inc., New York.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
Crescent Mche. Co., Ltd., Montreal, P.Q.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Jones & Lamson, Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DIES, METAL STAMPING
Crescent Mche. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

DRAINAGE FITTINGS
Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Atkins & Co., E. C., Hamilton, Ont.
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont.
Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
Aurora Tool Works, Aurora, Ind.
Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

DRILLING MACHINES, GANG
Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co, Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

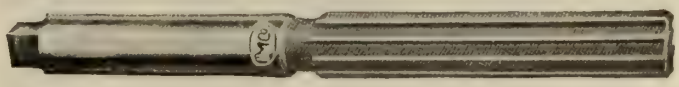
DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

DRILLING MACHINES, RADIAL AND TURRET
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, SENSITIVE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams Mchy Co., A. R., Toronto, Ont.

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Knight Metal Products, Toronto.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
U. S. Ordnance, Toronto, Ont.
A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.



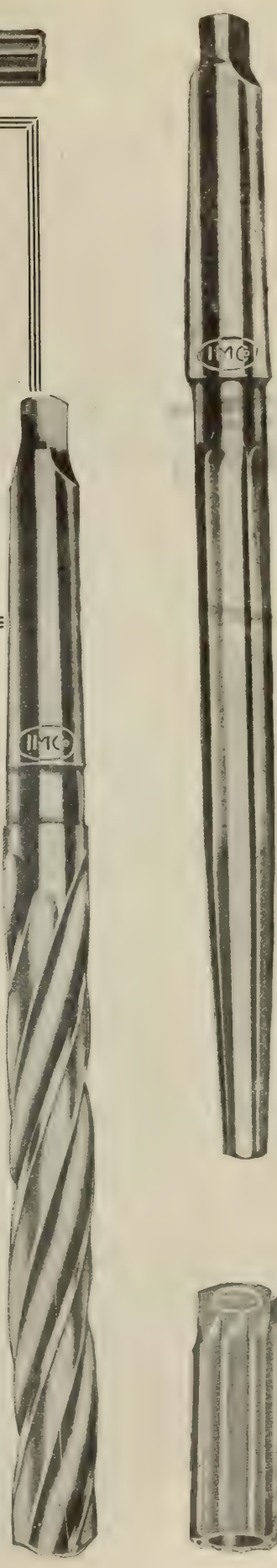


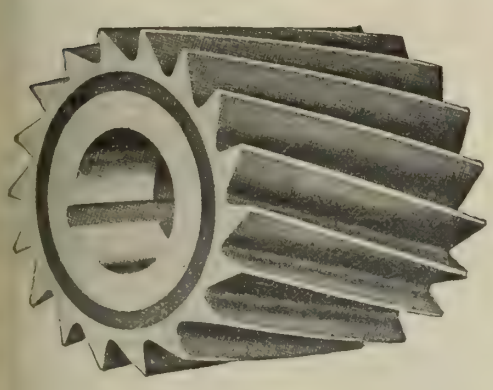
Quality

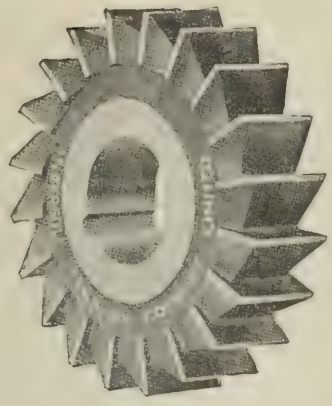
in its utmost

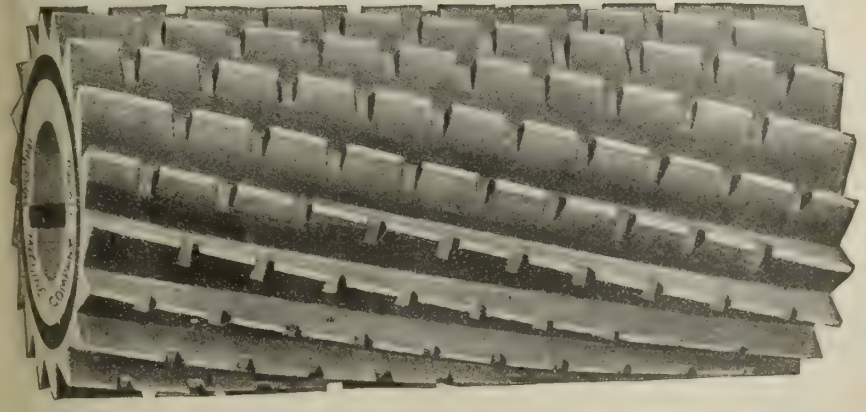
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"IMCO" TOOLS









Ingersoll Machine Co., Limited
Ingersoll, Ontario
erican Plant: American Machine Products Co., Inc.
DETROIT, Michigan

IMCO TOOLS

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DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

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Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto
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Armstrong Bros. Tool Co., Chicago, Ill
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
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Globe Engineering Co.

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Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

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Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
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Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

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DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

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Sturtevant Co., B. F., Galt, Ont.

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Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
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Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
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ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
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Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

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Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

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Curtis Pneumatic Machy. Co., St. Louis.

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Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
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Dom. Steel Products Co., Ltd., Brantford.
Oliver Machinery Co., Grand Rapids, Mich

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Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

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Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

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Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

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John Morrow Screw & Nut Co., Ingersoll

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Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

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A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
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St Lawrence Welding Co, Ltd., Montreal

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Walton Co., The, Hartford, Conn.

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Can. Foundries & Forgings, Ltd., Welland, Ont.

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FACTORY SITES
City of St. Johns, Quebec.

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Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

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Page Steel & Wire Co., New York N.Y.

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Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

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Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
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Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
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FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O

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Crane, Ltd., Montreal, Que.

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Crescent Mche. Co., Ltd., Montreal, Que.
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Toronto Tool Co., Toronto, Ont.

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FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

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Canada Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
William Hamilton Co., Peterboro, Ont.

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Hardware Co., Toronto, Ont.
& Forge Co., Kitchener.
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Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
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Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

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Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Toronto, Ont.
National Machy. Co., Tiffin, Ohio.
Petrie, Ltd., H. W., Toronto.
Chicago Flexible Shaft Co., Chicago, Ill

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Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

FRICTION LEATHERS
Graton & Knight Mfg. Co., Montreal

FRICTION SURFACE BELTING
Can. Consolidated Rubber Co., Montreal

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Chicago Flexible Shaft Co., Chicago, Ill
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'r'g Co., Three Rivers, Q
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

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Bellevue Industrial Furnace Co., Detroit
Chicago Flexible Shaft Co., Chicago, Ill
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

FURNACES — BRASS MELTING
General Combustion Co., Ltd., Montreal

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Chicago Flexible Shaft Co., Chicago, Ill

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill

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Dom. Forge & Stamp. Co., Walkerville

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Northern Electric Co., Ltd., Montreal Que

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British Smelting & Refining Co., Ltd., Montreal, Que.

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Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
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Graton & Knight Mfg. Co., Montreal

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Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

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Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
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Greenfield Tap & Die Corp., Greenfield
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Geovin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 318 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

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Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
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GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

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Petrie, Ltd., H. W., Toronto.
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Morse Chain Co., Ithaca, New York.
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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
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Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
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St Lawrence Welding Co, Ltd., Montreal

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Northern Elec. Co., Ltd., Montreal, P.Q.
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GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

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Strong, Kennard & Nutt Co., Cleveland.
Wilson & Co., Inc., T. A., Reading, Pa.

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Rice Lewis & Son, Toronto.

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Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

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Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
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Wisconsin Electric Co., Inc., Racine, Wis
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
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Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
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Ford-Smith Mach. Co., Hamilton, Ont.
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Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Universal Grinding Mach. Co., Fitchburg, Mass.

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Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
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MacGovern & Co., Montreal, Que.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
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Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Canada, Galt, Ont.

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Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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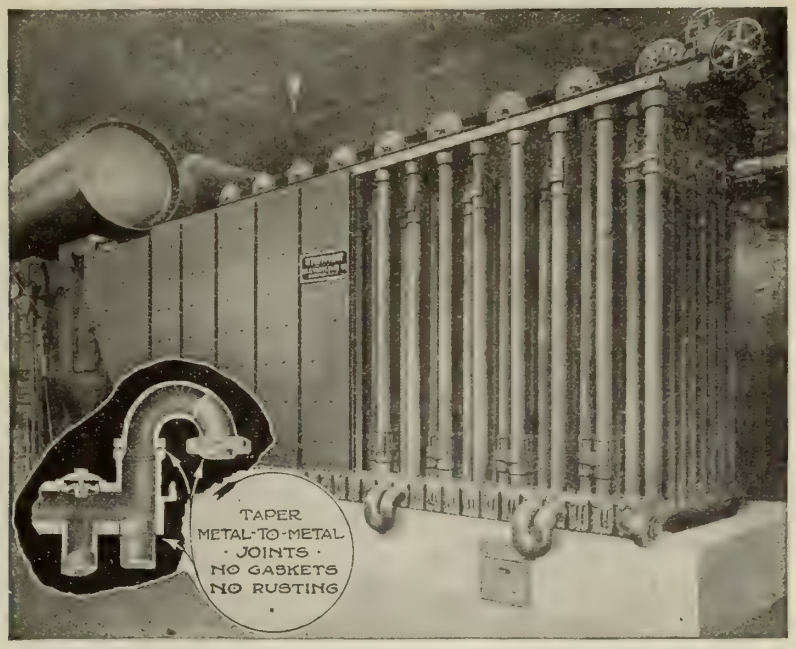
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Hoefer Mfg. Co., Freeport, Ill.
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Cincinnati Milling Machine Co., Cincinnati
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Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
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Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Fraser & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Clarke & Co., Furniss, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
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Williams Mchy Co., A. R., Toronto, Ont.

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PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

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General Combustion Co., Ltd., Montreal, Que.

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Graton & Knight Mfg. Co., Worcester.

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Boker & Co., Inc., H. Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
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Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O
Williams Mchy Co., A. R., Toronto, Ont.

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John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co. New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

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Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

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Bertram & Sons, John, Dundas, Ont.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp. Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

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Butterfield & Co., Inc., Rock Island, Que.

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Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto
Wells Bros. of Can., Galt, Ont.

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Garvin Machine Co., New York.

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Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

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American Pulley Co., Philadelphia, Pa.

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Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

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REPAIR WORK, ALL KINDS
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St Lawrence Welding Co, Ltd., Montreal

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Parmenter & Bulloch Co., Ganonoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

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Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

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High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

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G. F. Foss Mchy & Sply. Co., Montreal.

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Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Can. Link-Belt Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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Brown, Boggs Co., Ltd., Hamilton.
Can. Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
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H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALV, MONEL METAL, BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville.

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

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RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

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Dom. Steel Products Co., Ltd., Brantford.

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RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

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James Chesterman & Co., Ltd., Sheffield
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SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co. Haydenville.

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy Co., Toronto.
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SAW GUARDS
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Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
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SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
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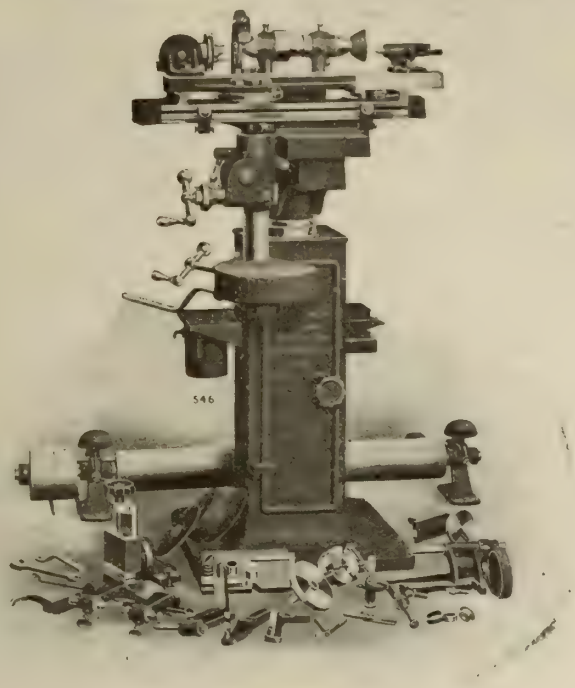
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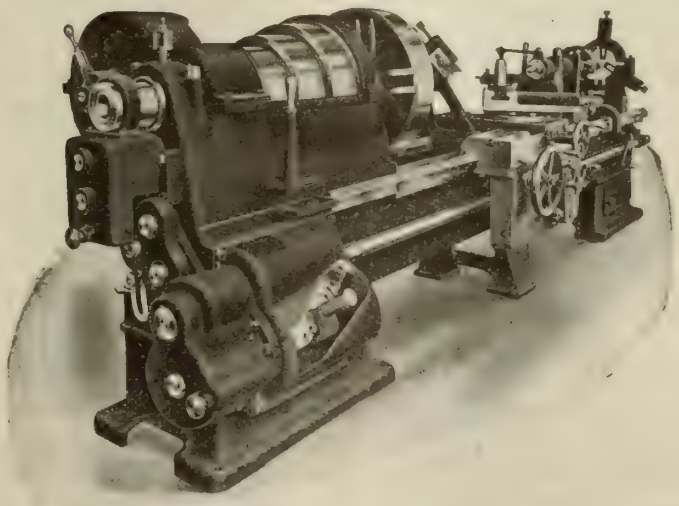
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Steel Co. of Canada, Ltd., Hamilton.
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National Acme Co., Cleveland, O.
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Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glassco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Rice, Lewis & Son, Toronto.

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Bertrams Ltd., Edinburgh, Scotland.
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Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

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The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

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The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

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Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

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Dominion Sheet Metal Corp., Hamilton.

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Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

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Dennis Wire & Iron Works, London.

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Dennis Wire & Iron Works, London.

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Armstrong Bros. Tool Co., Chicago.
I. H. Williams & Co., Brooklyn, N.Y.

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Jones & Glassco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

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Katie Foundry, Galt, Ont.

SLICING CLAMPS
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SLOTTERS
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

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Butterfield & Co., Inc., Rock Island, Que
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Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal.
Cleveland Wire Spring Co., Cleveland.
Dumbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Edlund, Inc., Courtland, N.Y
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Osgood Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mche. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia

SPRINGS FOR TOYS AND ELECTRIC DEVICES
The Dunbar Bros. Co., Bristol, Conn.

SPROCKET WHEELS, CAST
Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

SAW GUARDS
Oliver Mach. Co., Grand Rapids, Mich.

SAWS SWING
Oliver Mach. Co., Grand Rapids, Mich.

STAYBOLT TOPS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

STAIRS, IRON
Canada Wire & Iron Goods Co., Hamilton, Ont.

STAMPINGS, SHEET BRASS, COPPER, ALUMINUM AND STEEL
Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

STEEL, CARBON, FERRO-TUNGSTEN
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Latrobe Electric Steel Co., Latrobe, Pa
Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL CASTINGS
Davidson Mfg. Co., Ltd., Montreal, Que

STEEL CHROME VANADIUM
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CASTINGS
Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Jonette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor.
Swedish Crucible Steel Co., Windsor.

STEEL, COLD ROLLED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd. Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co, J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa.
Marshall, Son & Bunney, Toronto, Ont.
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, CHROME, MANGANESE
Joilette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York.

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt, Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, PNEUMATIC AND CLOSET
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd., Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
I. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

TAPS, ADJUSTABLE
Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Po.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Redford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co. The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt, Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

TOOL HOLDERS
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL ROOM PARTITIONS
Canada Wire & Iron Goods Co., Hamilton.

TOOLS, BLACKSMITHS'
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son Toronto, Ont.

TOOLS, ADJUSTABLE BORING
Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

TOOLS, SPECIAL
Lobe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TORCHES, BLOW
Int. Mach. & Supply Co., Ltd., Montreal.

TORCHES, STEEL
Armstrong, Whitworth of Can., Montreal.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

TORCHES, GASOLINE, KEROSENE AND ALCOHOL
Turner Brass Works, Sycamore, Ill.

TRACK SYSTEMS
Morris Crane & Hoist Co., Herbert Niagara Falls, Ont.
Northern Crane Works, Walkerville.

TRANSFORMERS
Can. General Electric Co., Toronto, Ont
MacGovern & Co., Montreal Que
Northern Electric Co., Ltd., Montreal.
U. S. Ordnance, Toronto, Ont.

TRANSITS
Hughes, Owens Co., Ltd., Montreal, Que.

TRANSMISSION CHAIN
Lyman Tube & Supply Co., Ltd., Montreal
Morris Chain Co., Ithaca, New York.

TRANSMISSION MACHINERY
American Pulley Co., Philadelphia, Pa.
Can. Link-Belt Co., Toronto, Ont.
Can Fairbanks-Morse Co., Montreal.
Coventry Chain Co., Coventry, England
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Kennedy & Sons, Wm., Owen Sound, Ont.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Machinery Co., A. R., Toronto.

TRANSMISSION ROPE
Jones & Glassco, Montreal, Que.
MacKinnon Steel Co., Ltd., Sherbrooke.

TRANSMISSION TOWERS
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton

TROLLEYS
Lyman Tube & Supply Co., Ltd., Montreal

Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

TRUCKS, FACTORY, FREIGHT, ETC
Canada Machinery Corp., Galt, Ont.
Chapman Double Ball Bearing, Toronto.
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
MacKinnon Steel Co., Sherbrooke, Que
Rice Lewis & Son, Toronto, Ont.
U. S. Ordnance, Toronto, Ont.

TRUCKS, ELECTRIC
Cowan Truck Co., Holyoke, Mass.
Good Engineering Co., Toronto, Ont.

TRUCKS, FLOOR
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.
U. S. Ordnance, Toronto, Ont.

TRUCKS, HAND
Can. Kron Scale Co., Montreal, P.Q
Cowan Truck Co., Holyoke, Mass.

TRUCKS, LUMBER AND KILN
Holyoke Truck Co., Holyoke, Mass.
Swedish Steel & Importing Co., Montreal
Northern Crane Works, Walkerville.

TRUCKS, LIFT, ELEVATING & TRANSFER
Cowan Truck Co., Holyoke, Mass.
Holyoke Truck Co., Holyoke, Mass.

TUBES, BOILER
Lyman Tube & Supply Co., Montreal, Que

TUBING, SEAMLESS, BRASS AND COPPER
Lyman Tube & Supply Co., Montreal, Que.
Standard Tube & Fence Co., Woodstock.
Tallman Brass & Metal Co., Hamilton.

TUBING COILERS, FLEXIBLE METAL
Almond Mfg. Co., Ashburnham, Mass

TUBING, FLEXIBLE METALLIC
Lyman Tube & Supply Co., Montreal, Que.

TUBING, SEAMLESS STEEL
Lyman Tube & Supply Co., Montreal, Que.

TUBING, WELDED STEEL
Lyman Tube & Supply Co., Montreal, Que.

TURRET MACHINES LATHES
Acme Mach. Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence.
Garlock-Walker Machinery Co., Toronto
Greenfield Tap & Die Corp., Greenfield
Hardinge Bros., Chicago, Ill.
Oliver Mchy. Co., Grand Rapids, Mich
Pratt & Whitney, Hartford, Conn.
Petrie, Ltd., H. W., Toronto.
Steinle Turret Mach. Co., Madison, Wis
Warner & Swasey Co., The, Cleveland, O

TURBO GENERATOR UNITS
MacGovern & Co., Montreal, Que.
Warner & Swasey, Cleveland, O.
Garvin Machine Co., New York.

TURNBUCKLES
Canada Fdrs. & Forg. Ltd., Welland.
Morrow Screw & Nut Co., Ingersoll, Ont.
Rice Lewis & Son, Toronto, Ont.

TURNTABLES
Can. Link-Belt Co., Toronto, Ont.
Dom. Bridge Co., Ltd., Montreal, P.Q
Elec. Steel & Metals, Welland, Ont.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.

TWIST DRILLS
Butterfield & Co., Inc., Rock Island, Que

UPSETTING AND BENDING MACHINERY
Bertram & Sons Co., John, Dundas.
Brown, Boggs Co., Ltd., Hamilton, Can.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Jardine & Co., A. B., Hespeler, Ont.
National Machy. Co., Tiffin, O.
Canada Machinery Corp., Galt, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Machy. Co., A. R., Toronto.

VALVE LEATHERS
Graton & Knight Mfg. Co., Montreal.

VALVES, MIXING
Crane, Ltd., Montreal, Que.

VALVES (IRON) STANDARD AND EXTRA HEAVY
Crane, Ltd., Montreal, Que.

VALVE GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

VALVES, REDUCING, REGULATING
St. Lawrence Welding Co, Ltd., Montreal

VALVES, HYDRAULIC
Metalwood Mfg. Co., Detroit, Mich.
St. Lawrence Welding Co, Ltd., Montreal

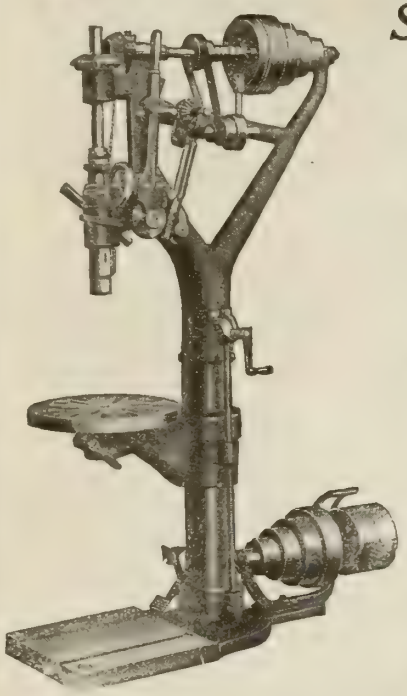
VALVES, RUBBER PUMP
International Mach. Spls., Ltd., Montreal
Quaker City Rubber Co., Philadelphia

VENTILATORS
H. H. Robertson, Ltd., Sarnia, Ont.

VENTILATING APPARATUS
Brantford Oven & Rack Co., Brantford.
Can. Blower & Forge Co., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
Williams Machy. Co., A. R., Toronto.

VISE STANDS, PORTABLE
Williams & Co., J. H., Brooklyn, N.Y.

Silver Drills



Simplicity, Convenience and Strength mark every feature

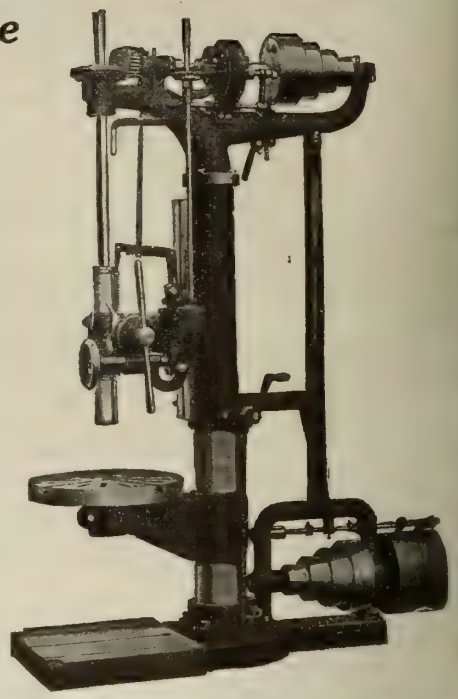
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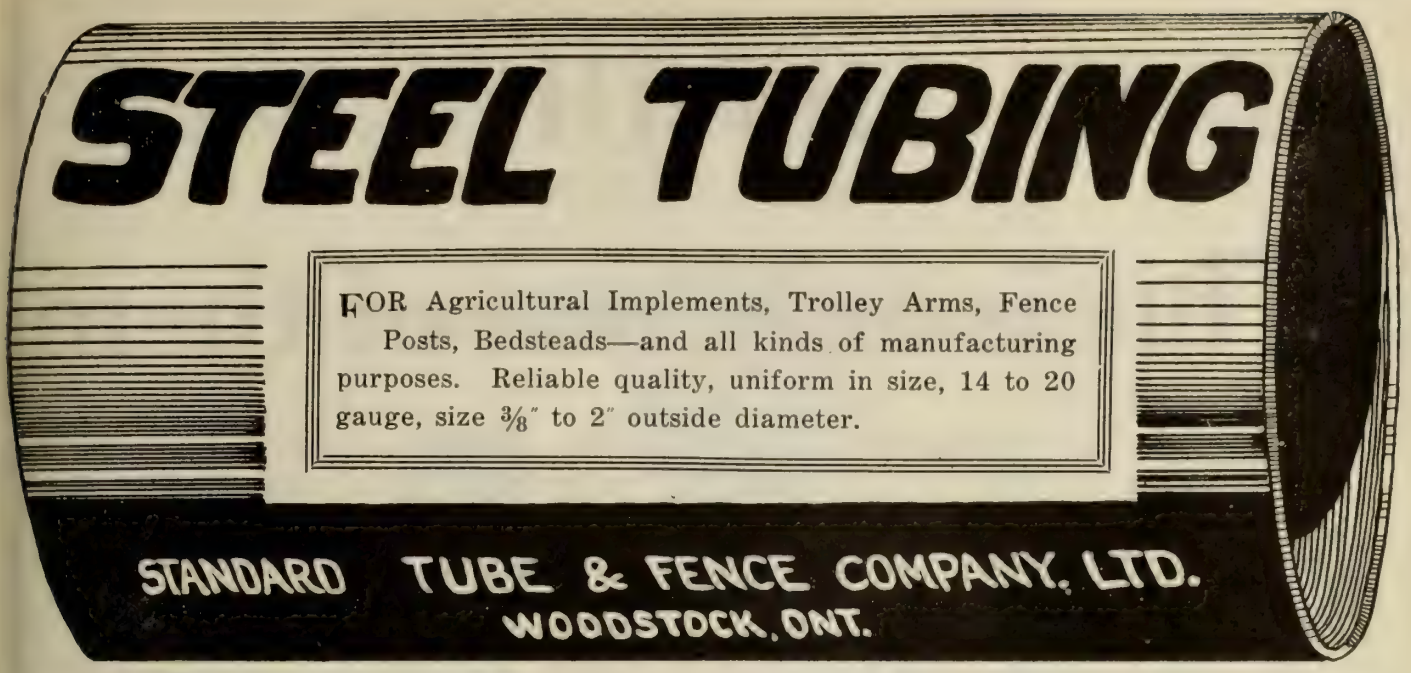
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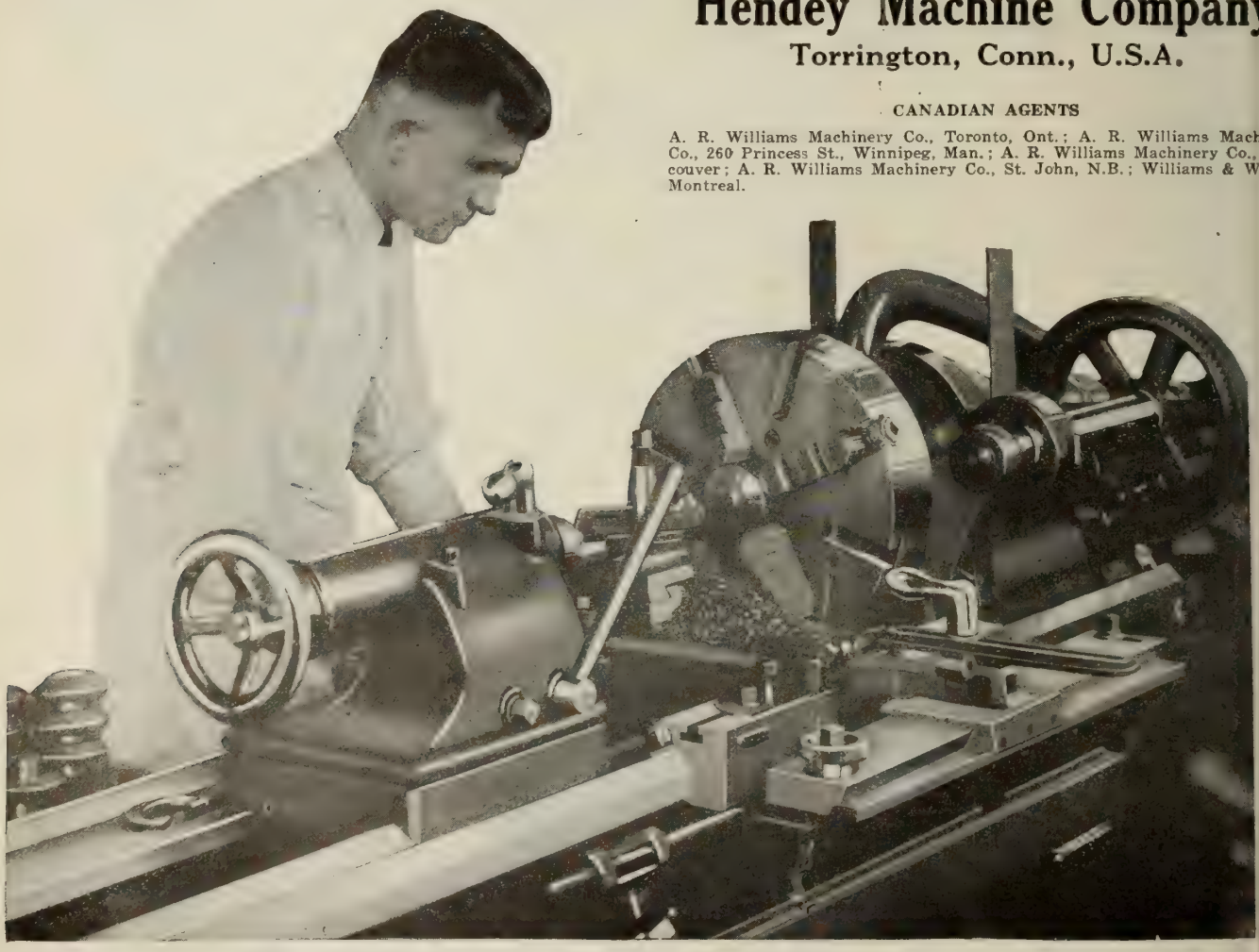
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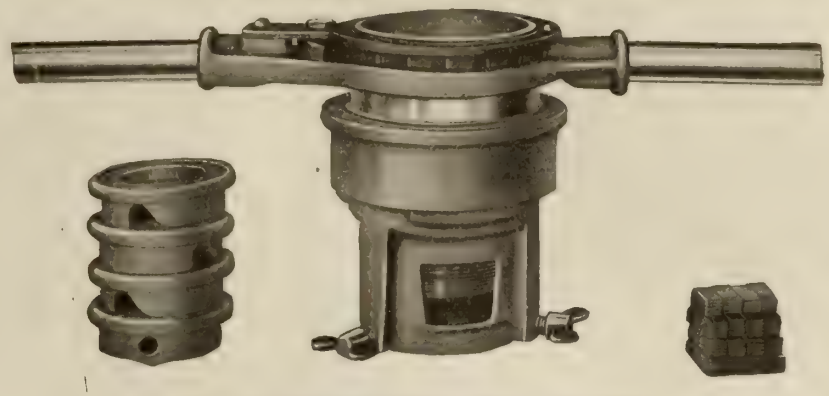
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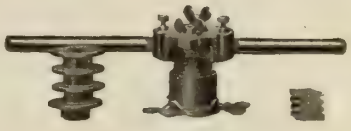
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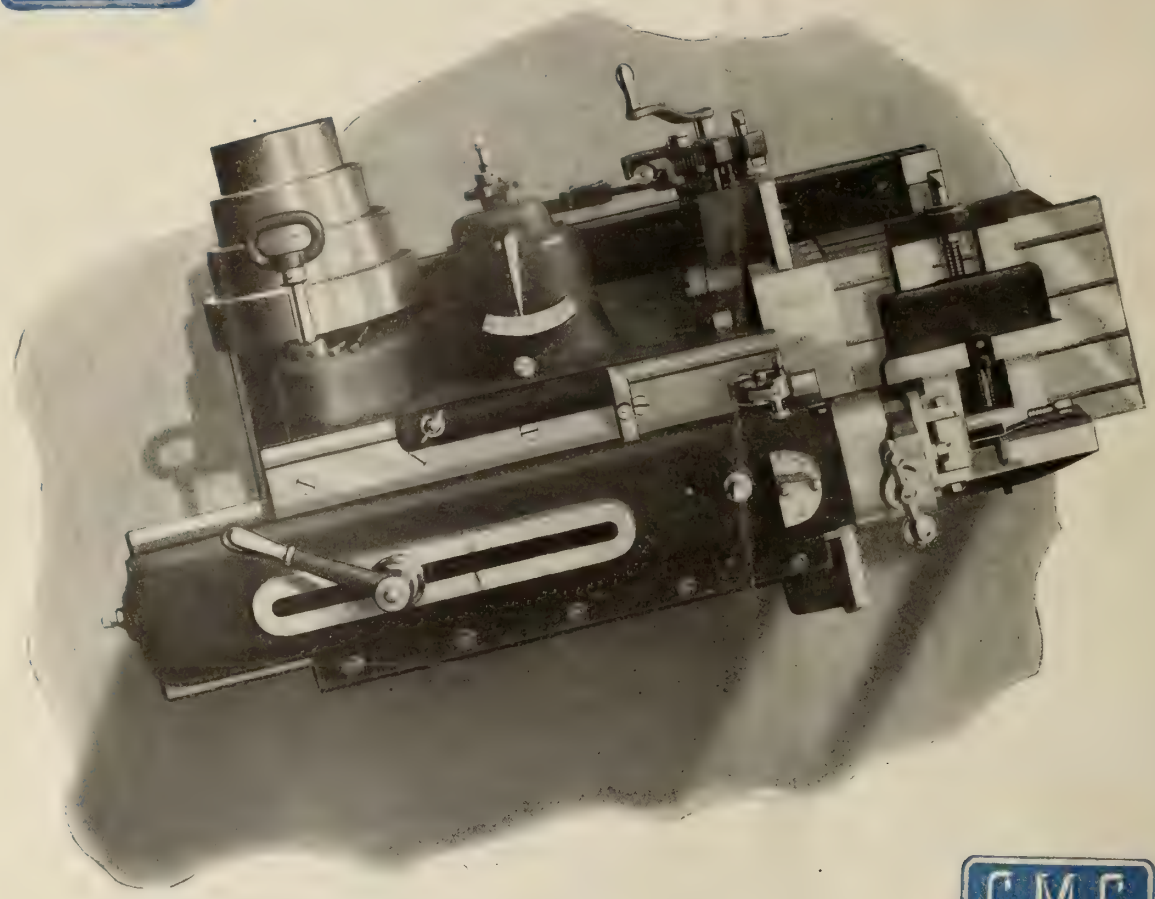
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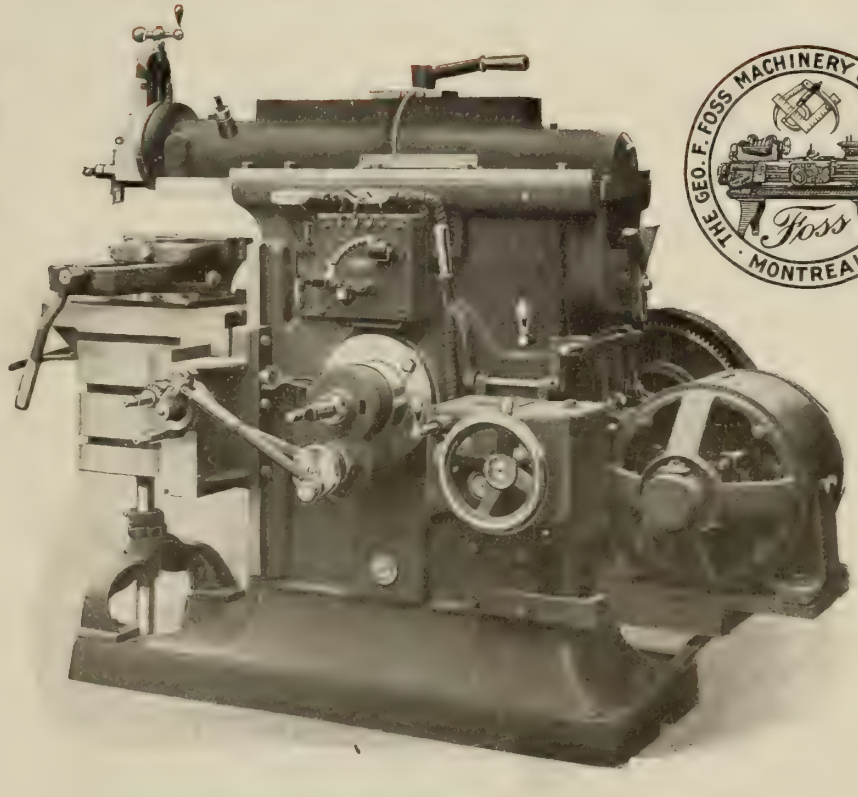
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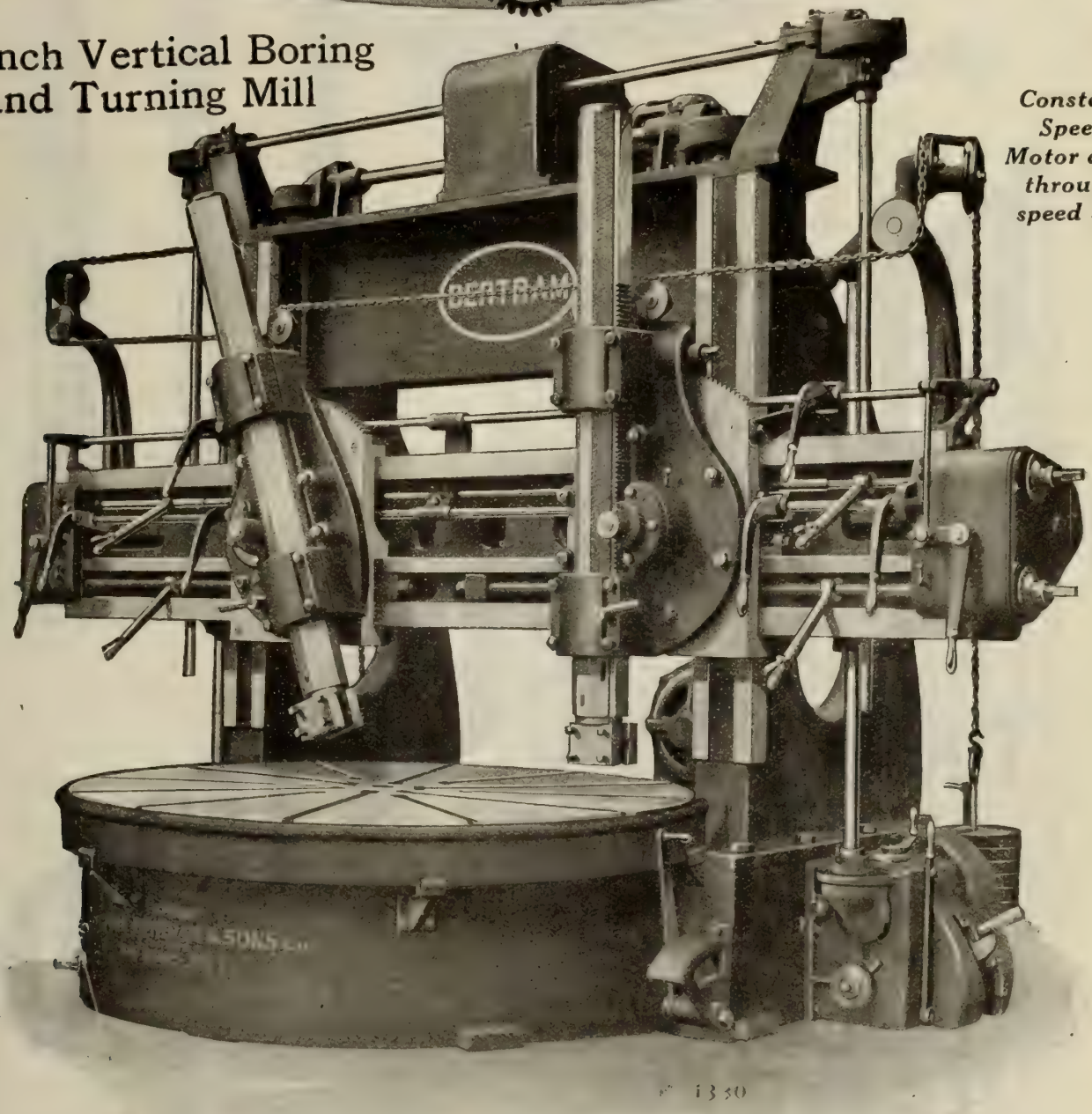


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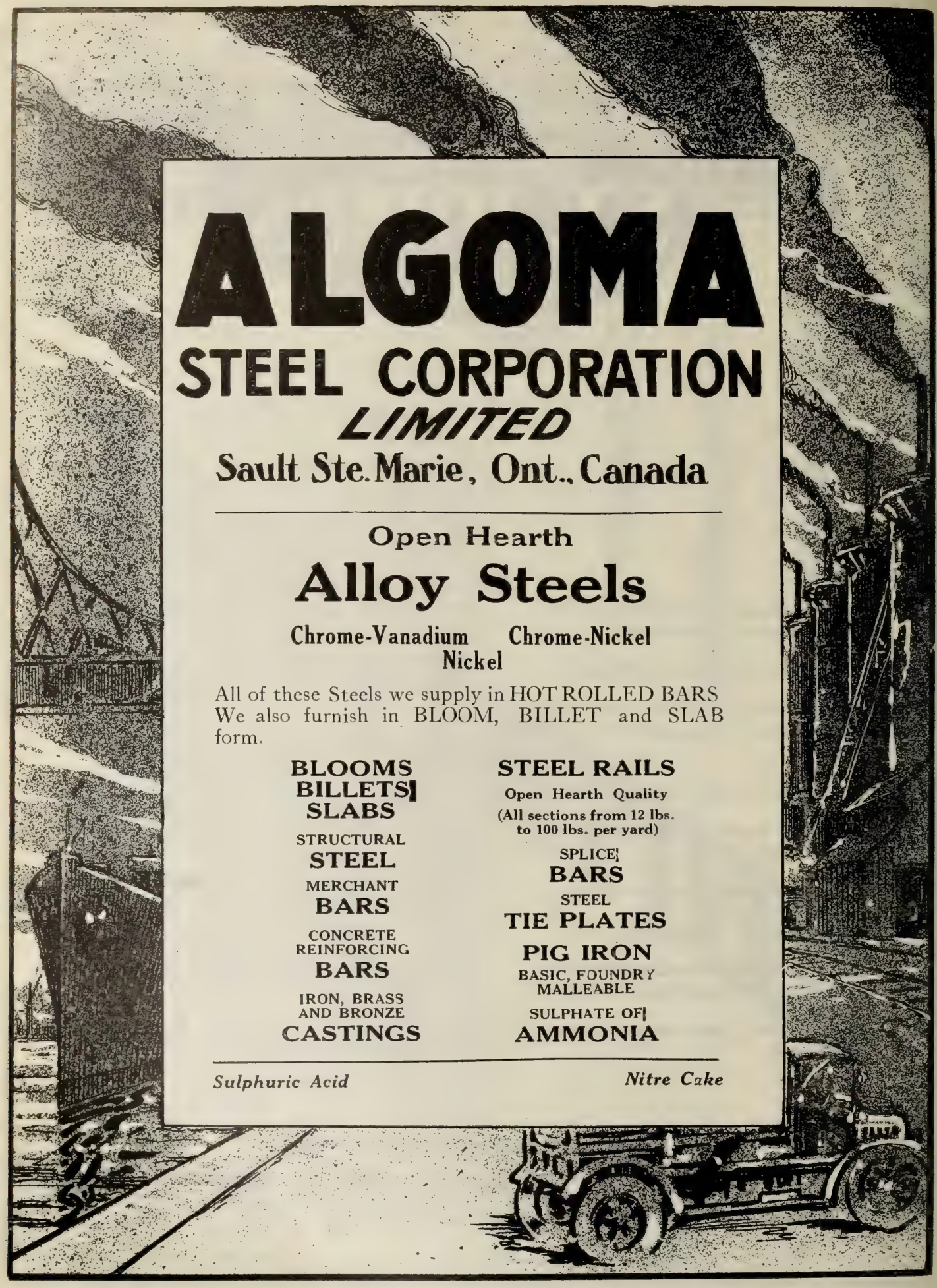
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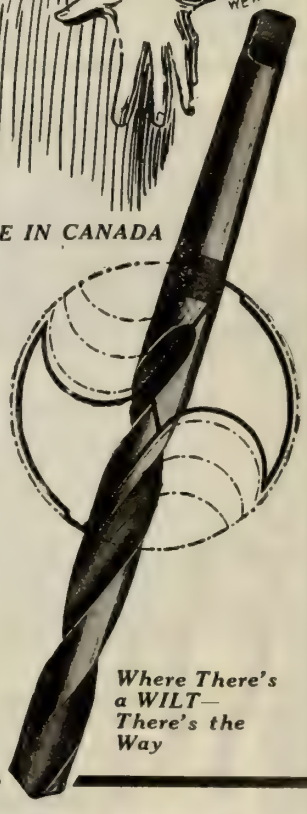
When a mechanic points to a WILT TOOL and exclaims: "There's a tool you can depend upon" (which is frequently the case) he means that WILT TOOLS have impressed him with their

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Any mechanic who has used WILT PRODUCTS will tell you that you can drive them hard—that they are unsurpassed for heavy, steady duty, and they proved it in the shops of Canada during the high-speed production days of the war.

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WATERWHEEL casings, penstocks, flumes, tanks and structural members have been part of the product of our Jenckes plant for many years and some of the most remarkable work of this kind ever done in Canada has come from this shop.

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by the
HARMET
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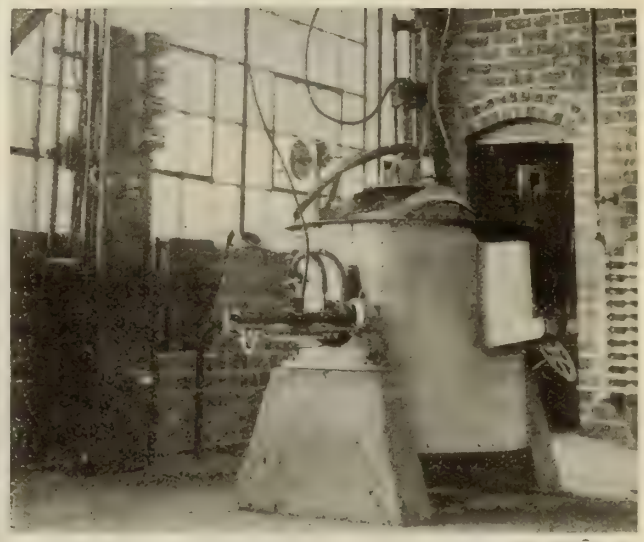
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Built in capacities from 100 lbs. to 6 gross tons

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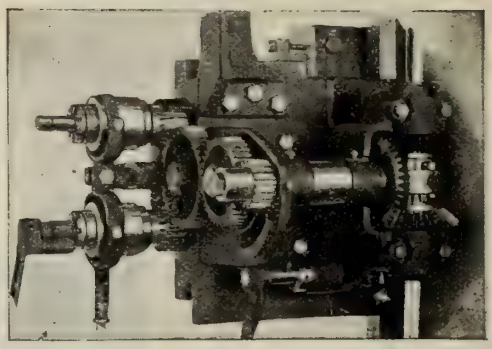
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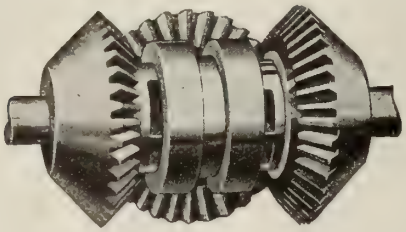
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THE JOHNSON FRICTION CLUTCH

Look Over This Practical Johnson Clutch Assembly

Here is a typical Johnson installation—the Colburn Boring Mill with three Johnson Clutches shown, and three more on the other end of the cross rail. For neatness and simplicity this arrangement is worthy of notice, but its real value appears in the smooth and convenient control of operations that it gives.





Double Clutch Between Bevel Gears

Builders of all types of machinery are placing their confidence in Johnson clutches and are finding them capable of the highest quality of service under any conditions.

Our booklet, "Clutches As Applied To Machine Building," shows many examples of successful clutch engineering. Let us send you a copy.

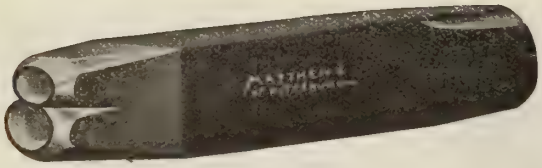
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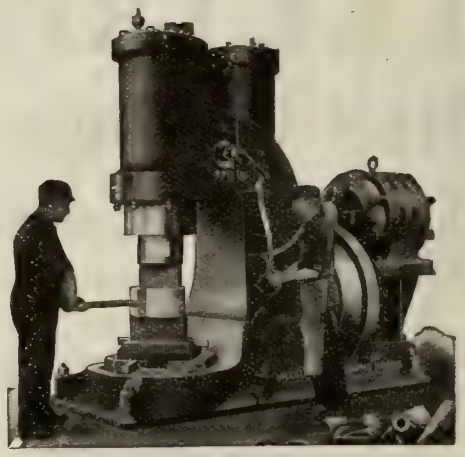
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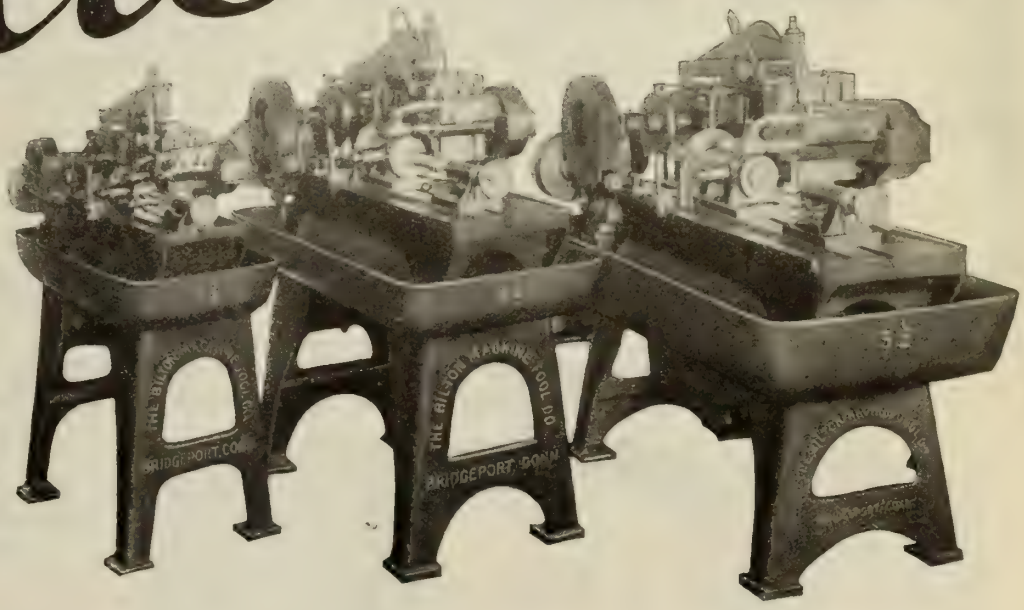
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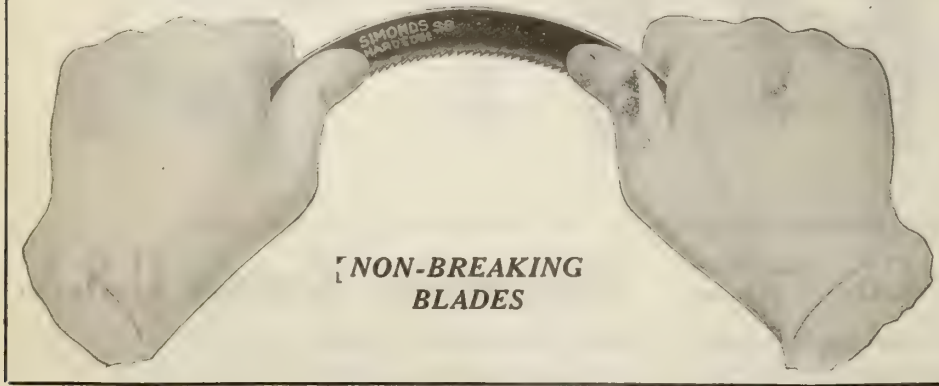
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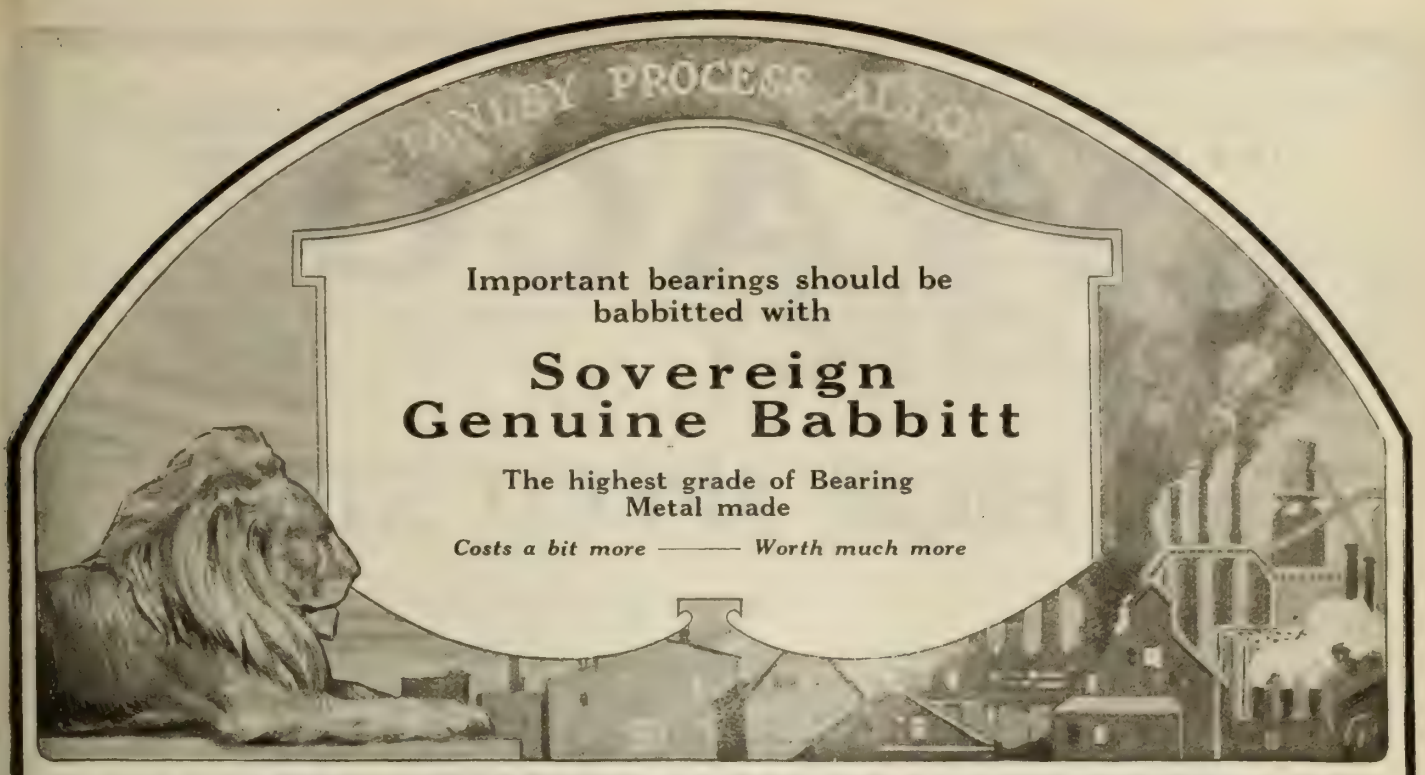


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Superior steels of the highest quality, each a leader in its class.

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Hoyt Babbitts, particularly Frost King, represent maximum value at minimum prices, possessing all the qualities and overcoming all the usual Babbitt faults found in ordinary bearing metals. We've been making Babbitts for nearly half a century.



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HIGH-SPEED AND CARBON
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MADE IN CANADA

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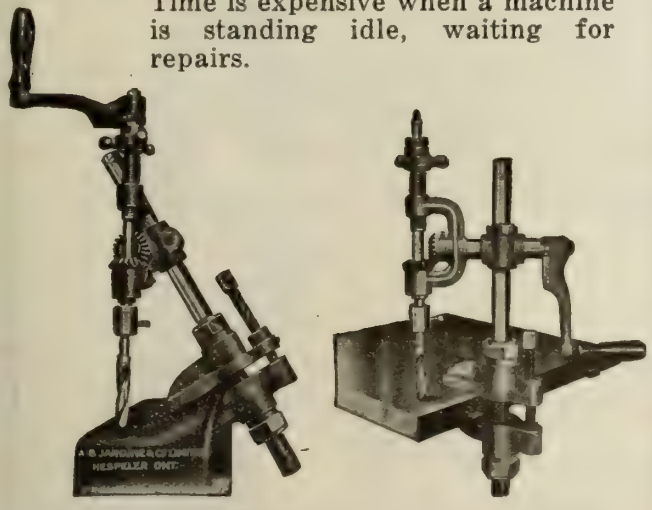
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Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses

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STELLITE

Not Steel—but its Master

A combination of non-ferrous metals that is harder, tougher and more durable than the finest high speed steel ever made.

Only "Stellite" can develop the full speed and capacity of the modern lathe—it cuts even better at a temperature up to and above a red heat than when cold.

"Stelliate" lathe tools are the ultimate in economical manufacturing methods.

We will send a demonstrator on request.

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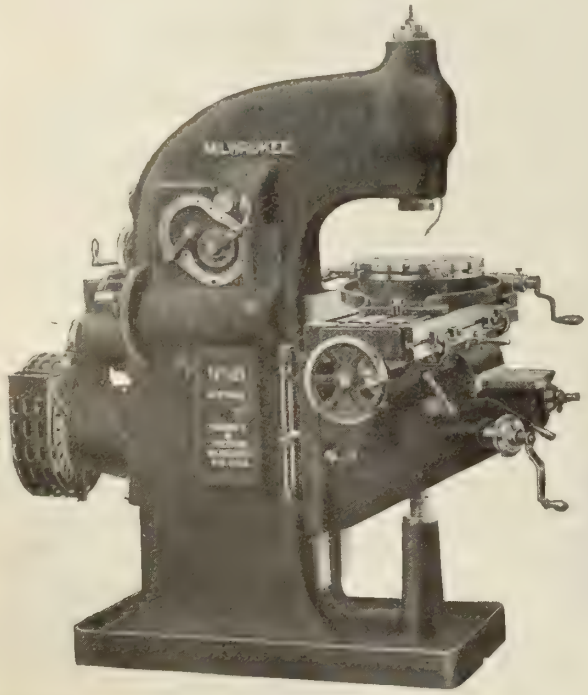
THE MASTER METAL

MILWAUKEE
MILLING MACHINES

Vertical Milling

THE main construction principles of the Milwaukee Vertical Milling Machine do not differ from our horizontal type—i.e., the heavily-ribbed, box-section column; the solid top knee; the constant speed drive; the automatic flooded lubrication system—these are embodied as being characteristics of Milwaukee Milling Machines in general.

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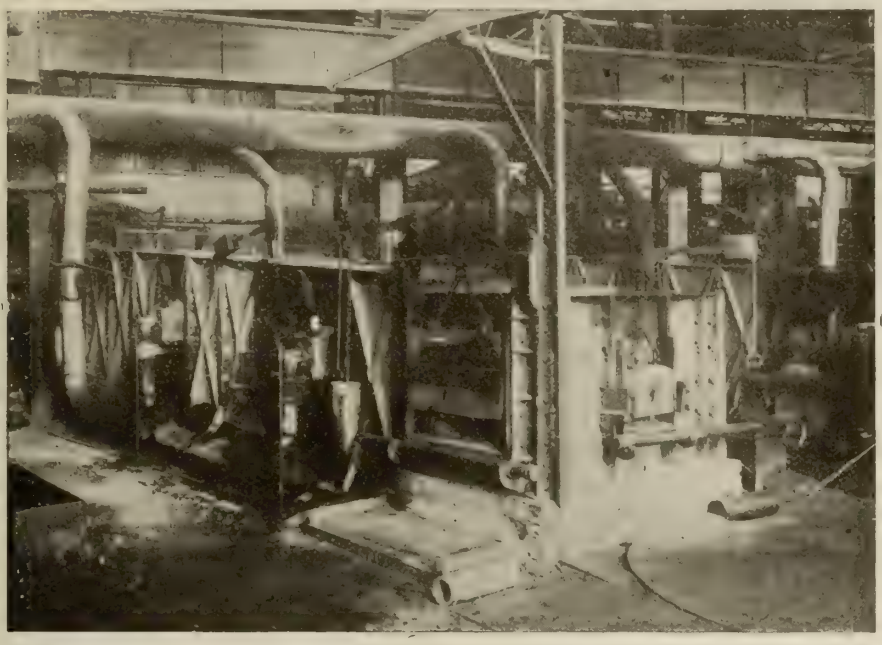
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KEARNEY & TRECKER CO.
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Another MECOL Furnace

demonstrated its superior features point by point to a group of men whose years of experience in the heat-treatment of metals made them appreciative judges.



We refer to the "Mecol" Furnace shown in this illustration, installed at the Pointe St. Charles Works of the Canadian Steel Foundries, Limited.

Our intimate knowledge of heat-treating methods, and our long experience in the building of efficient furnaces fit us to give helpful advice—and that we will do promptly if you

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Mechanical Engineering
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15 TON PRESS

A Simpler Hydro-Pneumatic Press

Complications in the construction of our High Speed Hydro-Pneumatic Press are so few that its operation is more readily understood than that of a more intricate machine.

Straightening, Forcing, Broaching

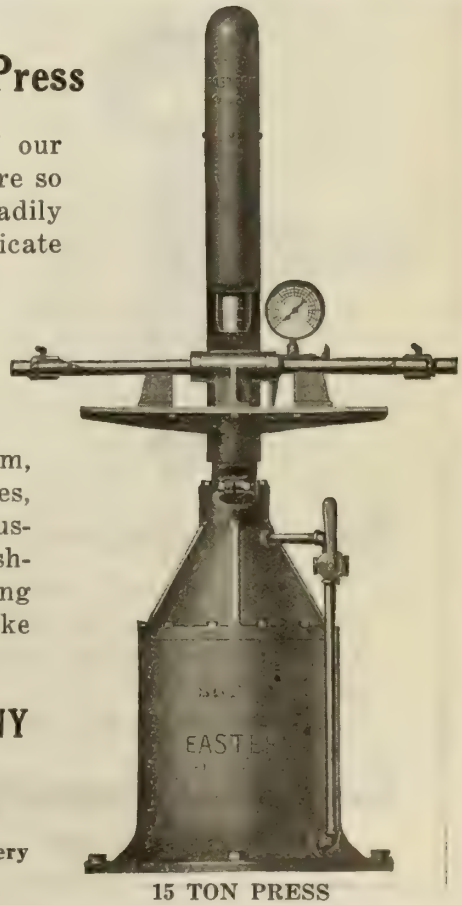
Particularly adapted for straightening cam, crank, pinion and wheel shafts, axle tubes, pinion tubes, assembling differential housings, assembling bearings in hubs, bushings in spindles and wheel rims, testing springs front and rear, broaching brake levers.

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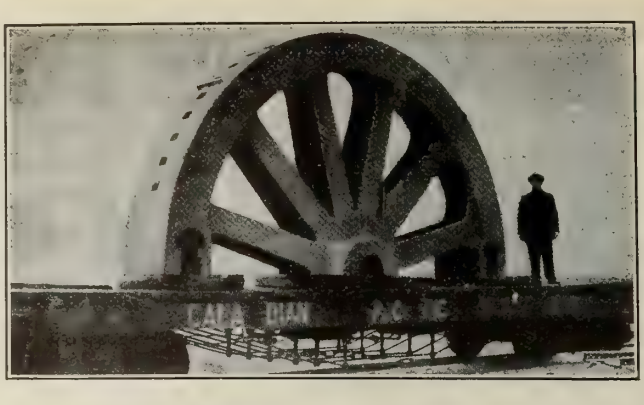
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Canadian Representative: F. F. Barber Machinery Co., Limited, Foy Building, Toronto



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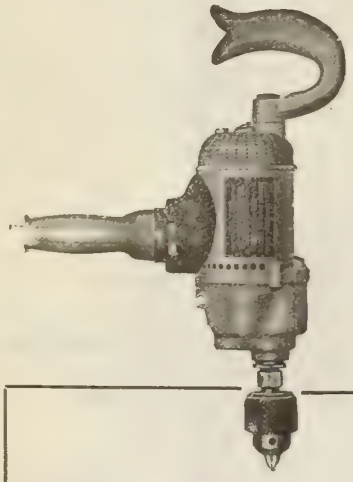
A New Canadian Record in Steel Castings

Cast Steel Half-Spider for Electric Generator

Diameter	- -	20 Feet
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Net Weight	-	64,000 Pounds

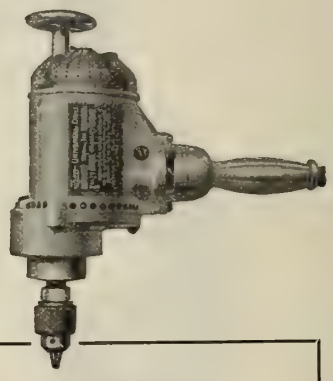
DOMINION FOUNDRIES & STEEL, LIMITED

HAMILTON :: :: ONTARIO



Thor

ELECTRIC DRILLS

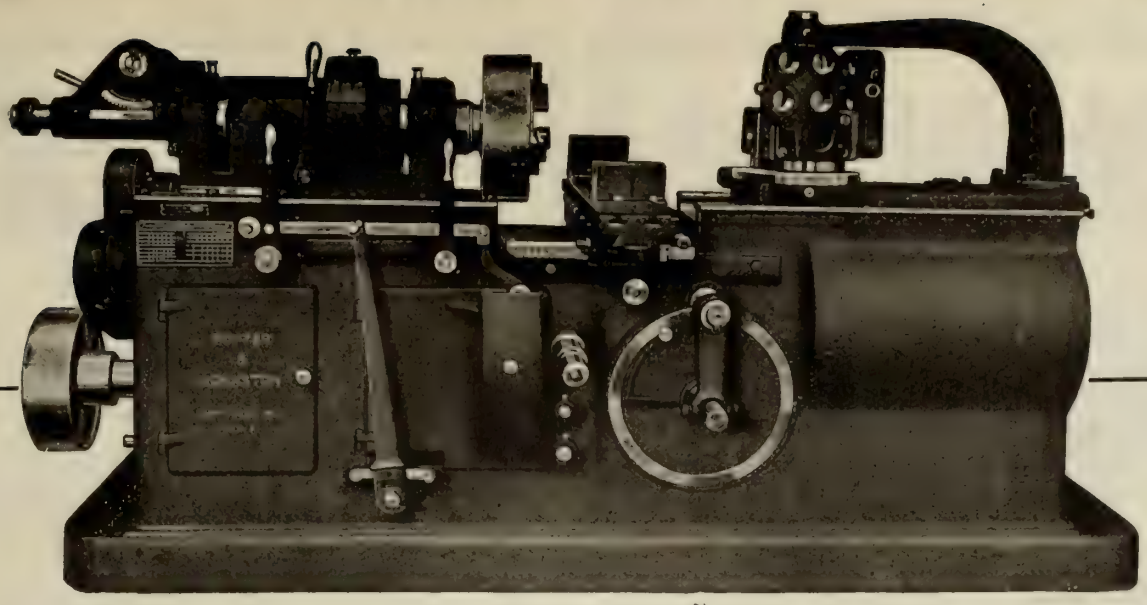


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Light, powerful and non-stallable, "Thor" Portable Electric Drills have offset spindles—which permit operating in close quarters—a variety of speeds, S K F Ball Bearings, four contact point switches, D.C. or Universal Motors and other distinctive advantages to recommend them. It will pay you to investigate the "Thor" line. Standard equipment on all classes of work.

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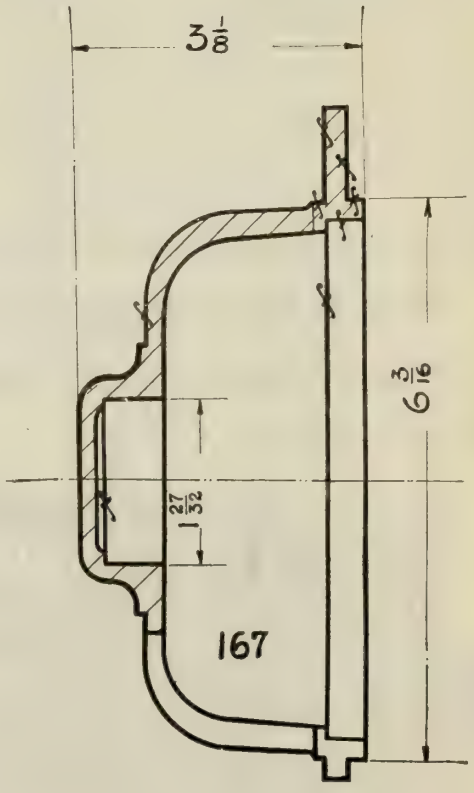
Nothing could be simpler

This piece is a cast iron front end plate and was finished on the Potter & Johnston Manufacturing Automatic Chucking and Turning Machine in two chucking operations.

On a job of this nature one man can easily attend to anywhere up to six machines, and all he has to do is to put work in the chuck and take it out again when the machine has finished it.

Why don't you send samples or blue prints along to us and we will tell you what P & J Automatics can do for you.

Bulletin 41



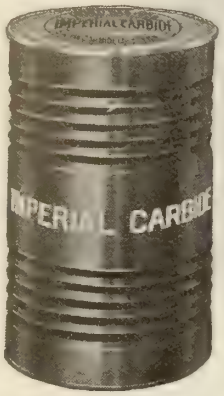
Canadian Office: POTTER AND JOHNSON MACHINE CO.

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Head Office: 1501 Royal Bank Building, Toronto, Canada
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For Welding Cutting and Lighting

HIGHEST GAS YIELD
IMPERIAL CARBIDE
MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

Manufactured by

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WELLAND, ONTARIO

Large Stocks maintained at convenient distributing centres throughout Canada

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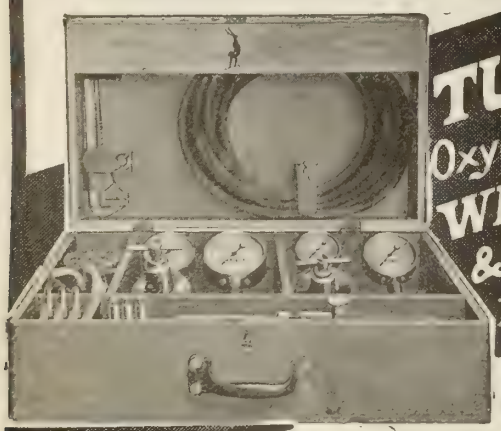
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We also handle Pure Acetylene.

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For Repairing Broken Machinery or Tools of Medium Size



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These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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ARMCO IRON is the standard welding wire for both electric arc and oxy-acetylene welding. It has unequalled welding qualities, due to chemical and physical uniformity; 99.84 per cent. pure iron content (minimum) guaranteed. Distributors in all industrial centres. 66

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When a severe windstorm wrecked several big dock sheds on the water-front of a large Southern city, 1,400 tons of steel were twisted into the entangled mass shown in this illustration.

Orders were given to remove debris in 24 days to make way for new sheds.

By means of the Prest-O-Lite Process of Oxy-Acetylene Cutting all wreckage was cut up and removed in 18 days—6 days ahead of schedule.

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It will pay YOU to know the savings and advantages that

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The Prest-O-Lite Process employs both gases (acetylene and oxygen) in portable cylinders.

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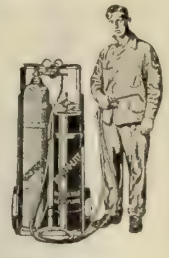
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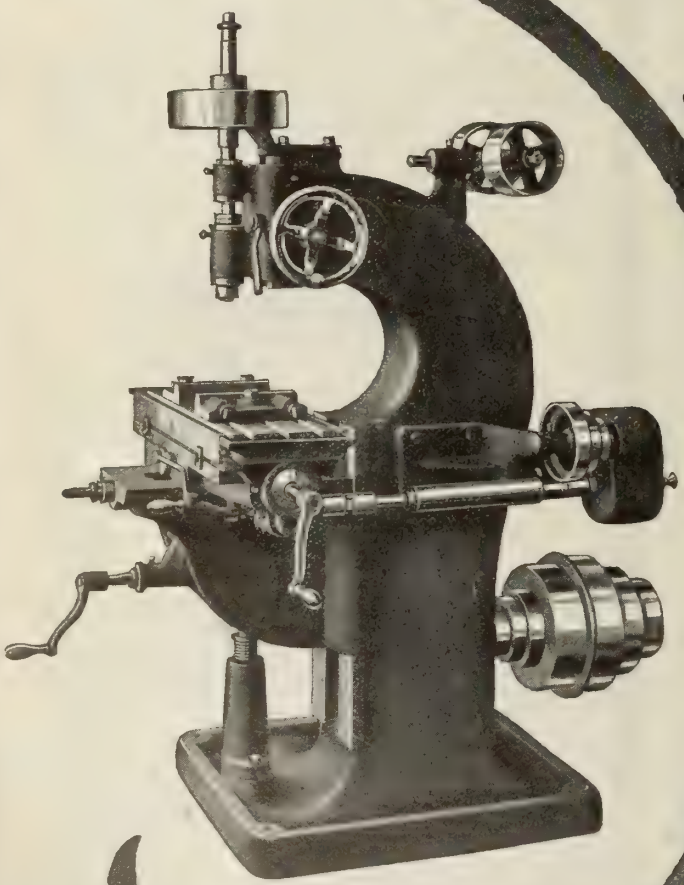
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Bristol Vertical Milling Machine

A Tool of Large Capacity





Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

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The Piston Rods are packed with a resilient packing that conforms to the shape of Rod without retarding its free action, and prevents any dirt from entering piston chamber and working parts—Rammers are fitted with either Round or Flat Rods as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.



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Bowes Couplings are instantly connected or disconnected.



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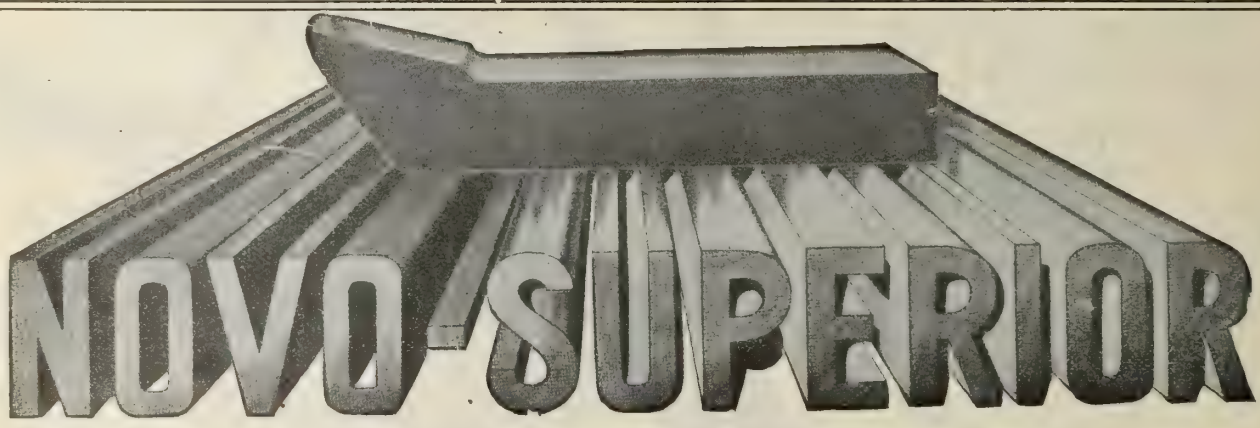
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HIGH SPEED STEEL

INTRA STEEL *GIBRALTAR STEEL*

Tool Steel for Every Purpose

SWEDISH LANCASHIRE IRON.

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
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Are you stalled?

If a bar, square or round will keep you going, why not use our

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Our first objective is to make friends—then forgings.

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The Babbitt Metal that's at the Front in Efficiency and Economy



Order a Box from our nearest Factory

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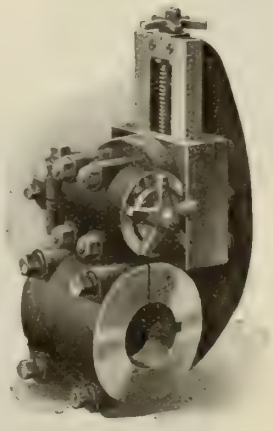
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A LANDIS FEATURE

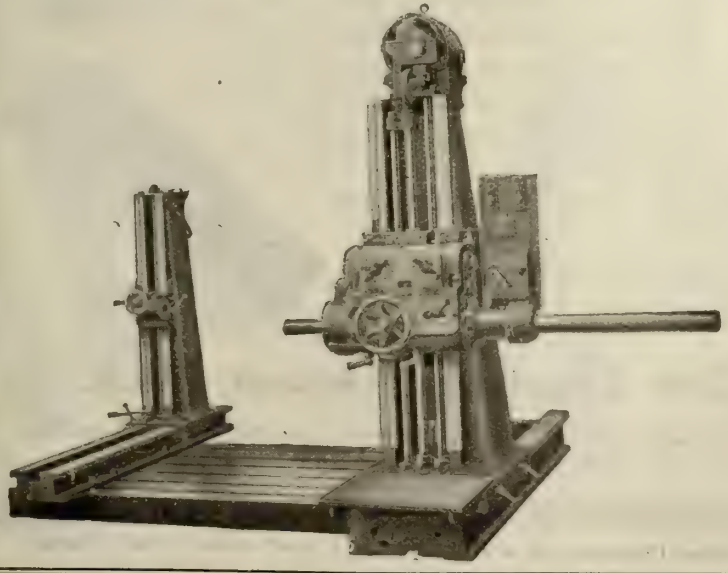
Landis Engineers are always adding that "little bit better" factor to Landis Boring Machines.

For facing surfaces beyond the capacity of standard facing tools, special facing heads are made. They are designed to be clamped to the spindle, but on special order can be supplied with flange for attaching to face plate for special work.

Write for our new bulletin on *Boring* Machines.



20-inch Swiveling Facing Head



The "Boring Machine With a Powerful Spindle"

LANDIS TOOL CO.

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New York Office: 50 Church St.

Canadian Agents:
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You may not buy your machine tools on a beauty basis

But you're pretty certain to be suspicious of a machine which is ugly to the mechanic's eye.

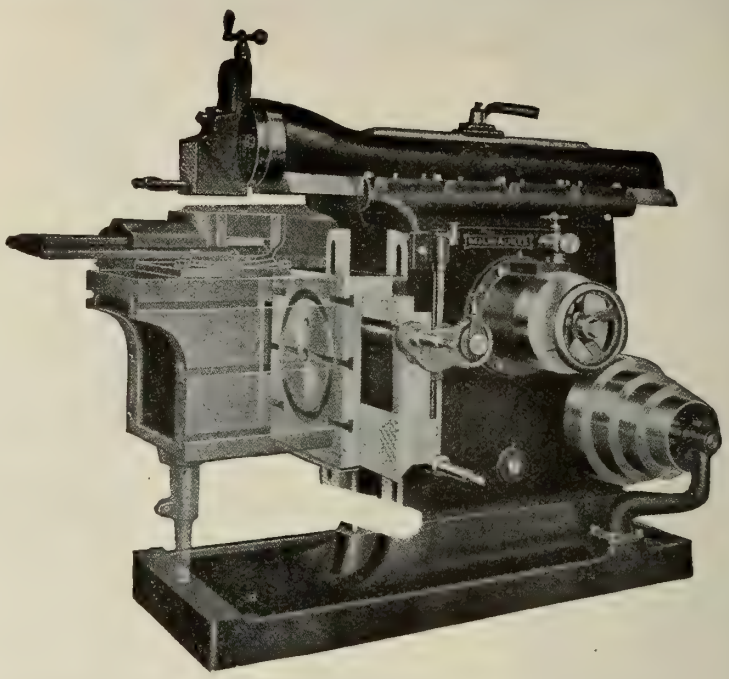
"When a machine is wholly right it is pretty sure to look right."—Professor Sweet.

The trained eye of the mechanic or the engineer rarely fails in its judgment. Heavy parts look awkward; light parts look weak; incorrect proportions look ugly; unnecessary parts look cheap.

"To be good, a design must be consistent."—Professor Sweet.

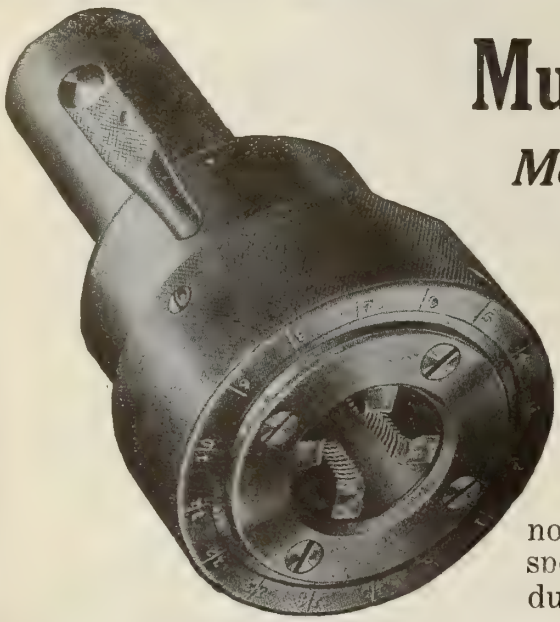
Designed by specialists in machine tool design, the Milwaukee Shaper is proportioned to be wholly right for its work. The machine is a beauty and we are proud of it. It's an indication of the quality of the design.

Literature describing this machine in detail, and any other information we can supply, is yours on request.



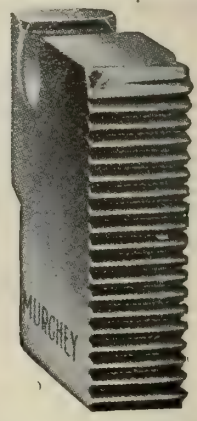
MILWAUKEE SHAPER CO.

1029 Coldspring Ave. Milwaukee, Wis.



Murchey Chasers

Mean Quick Deliveries





Murchey Tools will cut your tapping and threading costs. **They will boost production 50%.** Another important feature is Murchey's **Quick Deliveries on Chasers.** This is a Murchey specialty. No waiting! We get your chasers to you when you want them. Why not use Murchey Tools to speed up your threading production?

Send for a Murchey Tap or Die on approval and give it a trial. You will then secure actual proof of its value to you.

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Don't let a workman use a file after it has begun to lose its edge.

Files that have lost their original keenness tire workmen and do poor work. They waste time, which costs more than new files.

Specify Famous Five Files, the standard, and ensure the maximum of efficient service.

Steel from an exclusive formula, teeth accurately cut, and special hardening, are the secret.

They have stood practical tests for over fifty years. They are:

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GREAT WESTERN
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Made in Canada by





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General Office and Works: Pittsburgh, Pa., U.S.A.

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Pittsburgh, Pa. U. S. A.

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—makes furnace linings last longer

The linings of these brass furnaces don't last long when they are cemented with fireclay. Under high temperature the fireclay dries and then burns out, leaving open joints in the brick lining.

Clinton Cement prevents this disintegration because it sets to a flexible glass hard surface that allows for expansion and contraction and stands temperatures up to 3000° Fahrenheit.

Try it on your furnace linings—on any fire brick that gives trouble. We will send you for trial a five-pound tin of Clinton Super-Heat Cement, free and all charges prepaid.

Standard Machinery & Supplies Limited
261 Notre Dame St. West, Montreal

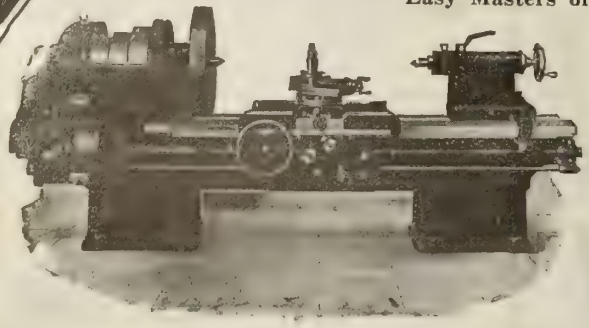
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For SERVICE

Heavy Duty Lathes

The 25-inch Heavy Duty Quick Change Sidney shown below is the last word in lathe construction. Every possible improvement will be found in this late model. Bed lengths available are 10, 12, 14, 16, 18 and 20 feet. Also built with a 27-inch swing.

Easy Masters of Big Jobs.



Regardless of the severity of work, dependence put on Sidney Lathes has never been misplaced. The Sidney line has made good—with a vengeance. New Bulletin just issued on 25-inch machine. Write to-day!

The Sidney Tool Company

SIDNEY, OHIO

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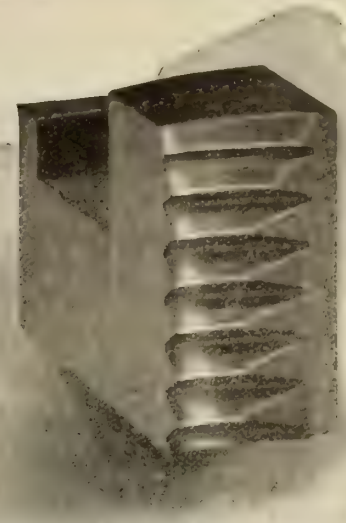
The Acknowledged Leader

In every field of industry there is one acknowledged leader by which all others of its type are judged.

The Chasers of the HARTNESS AUTOMATIC DIE hold this enviable position. Their superior efficiency is not a mere claim, but the verdict of expert mechanics based upon exhaustive tests covering many years of service.

For precision work, we can furnish chasers with a lead guaranteed within 0.001 inch per inch of thread.

Quantity and quality of output are the predominant factors upon which their reputation is built.



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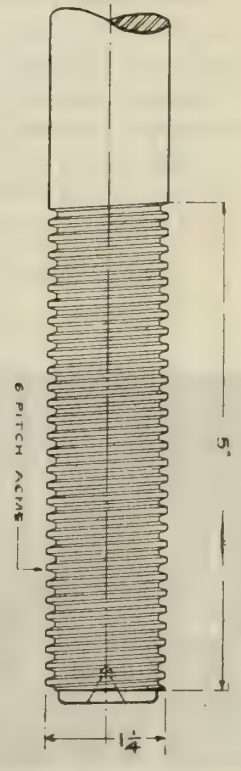
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Look at these figures: they show you why the Smalley-General means profit on Acme threaded work

Maybe you haven't an Acme thread job in your shop.

But you'll be interested in the difference between lathe time and thread miller time on this work. The time study gives the details.

Of course, if you **are** making Acme threads in the lathe, there's only one logical thing to do, and that's to get in touch with us. We'll work from your blueprints and give you a **guaranteed** production estimate of the **Smalley-General Thread Miller** on your work that will surprise you. If you send us samples of the work we'll be able to show you the real accuracy and finish that are possible with ordinary labor on the Smalley-General.



MATERIAL—Ground Shafting.
LATHE TIME—35 minutes, approx.
THREAD MILLER TIME — 2 minutes, floor to floor.
Note—This job would be supported at outer end by a tail-stock.

Smalley-General Co., Inc.

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MADE IN CANADA

INDUSTRIAL HOSE

Tires Lowered the Cost of Hose

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Hose built to fit the *needs* of many different industries.

Fabrics specially selected for hose. Rubber compounds brought to an exact, scientific standard. Construction governed only by the work the hose is to do.

Is it any wonder that Goodyear Industrial Hose is giving longer service; reducing hose costs; preventing delays due to repairing and replacing hose?

In foundry, paper mill, mine, railway, steel plant, and every other industry, Goodyear is setting new standards for hose.

Goodyear Industrial Hose will open up to you new possibilities of economy, increased production and hose satisfaction.

A man trained by Goodyear in hose problems will gladly call upon you without obligation.

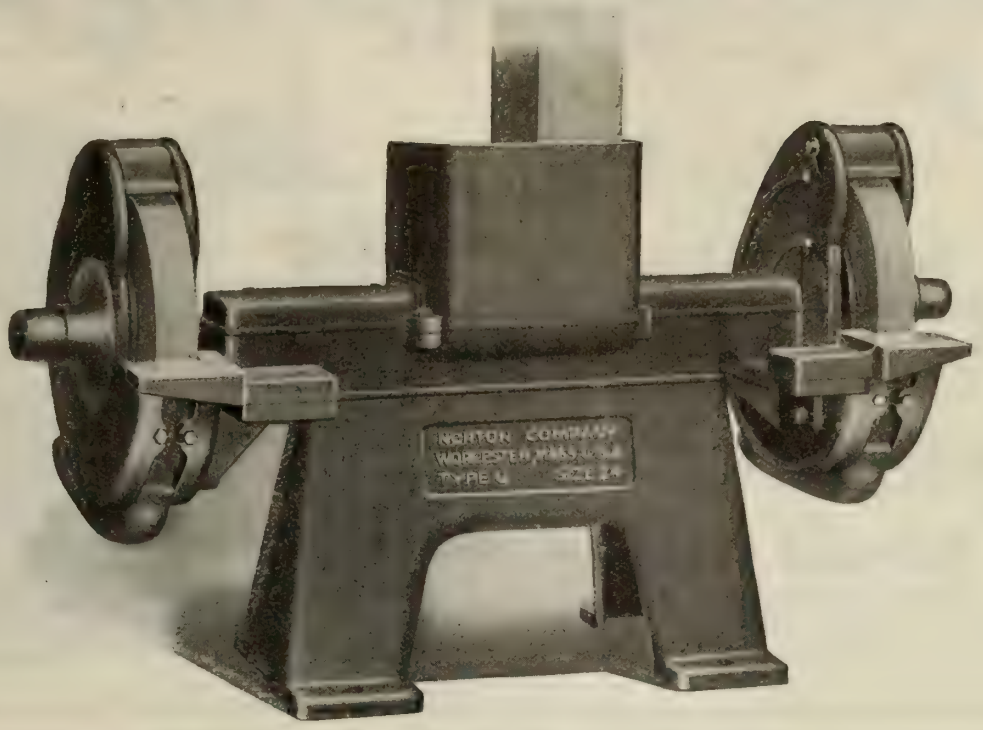
Just 'phone, wire or write the nearest branch.

The Goodyear Tire & Rubber Co., of Canada, Limited

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NORTON
GRINDING WHEEL STANDS
Save the Wheels and the Operator



NORTON GRINDING WHEEL STAND---Type Q

Note how this new Type "Q" combines those points in design and structure which are essential for maximum production, economy, and safety in grinding operations. Note how the long spindle gives ample foot-room for the operator; note the sturdy protection hood with its dust exhaust, the substantial belt guard and the heavy chilled work rests.

The weight and design of Norton stands secures the rigidity which gives longer life, lessens the number and extent of repair, prolongs the life of the wheel by reducing vibration.

Freedom from vibration permits the use of a smaller wheel, thereby increasing production, and helps the operator grind more tonnage with less fatigue.

Grinding costs—the true relation of output per unit of time, life of wheel, and operator's wages—are the lowest when the work is ground with

NORTON GRINDING WHEELS

Alundum for steel and steel alloys. Crystolon for cast iron, brass, bronze and aluminum

NORTON COMPANY

Grinding Wheel Division

WORCESTER, MASS.

Electric Furnace Plants: Niagara Falls, N.Y.; Chippawa, Ont., Canada

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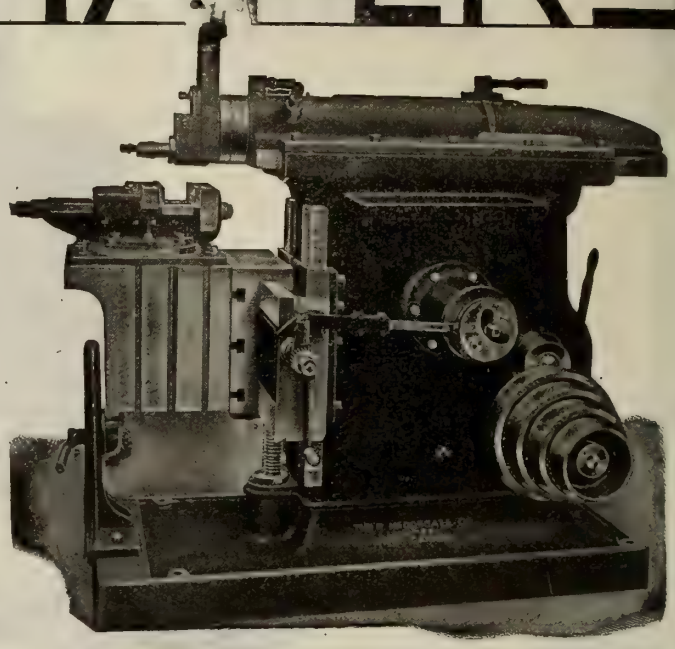
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Rigidity Plus

Simple Design and Convenience of Adjustments

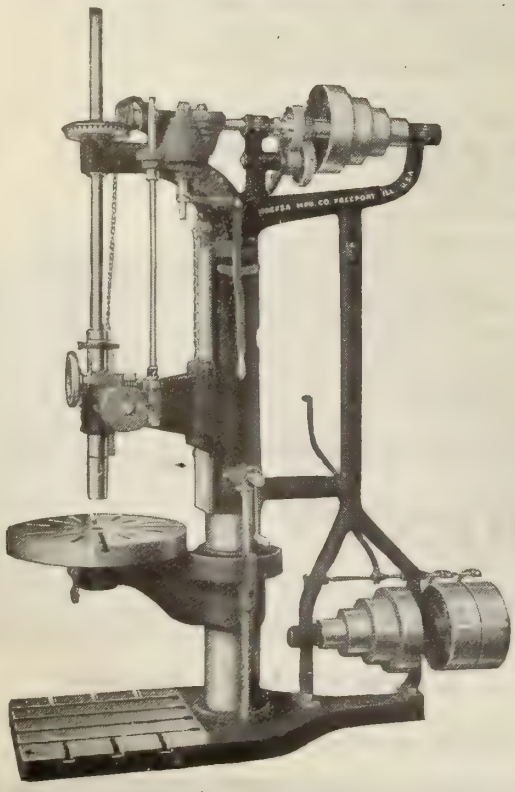
give operator every facility for ease of operation and Accuracy in Production

Our circulars, containing complete specifications and descriptions, are ready. Write us for one.



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HŒFER

Enable Your Workmen to Eliminate Spoilage

The Hoefer Driller is pre-eminently the one to be found in the best plants. "It's almost as good as a Hoefer," so often heard in the machine and tool trade, indicates the position held by Hoefer Drillers.

Exact drilling, to the last thousandth of an inch, pays by eliminating spoiled material. Hoefer Drillers pay for themselves and increase the workman's pride in his work.

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Twenty-five years making drillers has given Hoefer the "Know-how." The Hoefer Drillers are used by many of America's leading manufacturers. Equip your factory the Hoefer way. Take any kind of a drilling problem you have to the Hoefer Manufacturing Company, and the Company's experts can tell you how it was solved by other men, some of whom you may know.

Investigate now. Write to-day for catalog. The Hoefer engineers are at your service.

HOEFER MFG. CO.
FREEPORT, ILL.

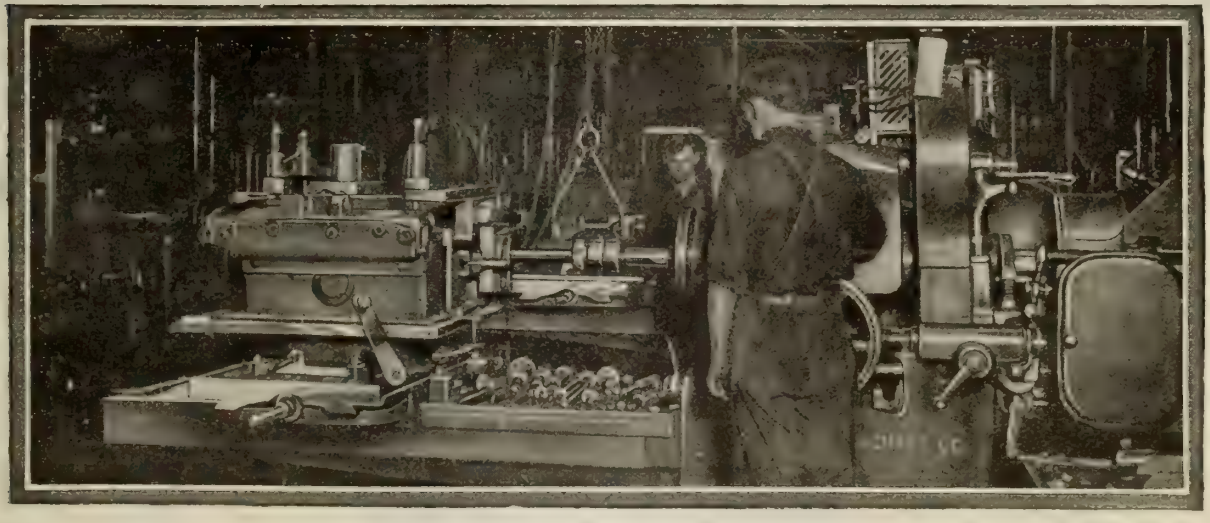
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Profitable Boring

On Gisholt Horizontal Mills

Gisholt users know the truth that lies in this statement.
The evidence is shown in the quantity of finished work produced.
The benefit of our years of experience in Boring Machines is embodied in the design of these machines. This enables you to get most work out of them.

Gisholt Methods Insure Accuracy and Economy



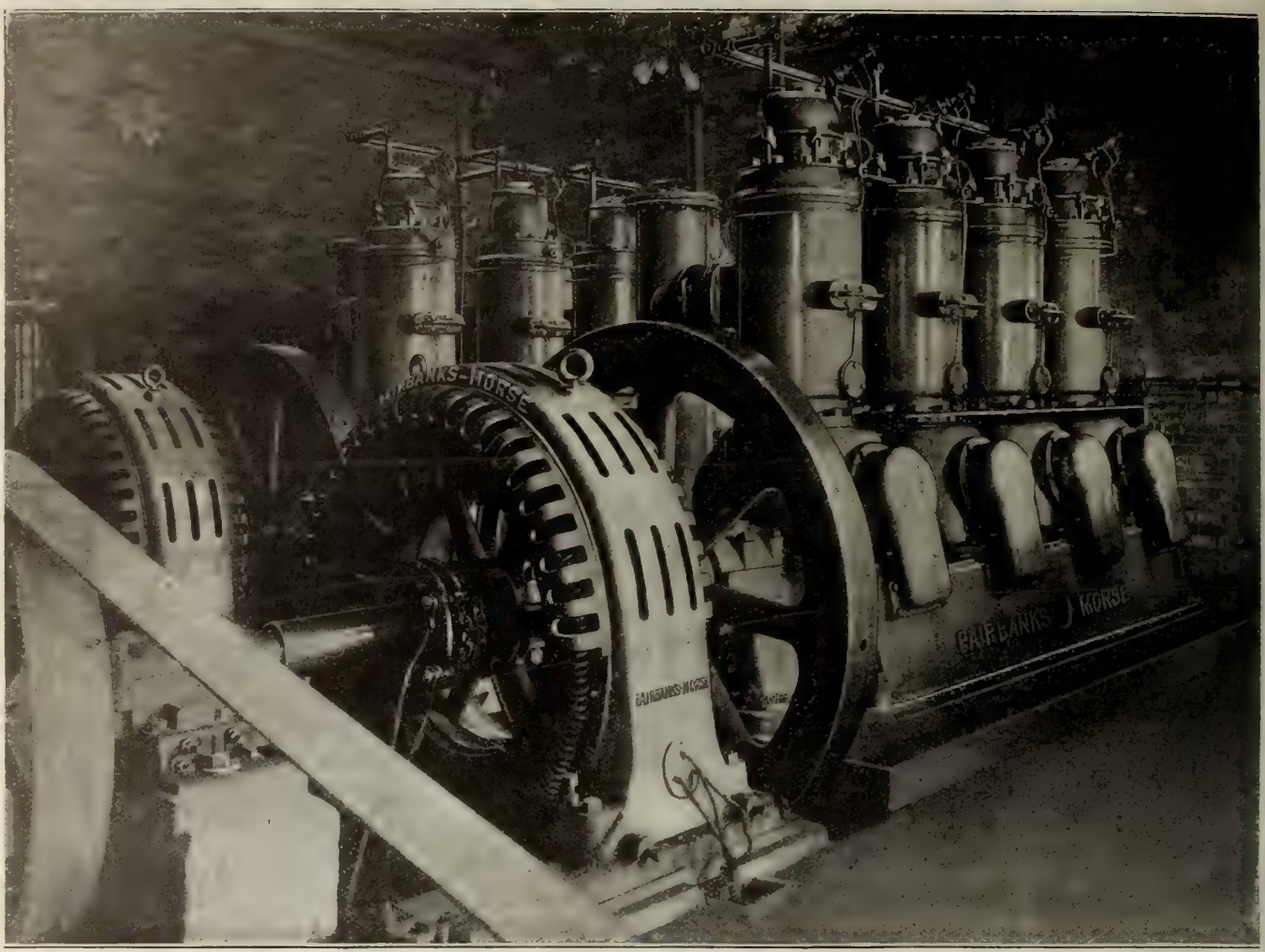
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The Helical Gear, Its Design and Application

The First Portion of a Treatise Covering the Application of Helical or Twisted Teeth to Gears Operating on Parallel Axis, Together With Data on Design, Application and Production

THE helical gear differs from an ordinary spur gear in five essential points:

First, contact of the teeth of a helical ear is progressive, starting in at one nd of a pair of teeth, then a little fur- ıer in from the end, then a little fur- ıer still, and so on, until the end of the ›oth is reached, and by this time the ext pair of teeth should be making ›ntact at the other end. This is known s "continuous helical action."

Second, owing to the overlapping of he teeth, the action is much smoother nd therefore much quieter than a spur ear.

Third, as there is always more than ne tooth in action, the helical gear ossesses greater strength over that of spur gear of the same pitch, pressure ngle and tooth form.

Fourth, owing to this ncreased strength it is ›ossible to reduce the ›itch of a helical gear ›ver that used for a spur ear carrying the same oad, and this reduction of ›itch gives still additional smoothness and quietness ›f action.

Fifth, because of the smooth action of helical gear teeth, it gives greater efficiency than he so-called straight-tooth spur gear.

These points are all of vital interest to designers and engineers.

The chief drawback to the use of the helical gear has been the complexity of the mechanism required for cutting it. The Fellows Gear Shaper Company has overcome these objections by designing a machine incorporating simplicity of mechanism and control, and the use of helical cutters, the teeth of which are generated by grinding after hardening.

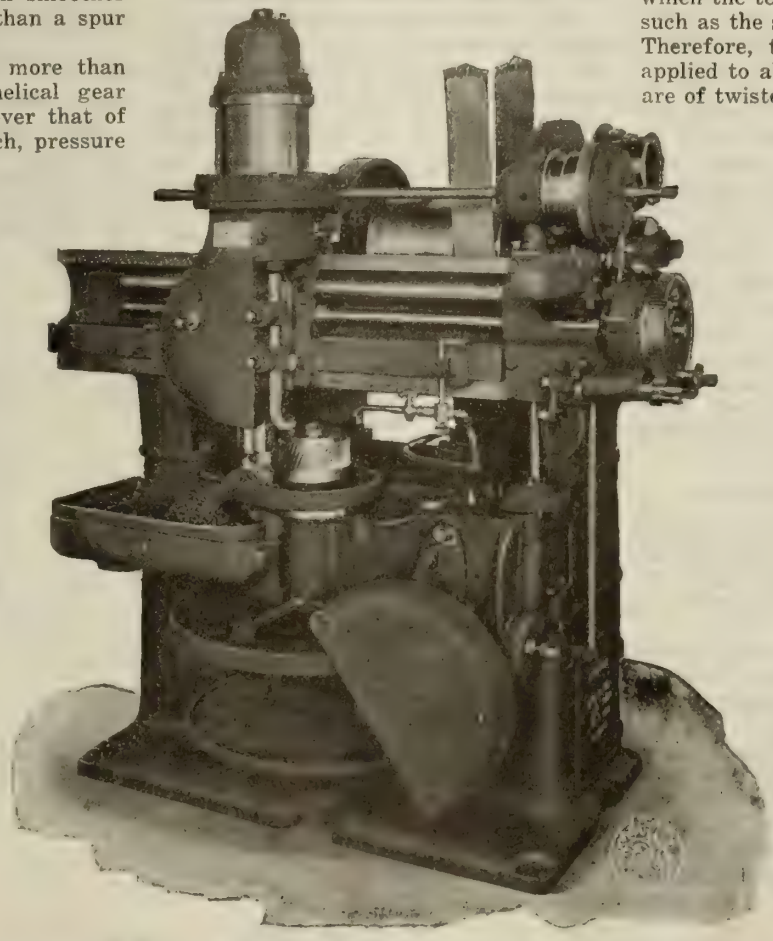
Owing to the fact that the helical gear possesses so many advantages over the ordinary spur gear, and also to the fact that it is receiving considerable attention at the present time, it has been thought that an article dealing with the design, application and methods of cutting helical gears would prove of value to designers and engineers.

Principle of the Helical Gear

There is some confusion regarding the proper use of the terms "helical" and "spiral." This has come about largely because of a lack of understanding of the proper application of the terms "helix" and "spiral." "Helix" means a concentric twist, whereas "spiral" means eccentric convolutions (see Fig. 1).

Therefore, when we speak of a helical gear, we mean a gear in which the teeth are twisted with relation to the axis of the gear blank.

When we speak of a spiral gear, however, we have reference to a gear in which the teeth all lie in the same plane, such as the scroll on the face of a chuck. Therefore, the term "helix" should be applied to all forms of gear teeth which are of twisted form, whether these gears are to drive shafts at right angles or in parallel planes.



GENERAL VIEW OF A FELLOWS HELICAL GEAR SHAPER.

Helical Gears Operating on Parallel Axes

In the following we will deal with only one type of helical gear; viz., that which operates on parallel axes. The only difference between an ordinary spur gear and a helical gear operating on parallel axes is that in the helical gear the teeth are twisted with relation to the axis of the gear instead of lying in a parallel plane. The action of the helical gear, overlooking this difference in tooth shape, is exactly the same as an ordinary spur gear, as is clearly shown at A in Fig. 2.

Helical Gears Operating in Angular Relations to Each Other

Other forms of helical gears, which we will not deal with here, operate on shafts that are set in angular relations to each other (see B, Fig. 2). This form of helical gear is

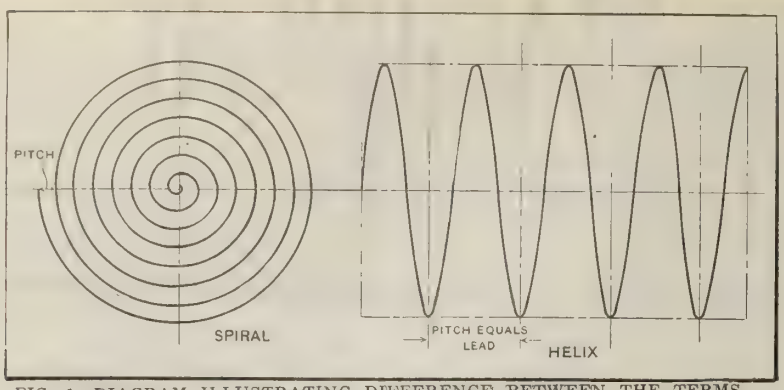


FIG. 1 - DIAGRAM ILLUSTRATING DIFFERENCE BETWEEN THE TERMS SPIRAL AND HELIX.

used to drive shafts located at angular relations to each other, and is sometimes used to take the place of a worm and worm-wheel. The action of this form of gear differs considerably from the action of a helical gear operating on parallel axes, in that there is not full-tooth length contact. Theoretically speaking, there is nowhere near as much contact of the teeth on helical gears set at right angles as there is between a worm and a worm-wheel

We will in the following devote our entire attention to that form of helical gear operating on parallel axes, as its use is more general.

Herringbone Gears

The herringbone gear does not differ essentially from the helical gear, except in one feature; viz., that of having opposed helical teeth, one right- and the other left-hand. This form of gear is so constructed that the end thrust, due to the twisted shape of the teeth, is consumed within the gear itself, and hence thrust bearings are not necessary. Herringbone gears of wide face and slight helix angles give very efficient results; but narrow-faced, steep-helix herringbone gears are objectionable, as will be explained more fully later on. Herringbone gears, as shown in Table II, are made in two types; that is, with "matched" and "staggered" teeth. When the teeth are staggered, the face width need be only one-half of that necessary when the teeth are matched.

Tooth Action of Helical Gears

Helical gears operating on parallel axes give smoother action than ordinary spur gears. In a spur gear there are three distinct phases of engagement, as follows:

1. The root of the (driving) pinion engages the point of the gear tooth.
2. The teeth are in engagement in the vicinity of the pitch line.
3. The point of the (driving) pinion tooth engages the root of the gear tooth.

From this it will be seen that with spur gearing, the teeth are in engagement only at the pitch line for a small part of their rotation, so that the greater part of the load is carried by the points and roots of the teeth.

Suppose we take two spur gears and rivet them together, setting the teeth of one in advance of the other, a distance equal to one half the circular pitch. We now have six instead of three phases of engagement. By carrying this still further and using a series of laminated gears, as shown in Fig. 3, we greatly increase the number of phases of engagement; until if it were possible to use a series of laminations of infinitesimal thickness we would have continuous engagement at the pitch line.

We now have a helical gear, because if we consider the laminations of infinitesimal thickness, the pitch point of action of the gears has developed into a helix, and if this has an advance equal to the circular pitch in the face width of the gear, we have what is known as "continuous helical action." It should be understood, however, that as far as the length of the line of action is concerned, this is the same as for two spur gears of the same pitch, tooth length, etc. The essential difference between a spur and a helical gear lies in the fact that helical gears, when properly designed and cut, are always in contact at the pitch line in some one plane. As the action between gear teeth is a purely rolling one at the pitch line, it can be clearly seen that from the standpoint of efficiency, the helical gear is superior to the ordinary spur gear.

Above and below the pitch line, the teeth slip upon each other and it is for this reason that certain indeterminate shocks sometimes develop in the use of spur gears, and more especially when they become worn, so that the back lash is considerable. With contact always at the pitch line and in some one plane as is the case with helical gears, these shocks are done away with. Furthermore since the teeth slip above and below the pitch line, more wear takes place at these points than at the pitch line, and the effect of this is to constantly throw the load to the pitch line where the action is best.

Methods of Producing Helical Gears

There are only two recognized methods of producing helical gears; viz., forming and generating. Previous to the design of equipment for generating helical gear teeth, this form of gear was always cut on a universal milling machine by using the index head and change gears arranged to give the proper helix. When only a small number of gear are required of any one particular shape and size, this method is in some cases still used.

For the production of quiet and efficient-running helical gears, this method has several disadvantages. We need not go into them in detail, except, so far as to say that it is difficult by this method to obtain teeth that are evenly spaced, tooth shapes that are perfect involutes, and helix angles that are duplicates.

Generating of Helical Gears

The other method of producing helical gears is by means of generating. There are several ways in which this is accomplished, but in the following we will deal exclusively with the Fellows Gear Shaper method of producing gears.

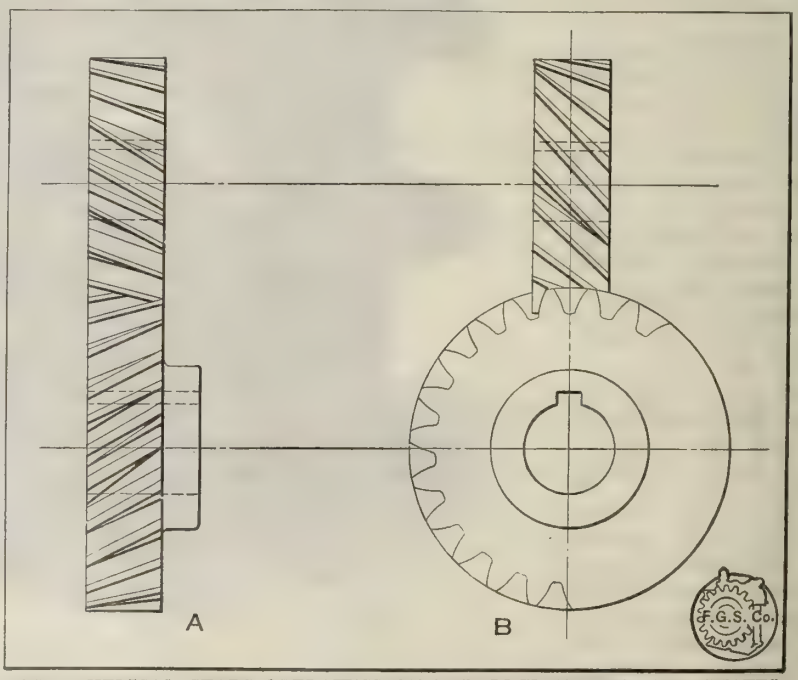


FIG. 2—HELICAL GEARS OPERATING ON PARALLEL SHAFTS, AND SHAFTS LOCATED AT RIGHT ANGLES TO EACH OTHER.

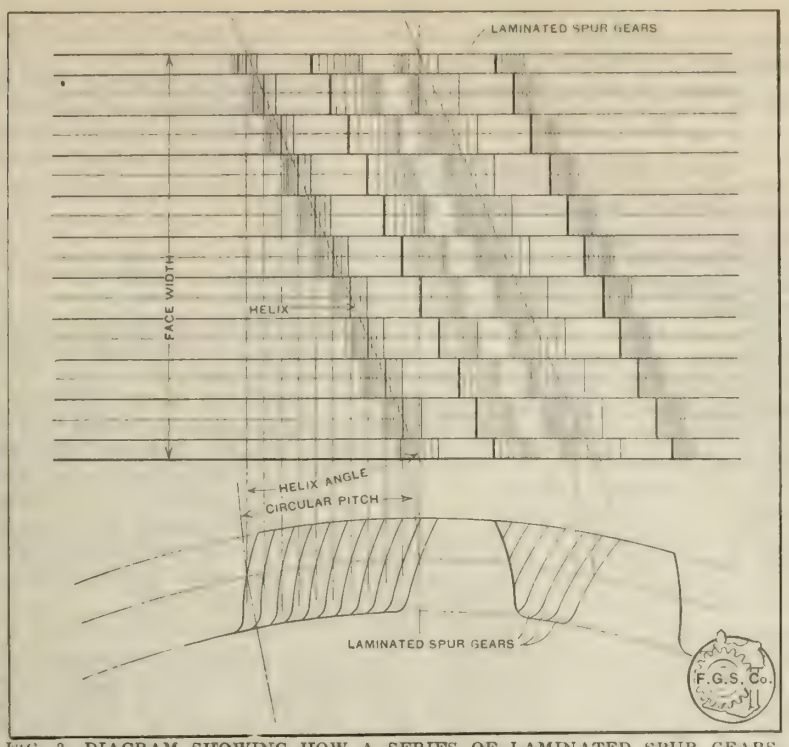


FIG. 3—DIAGRAM SHOWING HOW A SERIES OF LAMINATED SPUR GEARS WITH THE TEETH SET AT AN ANGLE GIVE THE SAME TOOTH ACTION AS A HELICAL GEAR.

In order to thoroughly understand this principle, we will refer to Fig. 4. This shows diagrammatically a helical gear in mesh with a plastic blank. Now, if we hold this plastic blank and roll the helical gear around it, we produce in the plastic blank similar helical teeth to those on the gear.

By replacing the plastic blank with an iron or steel gear blank and the gear with a helical Gear Shaper cutter, we can cut helical teeth in the blank by simply rolling the two together, meanwhile reciprocating the cutter back and forth, and at the same time guiding it in its proper helical path. This, essentially, is the principle upon which the Fellows Helical Gear Shaper operates.

Now, it should be noted in this connection that the cutter in its action on the work is not controlled in its helical path by means of a series of change gears or any other flexible device. Instead, the path, through which the cutter travels, is controlled by means of two helical guides which are exact duplicates of the helix angle on the cutter. It is evident from this that with properly machined guides it is possible to produce any number of helical gears which will have exactly the same helix angle. This is not possible when flexible devices are used. Consequently, it is easy to see that the helical Gear Shaper principle is ideal from the standpoint of accuracy.

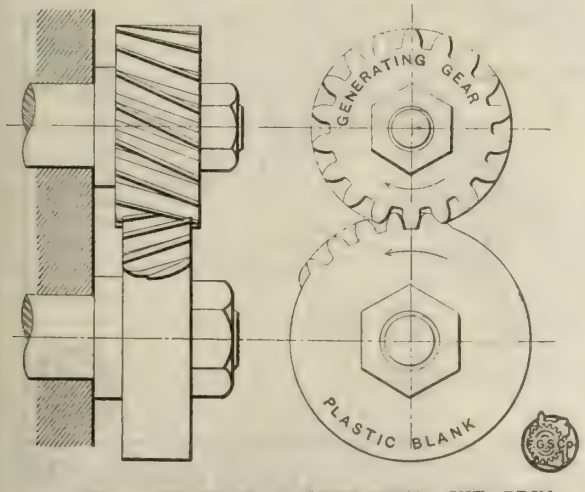


FIG. 4—DIAGRAM ILLUSTRATING THE PRINCIPLE UPON WHICH THE FELLOWS HELICAL SHAPER OPERATES.

Furthermore, we might state that the cutter, which is made from high-speed steel, is ground all over after hardening, including the involute curves on the cutter teeth, which are generated by means of a special grinding process. This removes all inaccuracies due to hardening, and produces a helical cutter which in reality is a laboratory product made in commercial quantities.

Design of Helical Gears

In designing a helical gear, it is very important to consider two things,—first, pitch and, second, helix angle. As will be explained further on, a change in the helix angle changes the so-called normal pitch, also the circular pitch, pressure angle and tooth thickness. The only possible disadvantage to the helical gear is that it creates an end thrust. This is due to the fact that the teeth are located in a helical plane and act somewhat similar to that of two inclined planes, working upon each other. With a slight helix angle, however, and a fine pitch, the end thrust is practically negligible; but when the helix angle is steep, then the end thrust becomes considerable.

Diametral and Normal Planes

There is one distinction between a helical and a spur gear which seems to confuse the average mechanic, and that is, that a helical gear can be viewed from two planes, commonly known as normal and diametral. The diametral plane of a helical gear, as shown in Fig. 5, refers to the outline of the tooth as it is viewed from a position parallel with the face of the gear. The normal plane is the shape of the tooth lying

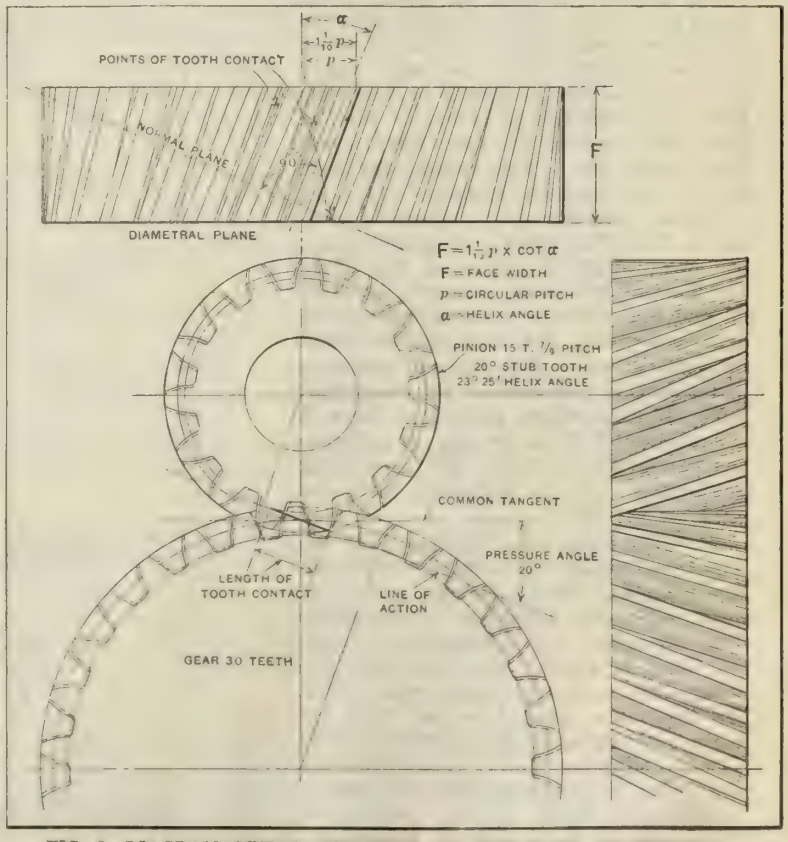


FIG. 5. DIAGRAM GIVING NOTATION OF ELEMENTS OF HELICAL GEAR TEETH

in a plane at right angles to the helix angle of the tooth. For this reason, a helical gear tooth is always thinner on the normal plane than it is on the diametral plane; also, the pressure angle and circular pitch are less on the normal than on the diametral plane.

It is the practice when cutting helical gears by the formed cutter or hobbing process, to consider the form of the tooth as viewed from the normal plane only, and not from the diametral plane. This necessitates calculation of the tooth elements on the normal plane, and to those unfamiliar with helical gearing presents a difficult problem.

With the Fellows Gear Shaper system just the reverse is the case, a helical gear is considered in all of its essential tooth elements exactly as a spur gear. The reason for this is that the Gear Shaper cutter tooth is ground so that it is of standard tooth thickness on the diametral plane, and hence cuts a gear which is correct in every respect whether it be viewed from the normal or diametral plane. For this reason, a helical Gear Shaper cutter is essentially nothing but a spur cutter with the teeth twisted. In the helical cutter, the faces of the teeth are ground at right angles to the helix, and a rake angle of five degrees is provided on the top faces of the teeth to make them free-cutting.

Relation Between Width of Face and Helix Angle

As the width of face of a helical gear and its pitch govern the helix angle of the tooth necessary to give continuous action, it is therefore evident that there is a distinct relation between these three factors,—width of face, helix angle and pitch. With a helical gear we are not so closely limited to the selection of a certain pitch as we are with a spur gear, for the reason that a helical gear tooth is considerably stronger than a spur gear tooth of the same pitch, pressure angle, etc. The reason for this will be subsequently explained.

We can also prove by a diagram similar to that illustrated in Fig. 6, that as the helix angle is increased, the effective load on the tooth is greatly increased and that there is a certain point—45 degrees—where the load on the tooth becomes so great that the end thrust is equal to 41½ per cent. of the tangential load. It is therefore plain that there is a considerable force tending to separate the two gears, and that this separating action also imposes a greatly increased load on the tooth.

We also know that the angle of repose for metals in contact varies between ten and fifteen degrees, and as we have previously explained in connection with the action of the helical gear tooth, the load is carried on the pitch line where the teeth roll upon each other. At the same time, however, that the teeth are rolling at the pitch line, there is also slippage taking place between the point of one tooth and the root of the mating tooth, or vice versa, and this friction to a certain extent—especially when the helix angle is slight—tends to reduce the axial thrust.

Relation Between Axial Thrust and Helix Angle

It is difficult if not almost impossible to determine mathematically the exact relation between axial thrust and helix angle of helical gears. If we investigate this subject we see that friction plays no unimportant part in this connection; and as correctly designed helical gears are always in contact at the pitch line at the same time that the teeth are slipping upon each other in some other plane, it is difficult to determine exactly just what part friction plays in reducing axial thrust.

For all practical purposes we can eliminate the part that friction plays and look at the subject from a theoretical angle. Reference to Fig. 6 will show that the tangential load c on the tooth can be resolved into two components a and b. a represents the total tooth load and b the axial thrust. By the law of triangles a is secant of angle a and b the tangent. Therefore, the secant of the helix angle times the tangential load gives the total tooth pressure on the normal section: Rule No. 1; and the tangent of the helix angle times the tangential load gives the axial thrust: Rule No. 2.

Assume, for example, that we desire to find the total tooth load and the axial thrust of a pair of helical gears having a helix angle of 15 degrees and carrying a tangential tooth load of 500 pounds.

Total tooth load = secant 15 degrees × 500 = 1.0353 × 500 = 517.6 pounds.

Axial thrust = tangent 15 degrees × 500 = 0.2679 × 500 = 133.9 pounds

If we still further increase the helix angle as shown at B and C in Fig. 6, we also greatly increase the total tooth load, and the axial thrust; until if the angle is increased to 45 degrees, the axial thrust equals the tangential tooth load and the total tooth load becomes 41½ per cent. greater than the tangential tooth load.

In addition to imposing a greatly increased load on the tooth, a steep helix angle also reduces the cross-section of the tooth on the normal plane, and hence weakens it, thus making it less capable of carrying the greatly imposed load. This can be clearly seen at D, E and F, Fig. 6, where the outlines of the

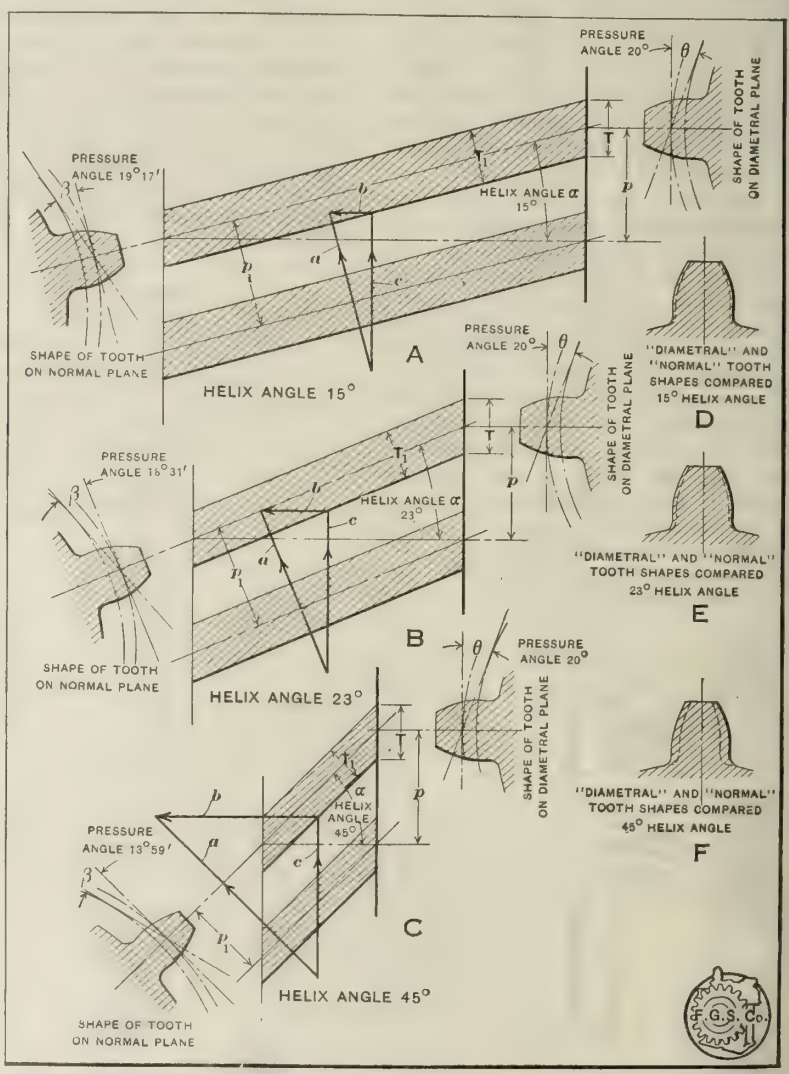


FIG. 6—DIAGRAM SHOWING HOW AN INCREASE IN THE HELICAL ANGLE GREATLY INCREASES THE AXIAL LOAD. DIAGRAM ALSO SHOWS RELATION OF ACTUAL TOOTH LOAD TO AXIAL THRUST

tooth on the normal and diametral planes have been superimposed for comparison. It is therefore evident that a moderate helix angle is to be desired in order that the axial thrust may be kept within practical limits.

Rules and Formulas for Calculating Elements of Helical Gear Teeth

There are two methods of figuring the elements of helical gear teeth. One is to calculate the elements of the teeth on the normal plane and the other on the diametral plane. For helical gears cut by the Gear Shaper method, the tooth parts can be calculated on the diametral plane in the same manner as an ordinary spur gear, thus greatly simplifying the calculations. When it is necessary, however, to change over from normal to diametral, or from diametral to normal, then certain rules and formulas have to be employed. Table I gives rules for calculating the elements of helical and herringbone gears.

Lead: The lead of a helical gear equals the pitch diameter times 3.1416, divided by the tangent of the helix angle. Rule No. 3.

Example: Assume that a helical gear has a pitch diameter of 3.5 inches and a helix angle of 23 degrees.

Then lead equals

$$\frac{3.1416 \times 3.5}{\text{Tan. 23 degrees}} = \frac{10.9956}{0.42447} = 25.904 \text{ ins.}$$

To find the tangent of the helix angle when the lead and pitch diameter are known, multiply 3.1416 by the pitch diameter and divide the result by the lead: Rule No. 4.

Example:

$$\frac{3.1416 \times 3.5}{25.904} = 0.42447 = \text{tangent } 23^\circ$$

Normal Circular Pitch (p_1): When the circular pitch (diametral) and the helix angle are known, the normal circular pitch can be found by multiplying the circular pitch by the cos. of the helix angle: Rule No. 5.

Example: Find the normal circular pitch of a 6-pitch gear, the diametral circular pitch being 0.5236 inch and the helix angle 23 degrees. Cos. of 23 degrees equals 0.9205.

$0.5236 \times 0.9205 = 0.48197$ inch, circular pitch (normal).

Circular Pitch (p): When the normal circular pitch and the helix angle are known, the circular pitch (diametral) can be found by dividing the normal circular pitch by the cos. of the helix angle: Rule No. 6.

Example: Find the circular pitch (diametral) of a 6-pitch gear, the normal pitch of which is 0.48197 inch and the helix angle 23 degrees.

$$\frac{0.48197}{0.9205} = 0.5236 \text{ inch circular pitch.}$$

Normal Diametral Pitch (P_1): When the diametral pitch and the helix angle are known, the normal diametral pitch can be found by dividing the diametral pitch by the cos. of the helix angle: Rule No. 7.

Example: Find the normal diametral pitch of a 6/8-pitch helical gear having a helix angle of 23 degrees.

$$\frac{6}{\cos. 23^\circ} = \frac{6}{0.9205} = 6.5182 \text{ normal diametral pitch}$$

Diametral Pitch (P): When the normal diametral pitch and the helix angle are known the diametral pitch can be found by multiplying the normal diametral pitch by the cos. of the helix angle: Rule No. 8.

Example: Find the diametral pitch of a helical gear the normal diametral pitch of which is 6.518 and the helix angle 23 degrees.

$6.518 \times \text{cos. } 23^\circ = 6.518 \times 0.9205 =$ 6 diametral pitch.

Pitch Diameter (D): The pitch diameter of a helical gear is obtained by the same formula as that used in obtaining the pitch diameter of an ordinary spur gear, Rule No. 9.

Normal Tooth Thickness (T_1): When the normal diametral pitch is known, the normal tooth thickness on the pitch line is found by dividing 1.5708 by the normal diametral pitch: Rule No. 10.

Example: Find the normal tooth thickness of a helical gear, the normal diametral pitch of which is 6.5182.

$$\frac{1.5708}{6.5182} = 0.2410 \text{ inch normal tooth thickness.}$$

Tooth Thickness, Diametral (T): When the normal tooth thickness and the helix angle are known, the tooth thickness at the pitch line on the diametral plane can be found by dividing the normal tooth thickness by the cos. of the helix angle: Rule No. 11.

Example: Find the tooth thickness on the diametral plane of a helical gear, the normal tooth thickness of which is 0.2410 and the helix angle 23 degrees.

$$\frac{0.2410}{0.9205} = 0.2618 \text{ inch tooth thickness.}$$

Normal Pressure Angle (B): When the pressure angle on the diametral plane and the helix angle are known, the tan. of the normal pressure angle is found by multiplying the tan. of the diametral presure angle by the cos. of the helix angle: Rule No. 12.

Example: Find the normal pressure angle of a helical gear, the diametral pressure angle of which is 20 degrees and the helix angle 23 degrees. Tan. 20 degrees equals 0.36397. Tan. $B = 0.36397 \times 0.9205 = 0.3350 =$ approximately 18 degrees 31 minutes, normal pressure angle.

Pressure Angle, Diametral (Θ): When the normal pressure angle and the helix angle are known, the tan. of the actual pressure angle is found by dividing the tan. of the normal pressure angle by the cos. of the helix angle: Rule No. 13.

Rule No.	Tooth Element Wanted	Rule	Formula
3	Lead (L)	Multiply pitch diameter by 3.1416 and divide result by tan. of helix angle	$L = \frac{3.1416 \times D}{\tan. a}$
4	Helix Angle (a)	Multiply pitch diameter by 3.1416 and divide result by lead	$\text{Tan.}(a = \frac{3.1416 \times D}{L}$
5	Normal Circular Pitch (p_1)	Multiply diametral circular pitch by cos. of helix angle	$p_1 = p \times \cos. a$
6	Diametral Circular Pitch (p)	Divide normal circular pitch by cos. of helix angle	$p = \frac{p_1}{\cos. a}$
7	Normal Diametral pitch (P_1)	Divide diametral pitch by cos. of helix angle	$P_1 = \frac{P}{\cos. a}$
8	Diametral Pitch (P)	Multiply normal diametral pitch by cos. of helix angle	$P = P_1 \times \cos. a$
9	Pitch Diameter (D)	Divide number of teeth by diametral pitch	$D = \frac{N}{P}$
10	Normal Tooth Thickness (T_1)	Divide 1.5708 by normal diametral pitch	$T_1 = \frac{1.5708}{P_1}$
11	Tooth Thickness Diametral (T)	Divide normal tooth thickness by cos. of helix angle	$T = \frac{T_1}{\cos a}$
12	Normal Pressure Angle (β)	Tangent of normal pressure angle equals tan. of diametral pressure angle times cos. of helix angle	$\text{Tan. } \beta = \text{tan. } \theta \times \cos. a$
13	Pressure Angle "Diametral" (θ)	Tangent of "diametral" pressure angle equals tan. of normal pressure angle divided by cos. of helix angle	$\text{Tan. } \theta = \frac{\text{tan. } \beta}{\cos. a}$

TABLE I.—RULES AND FORMULAS FOR CONVERTING FROM NORMAL TO DIAMETRAL PITCH FOR HELICAL AND HERRINGBONE GEARS.

Example: Find actual pressure angle of a helical gear, the normal pressure angle of which is 18 degrees 31 minutes and the helix angle 23 degrees.

$$\frac{0.3350}{0.9205} = 0.36397 = \text{tan. of } 20°$$

Owing to the twisted shape of a helical gear tooth, difficulty is generally experienced in using the gear-tooth caliper, in order to obtain the chordal tooth thickness and the corrected addendum. For this reason, it is always advisable to check the tooth parts of a helical gear by holding two gears on a standard testing fixture. In this way the tooth parts can be checked with relation to the centre distance, which can be obtained by measuring over the pins with a regular micrometer caliper.

The centre distance of two helical gears would be exactly the same as two spur gears of the same pitch, tooth ratio and tooth shape. The helical-gear problem can be greatly simplified by ignoring the fact that the teeth are twisted and considering it as though it were an ordinary spur gear. The Gear Shaper method of cutting helical gears is based on this principle.

Gear Shaper Standards for Helical Gears

At the present time there is no fixed standard for helical gears, but the economical production of this form of gear makes the adoption of some standard desirable. We will therefore discuss some of the factors that enter into this problem and explain why the adoption of a standard for helical gears is desirable. We will also show further on the disadvantages of a steep helix angle, especially from the standpoint of increased end thrust and decreased strength.

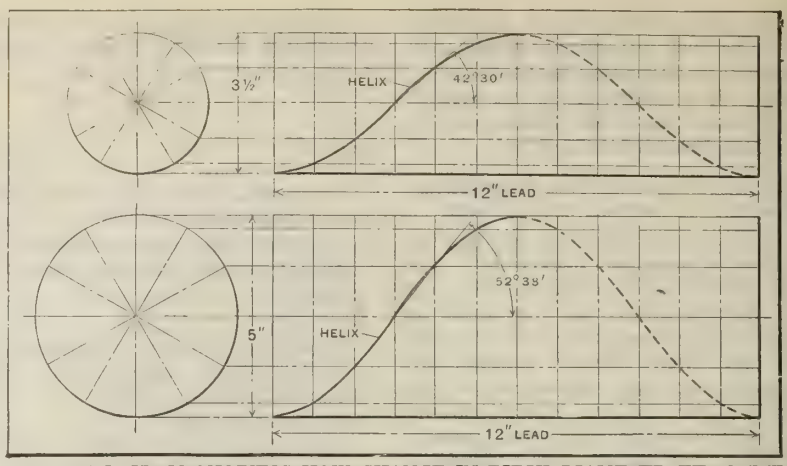


FIG. 7.—DIAGRAM SHOWING HOW CHANGE IN PITCH DIAMETER WITH THE SAME LEAD PRODUCES A DIFFERENT HELIX ANGLE.

Before the introduction of the helical Gear Shaper, the only practical means of cutting helical gears was by the hobbing process. The standard spur gear hobs were made to cut diametral pitches and because of convenience it has become common practice to use the same hob for cutting helical gears. The result is that if a 6-pitch hob be adjusted to feed at the necessary angle to cut a helical gear, it cuts a 6-pitch gear only when measured on the normal section (see Fig. 5) at right angles to the helix of the tooth. Its normal pitch is 6, but measured diametrally it is something fractional, depending upon the helix angle of the tooth. The diametral pitch, therefore, changes with every change of the helix angle.

It, therefore, comes about that in many cases with helical gears all of the advantages of the diametral-pitch system have been discarded and the normal pitch with its attendant complications of calculations has been substituted. The Gear Shaper system, in which the helix angle is fixed, lends itself particularly well to the cutting of diametral pitch gears, and because the helix angle is never adjusted, the relation between the pitch and the number of teeth is fixed, as is the case with spur gears; for this reason the use of the normal pitch disappears. We have explained in a previous paragraph what it meant by the normal pitch, also how it is possible to calculate the tooth section on the normal plane, when such is desirable.

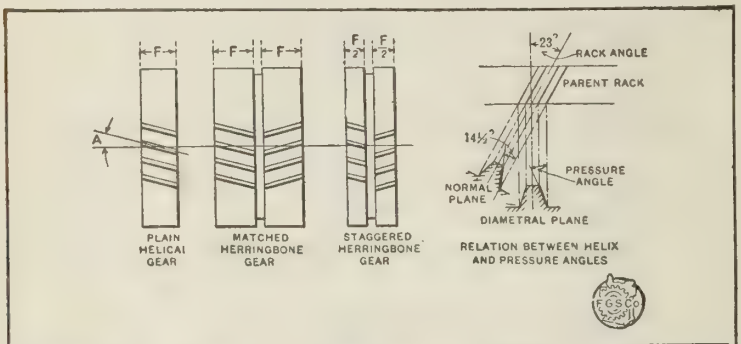
For helical gears The Fellows Gear Shaper Company has adopted the stub-tooth as its standard, and two leads giving one turn in 41.207 inches and 25.904 inches respectively. Table II gives a list of the pitches and angles for which standard right and left-hand helical cutters are made. Two standard helical guides have been adopted, as previously stated, and these give approximate helix angle of 15 and 23 degrees, respectively. The reason for the slight variations in these angles for the various pitches is due to the fact that with a nominal pitch diameter of 3½ inches (which is the approximate pitch diameter of all helical cutters) it is not always possible to get a whole number of teeth in the cutter, so that the pitch diameter has to be either larger or smaller. This, of course, changes the helix angle slightly when a standard lead is used.

For example: 4, 6, 8 and 10 pitch, etc., when multiplied by a pitch diameter of 3.5 inches gives a whole number of teeth such as 14, 21, 28 and 35 teeth in the cutter; but 5, 7 and 9 pitch do not give a whole number of teeth, so that for these particular pitches we increase the pitch diameter. This changes the helix angle slightly.

For the information of those to whom this subject appears difficult, we have prepared a diagram, which is illustrated in Fig. 7. This shows why, with the same lead and an increase in the pitch diameter, the helix angle becomes greater.

At A we have a pitch diameter of

The Fellows Gear Shaper Company Standard



Diametral Pitch	Normal Pitch	Helix Angle "A"	Lead of Helix in Inches	Minimum Width of Face "F" in Inches
5/7	5.184	15°–20′	41.270	$2\frac{19}{64}$
5/7	5.456	23°–35′	25.904	$1\frac{7}{16}$
6/8	6.209	14°–55′	41.270	$1\frac{31}{32}$
6/8	6.518	23°	25.904	$1\frac{15}{64}$
7/9	7.254	15°–12′	41.270	$1\frac{21}{32}$
7/9	7.629	23°–25′	25.904	$1\frac{5}{64}$
8/10	8.279	14°–55′	41.270	$1\frac{31}{64}$
8/10	8.691	23°	25.904	$\frac{15}{16}$
9/11	9.324	15°– 9′	41.270	$1\frac{19}{64}$
9/11	9.801	23°–20′	25.904	$\frac{13}{16}$
10/12	10.349	14°–55′	41.270	$1\frac{3}{16}$
10/12	10.863	23°	25.904	$\frac{3}{4}$
12/14	12.418	14°–55′	41.270	$\frac{63}{64}$
12/14	13.036	23°	25.904	$\frac{5}{8}$

TABLE II.—MINIMUM WIDTH OF FACE FOR CONTINUOUS HELICAL ACTION OF HELICAL AND HERRINGBONE GEARS.

3½ inches and a lead equal to one turn of the cylinder in 12 inches. This develops a helix angle of 42 degrees 30 minutes. If we increase the pitch diameter or diameter of the cylinder, as illustrated at B, to 5 inches and use the same lead of one turn in 12 inches, we find that our helix angle is greatly increased, and instead of being 42 degrees 30 minutes, it is 52 degrees 38 minutes. We therefore see that by using the same lead, but increasing the pitch diameter, we change the helix angle.

The two standard leads previously given cover practically all requirements that are met with in the design of helical gears. When the face width is not limited to any particular dimension, a helix angle of 15 degrees is recommended, but when the face width (which for average cases should be equal to from 2½ to 3 times the circular pitch) is limited, then 23 degrees is sometimes found desirable. Helix angles greater than 23 degrees cause excessive end thrusts, and in addition impose greatly increased loads on the tooth. Table II gives the minimum face width for the different pitches and helix angles. The face width should never be less than the dimension given and preferably should be wide enough so as to give an advance in the face width equal to 11-10 times the circular pitch.

(To be continued)

Quick Action Device for Jig and Fixture Work

By ROBERT MAWSON

CASES sometimes occur when designing jigs and fixtures, that a part of the piece being held projects forward of the locating surface.

Under these conditions, if the ordinary type of screw were used, much time would be lost in moving the adjusting medium out of the way, so that the part could be removed from the jig or fixture.

It need scarcely be said that such a procedure is bad practice as it would defeat one purpose of special tools, namely, quick action.

In Fig. 1, at A, is shown a locating surface represented by a single line. At B is also shown a protruding surface which is under the surface A.

It is obvious that before such a part could be removed from the tool the screw must be drawn back past the surface B.

A quick acting device designed for such conditions as outlined, as shown assembled in Fig. 1. This is made of steel and may be hardened, if desired, with a circular body C, which is made a sliding fit in a machined hole of the jig or fixture wall.

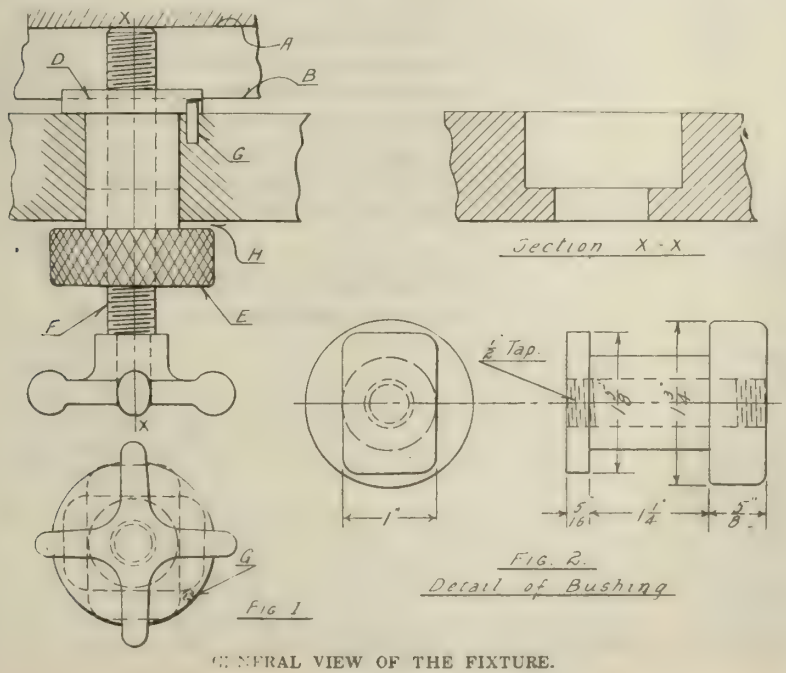
At the rear of the circular portion is a rectangular part D, one dimension being the same as the diameter of body C. At the forward end is a circular knurled part shown at E and a threaded hole is machined through the centre of this device.

The wall of the jig or fixture casting is milled out with a slot which must be at least as wide as the longest side of the end D, and as deep as the distance A to B. The construction of this operation is shown by the section X X.

When it is desired to draw back the screw F, it is given a slight turn to the left (the screw being right hand), which removes the pressure from the piece. The knurled part E is then given a quarter turn to the left which will bring the wide portion of the end D in line with the slot in the casting.

The bushing and screw can then be drawn back into the jig wall so that the part can be lifted out of the jig or fixture without interference. A locating pin G is driven into the wall of the tool and is used to locate the bushing in the proper position for operating.

A detail of the bushing is shown at Fig. 2 and its construction can readily be followed when used in connection with the description here given. Another feature should be mentioned, namely, the leaving of a slight clearance H between the wall of the tool and the bushing. This enables the bushing to be easily drawn back or forward when descending, the pressure of the screw always forcing the bushing against the rear wall. This device can be used for various sizes of screws.



GENERAL VIEW OF THE FIXTURE.

WELDING BELL METAL

Bell metal is usually composed of about 80 per cent. copper and the balance tin, with the addition of small amounts of other metals to produce tone. The proportions of copper and tin produce a very hard and brittle metal, one which becomes increasingly harder to handle in very large bells. A bell weighing as much as 1,500 pounds, for instance, is cast very thick, not for strength but for foundry reasons. This type of bell will cool very slowly and should be handled carefully.

To weld, first V out the crack and drill a small hole at the theoretical extension of the crack. This will prevent further cracking. Place the bell on a fire-brick platform, supported above the platform by fire-bricks. Heat the bell carefully and slowly. When it is hot enough to melt lead, choke off the fire. Be sure that the supports under the bell are so arranged that no part of the bell sags. Proceed to weld in the usual way for brass or bronze, using a Tobin Brone rod. A special rod, of the same metal as the bell, would be better. The line of the weld should be slightly overcharged. Allow the bell to cool very slowly. When cool, clean up the line of the weld. After the bell has entirely cooled, it is said that the original tone may be entirely restored by again heating the bell as before, after which it is cooled suddenly with cold water. Large bells may be cooled by using two or three lines of hose.—"Welding Engineer."

Telling the Story of Safety by Moving Pictures

You Seldom Find Any Plant Inviting Their Employees to a Movie Show in Working Hours, But Here is One Case Where Not Only Do They Invite Them to the Show, But Actually Pay Them Real Money to Go and See It

By J. H. MOORE

THE prevention of unnecessary accidents is something in which the International Harvester Co. have always been interested. They have at the present time various safety councils, committees, etc., but in the writer's opinion their newest effort to educate their various workmen by means of the movies is worthy of special consideration.

They have prepared in two-part form a moving picture story of Old King Carelessness and his seven little imps. This scenario was written by David S. Beyer, chief engineer of the Liberty Mutual Insurance Company, and was adopted by the International Harvester Co. for use throughout their plants.

The picture is entitled "The Outlaw," and is presented in true movie form. Briefly, the manner of presentation is as follows:

Mr. Christie, who is chief safety engineer for this company, travels around through the various plants showing his safety story. On arriving at a plant, the general manager and himself map out a program of hours in which the various departments can view the film. For example, they accommodate from 100 to 150 persons at a time, and the picture takes a little over an hour to show.

Certain departments are grouped together and informed as to the time set aside for their viewing the picture. They are also acquainted with the fact that they will be paid at regular rates while attending the performance, and that it will therefore make no difference in their wages. Who wouldn't attend a movie show in place of working?

In this way the employees are doubly interested, for they cannot help but realize that if the firm is willing to pay them for sitting watching a picture, there must be something worth while looking at.

Of course, as can be understood, Mr. Christie is accompanied by a capable operator, with all necessary paraphernalia to show the film to advantage.

As employees enter the portion of plant set aside to present the picture, they are handed a neat little booklet, describing the picture they are about to see. This booklet has so much matter of real value in it that we reproduce various pages for reader's perusal.

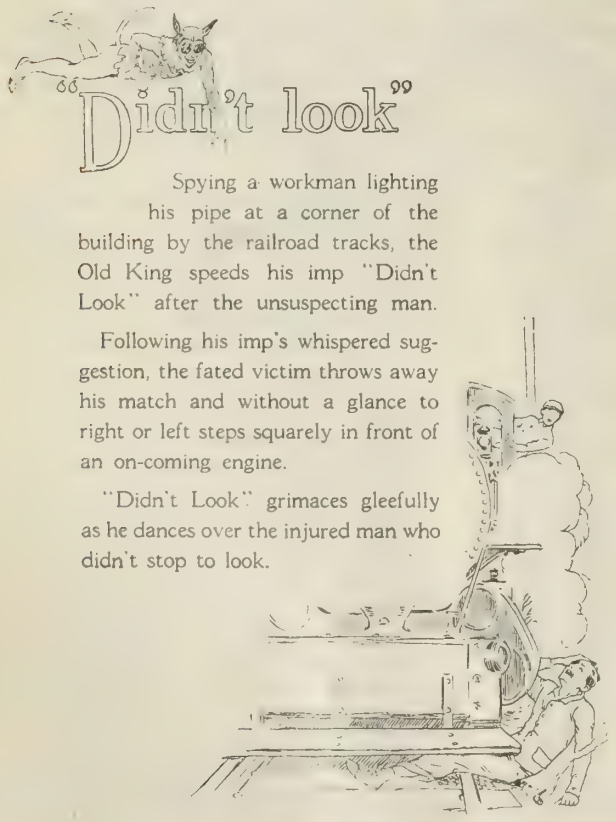
Now that we have described the method of interesting employees in the film, and the manner of its presentation, we will proceed with the story itself.

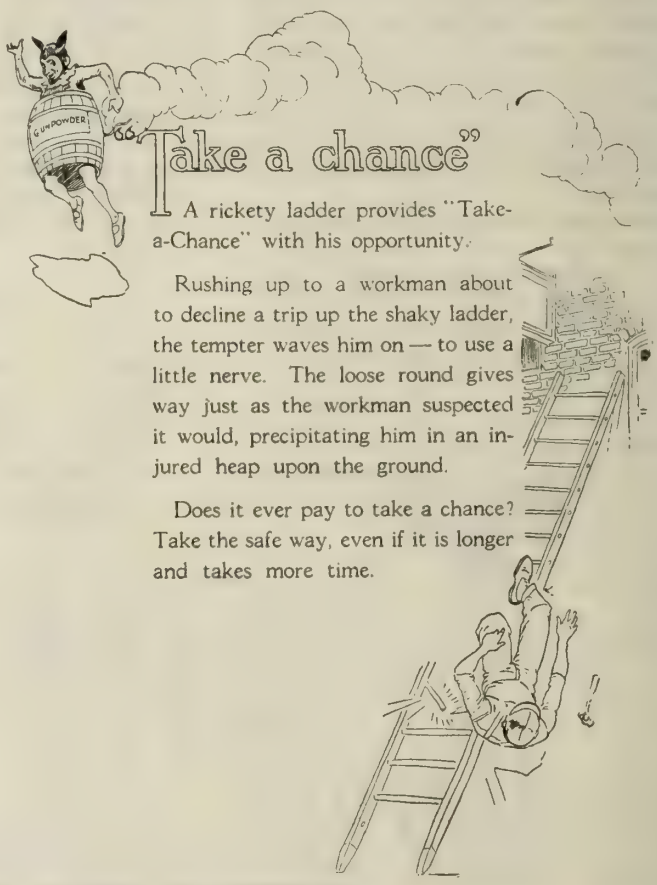
The Story of Old King Carelessness

The first thing which comes to view is a large-sized man, with a rather cruel looking face, who is called King Carelessness. He is seated on a throne, duly crowned, and holds as a sceptre a skeleton head. Having acquainted us who he is and what he stands for, he introduces his seven little imps, who are as follows:

"Didn't Think," "What's the Use," "Horse Play," "Inattention," "Didn't Look," "I Should Worry," and "Take a Chance." As he states himself, these knaves are his slaves, and delight in corrupting the good intentions of all workmen.

The plot of the story now begins in earnest. We see the King leading his imps out to the front of a building,





THE TWO ILLUSTRATIONS TELL THE STORY FOR THEMSELVES

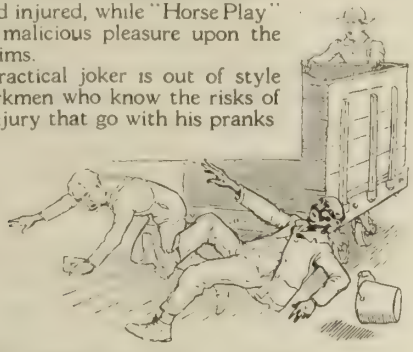


"Horse-play"

A practical joker is "Horse Play," who works best in the hearts of boys and young men, though he occasionally succeeds with the older ones.

As a boy comes thru the factory door, and stops to glance at the colored janitor leaning out of a window, "Horse Play" races to whisper a poisonous suggestion in the boy's ear. Thereupon the lad seizes a chunk of dirt and takes a shot, bringing his angry victim in full cry The lad is almost overtaken when they both run into a moving truck suddenly appearing out of a door Both are knocked down and injured, while "Horse Play" grins in malicious pleasure upon the two victims.

The practical joker is out of style with workmen who know the risks of bodily injury that go with his pranks



HERE IS HOW HORSEPLAY GOT TO WORK

which is labelled "Enny Mfg. Co." They decide that here is a good place to start their mischief, so stealthily creeping through the office of the plant, they get out into the factory itself, seeking unsuspecting workmen upon whom to practise their wiles.

"Didn't Look" Lands a Victim

The imp "Didn't Look" finds the first opportunity of creating damage. Spying a workman lighting his pipe at the corner of a building by the railroad tracks, Old King Carelessness speeds his imp in that direction.

Up runs the imp behind the man, whispering to him the suggestion that it isn't necessary to look where you are going.

Following the suggestion the unsuspecting victim throws away his match, and without a glance to right or left, steps squarely in front of an on-coming yard engine. He is crushed beneath its wheels, at which the imp runs back gleefully to his master to receive due praise for his efforts.

The complete scene is portrayed in such a natural manner that you cannot help but become convinced of the possibility of the same accident happening to even yourself in a careless moment.

"Take a Chance" Gets His Chance

The next scene depicted is that of a workman preparing to climb a ladder. On placing the ladder on the ground it is noticed that it is very shaky. The workman himself comments on this fact, and states that he doesn't like the look of it. The imp "Take a Chance" has been watching from a safe distance, and now gets his opportunity. Sliding up behind the workman he whispers, "Take a chance."

This the workman decides to do, and starts up the ladder. Half way up he meets in with a loose rung, and away it goes. So does the workman, who reaches the ground much quicker that he expected. He is, however, able to limp out of the picture, a sadder and a wiser man.

Once more we feel we should comment on the natural way these incidents are portrayed. Personally, the writer remembered one case where he himself took a chance which might have resulted in similar disaster.

The Danger of Horse Play

The third imp to start trouble is Horse Play. It is safe to say that Horse Play starts trouble in many a plant, but in this case the whole affair started with a boy coming through the factory door. Noticing the colored janitor leaning out of a window, Horse Play whispers the suggestion to the lad to have some fun at the janitor's expense.

Acting on the suggestion, the lad picks up a chunk of dirt and takes a shot at the janitor, bringing him after him full pelt. They both run, when suddenly a moving truck appears out of a door and runs them both down, injuring them to quite an extent.

Horse Play, having accomplished his object, prances off, while both workmen have, at serious cost, learned their lesson.

Inattention Scores a Point

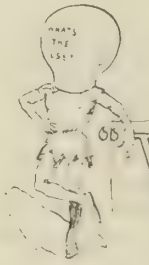
Inattention next gets his opportunity. Two men are carrying planks, tandem fashion, across the factory floor, when a pretty girl appears on the scene. "You don't need to pay attention to where you walk," says Inattention, and the men act on his suggestion, placing all their attention on the young lady. A pile of wood gets in their path, and down they go. The complete story is told so simply that it demands attention.

Oh, What's the Use!

We next meet with an old friend in the shape of the imp "What's the Use." We often use this expression; so now let us see how he works.

The scene depicts a workman about to start down a flight of stairs. At the head of these stairs is a warning to keep your hand on the rail as you go down. The workman reads this notice, but is tempted by our familiar imp, who whispers, "What's the use." The workman decides that the imp is right, and the notice wrong, so sticking his hands in his pockets, off he starts down the steps.

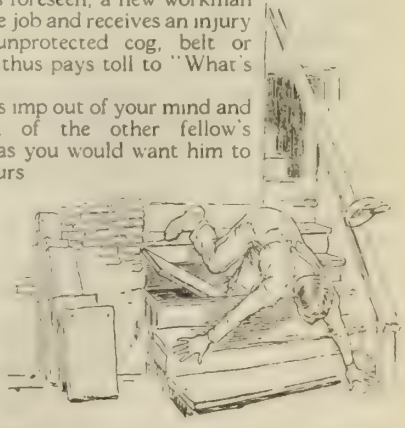
Partially down, he hits a loose step, and away he goes pell mell to the bottom, arriving at the floor in a dazed



"What's the use"

However strict and rigidly enforced are the rules regarding guards on dangerous parts of machines. "What's the Use" nevertheless finds frequent victims. He tempts the workman to leave off the guard after some necessary repair,—"Oh, what's the use of replacing the safeguard, you won't hurt yourself?" But tomorrow, as the little imp with uncanny sureness has foreseen, a new workman comes on the job and receives an injury from the unprotected cog, belt or pulley, and thus pays toll to "What's the Use."

Chase this imp out of your mind and life. Think of the other fellow's safety just as you would want him to think of yours



WE ALL KNOW HOW EASY IT IS TO SAY "WHAT'S THE USE

and injured condition. Of all the imps this "What's the Use" is certainly well known.

"I Didn't Think" Causes Trouble

Who hasn't said regretfully, "I didn't think," after some accident? In the case presented in the picture we see the elevator attendant reading baseball news and more interested in this than in his elevator. A workman on a lower floor starts his loaded truck on its way without a thought. He forgets to ring the warning bell, when suddenly the elevator starts when his truck is only partially on. Up



THREE VALUABLE AIDS TO SAFETY

goes the elevator, and down goes the workman to the bottom of the elevator shaft, with disastrous results.

Now Enters "I Should Worry"

Last, but not least, comes the work of that imp called "I Should Worry." We see two workmen piling castings outside in the factory yard. Suddenly one of the men gets his hand caught and bruised. His co-worker suggests that he go and see the doctor, but he pooh-poohs the idea, spits on the wounds, remarks that it's merely a bruise and that he should worry.

Blood poisoning, however, sets in, with the result that his arm has to be amputated. "I Should Worry," who has been always hovering near, grins his triumph on seeing the result of his work. At this point Part I comes to a close, while up comes the reassuring remark that "Safety First" comes into his own.

Enter the Safety Engineer

Part II opens up with the office staff of this concern busily engaged at work, when in comes the safety engineer. He is, of course, granted an interview with the manager, who expresses his surprise at the long list of accidents which have happened at his plant. He states that to the best of his belief he had thought Old King Carelessness had been kept out of the factory.

He cannot, however, dispute the evidence shown him, so on the advice of the engineer he decides to adopt the following plans:

Practical safeguards will be installed on all machines where needed.

All dangerous places will be guarded.

A works safety inspector will be appointed.

A central safety and workmen's safety committee will be organized.

Each workman will be asked for help in this campaign to eliminate accidents.

The foremen will be taught to take pride in running their departments without accidents.

Last, but not least, the safety committees will boost the cause of safety in every way, telling the workmen how accidents happen in other places, using the moving picture machine as a medium.

The plans are heartily endorsed, and a safety meeting started at once. The manager sends for his superintendent and other departmental heads, explaining to them the idea. The safety engineer clears a space on the wall and sets up his portable picture machine.

As soon as everyone is seated, the engineer starts the pictures with a scene of crippled men, some with arms off, others with legs and hands gone, or maimed by infection, eyes out, men on stretchers, on crutches, and others defective because of different industrial accidents.

He tells his audience that even should this procession keep going on, it would take eight days and eight nights for the crippled to pass who are maimed each year in the United States alone.

He next introduces some of his assistants who can fight King Carelessness. The warning gong that is used for trains, elevators, transfer cars and trucks, is shown. Then comes the signal bell, which is ideal for use at dangerous corners and buildings, and at railroad tracks, etc. Now comes safety railing, who delights in protecting unguarded corners, excavations, belts, cogs, gear, and other moving machinery.

We next see Safety Bulletin, who requests that you read his message carefully, as he tells of ways and means to prevent accidents. Lastly, along comes First Aid, who urges you to come to him at the slightest injury. These different characters are so ingeniously displayed that we reproduce them in this article for readers' benefit.

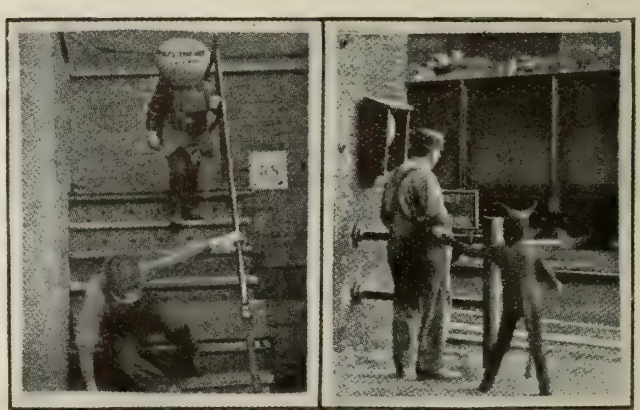
The Downfall of Carelessness

Having shown these various helps in overcoming carelessness, each foreman decides to co-operate in eliminating accidents throughout the plant.

The scene changes, going back over the same incidents that previously caused accidents. Up comes the same fellow who was seriously injured by the yard engine, and by a combination of safety sign, gong, and railing, the workman plays safe and does not listen to the temptings of the imp "I Didn't Look."

Next comes the incident of the stairway and the railing. By means of a safety bulletin the worker is convinced that it would be wise to keep his hand on the railing. On going down he strikes a loose tread, but as his hand is on the rail no harm results. He immediately obeys the instructions on the safety bulletin, which says that all dangerous spots should be reported to the safety committee. At once the loose tread is repaired, removing the danger.

We now see once more the two men unloading castings, the one chap getting his hand pinched as before. Being instructed in the need of care to any injury, no matter how slight, he goes to the doctor, receives first aid, and thus avoids infection. The imp "I Should Worry" tries to persuade the workman against this step, but without avail.



AFTER THE SAFETY ENGINE HAD GOT TO WORK

Having demonstrated the value of safety in these ways, the engineer remarks that safeguards, safety bulletins, clean passage ways, inspection, organization, can do a lot, but can only save about one-half of the accidents occurring in industry. Carelessness causes the other half. "If we expect to save workmen from injury we must drive out King Carelessness from every factory," says the engineer, when suddenly King Carelessness is found to be in the room, actually listening to the safety talk.

Continued on page 275

The Present Status of the Electric Furnace

The Electric Furnace Has Found Its Own Particular Sphere of Usefulness and With Increasing Knowledge of Its Capabilities It Will Become a Necessary Aid in the Iron and Steel Industry

By W. F. SUTHERLAND

THE electric furnace as a metallurgical instrument has come to stay. Its importance during the war was very evident, and the ease with which it handled troublesome raw materials such as shell turnings, together with the high quality and comparative cheapness of the resulting product, brought it very prominently to the fore. Extravagant claims have been put forward as to a possible revolution in the steel industry through its aid and, equally pessimistic views have been held as to the future of electro-metallurgy—the truth will probably be found midway between the two extremes and the future work of the electric furnace in the iron and steel industry will be the making of steel for the steel foundry, high grade and complex alloy steels and the refining of hot metal from the open-hearth and Bessemer. There are also excellent possibilities for its use in the making of steel direct from ores; this feature is dealt with at greater length below.

The crucible process, while one of the earlier methods of producing steel, has been almost superseded by the electric furnace. Several factors are responsible for this. The crucible process is expensive and at best can never handle large quantities unless an enormous plant is installed. It is also subject to metallurgical limitations which are absent in the electric process. In the latter the carbon content can be more accurately controlled and refining is possible to a far greater extent. The costliness of the former process is also obviated.

When the open-hearth or Bessemer is considered the advantages are not so apparent, at least in the quantity production of steel. For plants working from cold metal the electric furnace is ideal and is rapidly supplanting the Tropenas convertor and the smaller sizes of the open-hearth. Better steel results; the ease with which occluded gases are eliminated, the refining operations which can be carried on and the facility with which alloying additions can be made, all serve to give the electric furnace a very decided advantage. While good steel does not necessarily result from the electric furnace, since it in itself is only a means to an end and depends like everything else upon intelligent operation for best results, it is possible to produce a much superior steel than that obtained by the other processes mentioned. It must be remembered in this connection that the better the product the more it usually costs and the production of high-grade steel in the electric furnace necessarily costs more than a poorer quality. Cheaper grades of scrap, cheaper because of their physical condition, can be successfully handled, thus the familiar shell turning of bygone munition days made an admirable raw material.

While the electric furnace process will likely supplant other forms of steel making from cold scrap, it is unlikely that it will ever entirely supplant the Bessemer and open-hearth in the making of steel direct from the product, either hot metal or in pig form, of the blast furnace. Rather, it will become an adjunct to these types of furnaces, being used for finishing off the product resulting from their operation. The reason for this is apparent when the reduction of the carbon content of the blast furnace iron is considered. It is entirely possible to bring the carbon down, but the reactions resulting from the addition of ore for this purpose are not conducive to furnace life and the time taken greatly increases the power input required. Finishing off in the electric furnace is entirely practicable and is being practised to-day with material benefit to the physical properties of the resulting steel.

The Electric Smelting of Iron Ores

Much effort has been expended on the problem of making iron and steel direct from iron ores. In its essentials, simplicity itself, many difficulties have been encountered and the cheapening of the process to a point where it would be able to compete with the blast furnace has been a matter of extreme difficulty.

Many countries possess large deposits of iron ore together with abundant water powers, but little or no coal. For these countries electric smelting is ideal, and in one of them, Sweden, has been practised for some time successfully. The success achieved by present methods is only comparative however, and the industry depends entirely on peculiar local conditions for its continuance.

The electric smelting of iron ores differs from blast furnace practice in that only sufficient carbonaceous material is incorporated in the charge to reduce the ore and to give it the necessary carbon content. None is needed for the supplying of heat necessary for reduction, this being furnished by electric energy. A material saving in fuel is thus effected, and where this is imported at considerable expense the process is economically feasible.

The blast furnace suggested one line of attack and the furnaces used in Sweden at present are the outcome. These consist of a shaft and bush similar to those familiar in blast furnace practice, superimposed upon a hearth fitted with electrodes. The reduction is effected by carbon and a portion of the waste gases are recirculated. The electrodes are submerged in the charge and serve to furnish the heat for reduction to fluid metal. While the saving in fuel is important the consumption of power is considerable, ammounting to about 2,000 kw. hr. per metric ton.

The process also suffers from the further disadvantage of producing only pig iron. The iron produced under the best operating conditions is a white charcoal iron, and while of high grade, can only be used in the open-hearth as melting stock.

The direct production of steel from iron ore has been attempted by Stassano and others in the arc furnace, typified by the familiar types of the steel foundry, although differing from them greatly in design and construction. Here also a measure of success has been attained but at considerable expense, thus rendering the process economically impossible.

The true solution of the problem will be found in a discontinuous process—one in which the bath is subjected to the refining action of slag or other influences for the proper time. Furthermore the reduction of ore to the metallic state should be accomplished without the aid of electrically-produced heat. In addition to this the carbon content of the material changed into the electric furnace should be such as to eliminate a lengthy period for its adjustment.

The solution of the many difficulties surrounding the conversion of iron ore into steel without the aid of the blast furnaces and by the use of electric heat has been brought appreciably nearer solution by a method devised by J. W. Moffat of Toronto. An article descriptive of the process and outlining the patent claims appeared in CANADIAN MACHINERY last year, and a brief outline will be presented here.

The ore is first treated in a reducing furnace of comparatively low temperature in which it is deprived of its oxygen as completely as possible and is then in a physical form known as "sponge." This product is transferred, either hot or cold, into an electric furnace to be melted down and finished into metal. The finishing of the metal in the melting furnace makes the process a discontinuous one—more convenient in operation and more suitable for meeting trade demands.

The various phases through which the ore passes in its conversion into metallic sponge are of some interest. Hematite (Fe_2O_3) begins to be reduced at a temperature of about 300° C., and has been converted wholly into magnetite (Fe_3O_4) at a temperature of 450° C. This ore, with the natural magnetite in the charge, begins to be reduced to a ferrous oxide (FeO) at a temperature of about 500° C., and the reaction is complete at about 590° C. Ferrous oxide begins to be con-

Continued on page 65



WELDING AND CUTTING



Electric Arc Welding Equipment

(Continued from Feb. 26th issue.)

By H. L. UNLAND

For small work, the positive lead may be bolted to an iron plate forming the top of a work bench. The work may be set on this bench, the contact being sufficient to carry the current. A vise mounted on the table will often be found desirable. If the work is too large for the table it may be set beside the table and a bar laid across to it. This will provide sufficient current-carrying capacity, provided scale and rust do not prevent contact entirely. The rails in a round-house if bonded are usually connected to the positive lead, and any car on these tracks may be welded by running only the cable leading to the electrode, the return cable being unnecessary since the current will be carried back through the rails.

A convenient terminal for the positive cable consists of a copper hook of proper size to which the cable is bolted. The terminal may be laid on the work or hooked on a projecting part. It is seldom necessary actually to clamp the return lead to the work unless the metal is covered thickly with scale or dirt, which acts as insulation. Even here it is easier to chip or brush off a clean place for the contact than to use a clamp.

If welding is to be done in a room where other employees are doing other work, screens should be provided around the welding operator. They should be high enough to prevent the light striking much of the ceiling since the flicker of this light would probably affect the other workmen. The effect, while probably not injurious, would be irritating. White walls and ceiling should be avoided in a welding room.

Gas burners for pre-heating, and firebrick, sand, or sheet asbestos for covering, are useful, especially for cast iron work, which in many cases should be preheated uniformly to a red heat and welded while at this temperature. A receptacle for water is desirable, in which the electrode holder can be cooled when continued use makes it too hot.

Differences of Opinion

Some operators feel that gloves are necessary to protect the hands from the arc. Other operators, however, find gloves to be in the way, especially when working with the metallic electrode. If desired, however, any leather or cloth glove will give sufficient protection to the skin of the hands, which is much less sensitive that the skin on other parts of the body. The arms, neck and face should, however, be covered, since exposure of these parts will probably cause burns similar to sunburn. These burns, while painful, are not serious.

It is the experience of a great majority of welders that flux of any kind is unnecessary, and further, that it is a source of danger because it is likely to contaminate the weld. If the work is kept clean by brushing at frequent intervals and ordinary care is taken in the operation of the arc a good weld can be made without flux. If these precautions are neglected, flux will not make a good weld.

Cleanliness is a requisite for making a good, strong weld. Scale, rust, grease, soot, and foreign matter will contaminate the weld, and such inclusions necessarily weaken it or else make it hard. Impurities may also make the metal porous and spongy because of liberation of gas. Pieces of foreign matter may prevent the molten metal filling all parts of the weld and may cause cavities. Various methods for cleaning are in use, among them being pickling for small parts, washing with gasoline or lye, boiling with lye, sand blasting, chiseling, and scratch brushing, the method depending on the local conditions.

Preparatory to welding locomotive tubes to the sheets, it is sometimes advantageous to send the locomotive out on a run in order to burn off the grease and then to clean off the oxide and soot by sand blasting. Another method is to heat the boiler to normal by steam pressure and then clean by sand blasting or scratch brushing.

In welding heavy sections where it is necessary to deposit several layers of metal, the surface of the preceding layer should always be cleaned before starting the next.

When sections ⅛ in. or less thick are to be joined, the edges need not be beveled but they should be separated a small amount. Thicker sections, besides being separated by ⅛ in. should have the edges beveled to give a total angle of 60°. In some special cases angles as low as 30° or as high as 90° may be necessary, but an average safe value is 60°. Still heavier sections may be beveled from both sides and the weld made from both sides. In the latter case a layer should be put on one side and then a layer on the other to prevent warping. For long seams the edges should be ⅛ in. apart at the end where the weld is started, and at the far end the space should be ⅛ in. plus 1½ per cent. of the length. This takes care of the expansion of the metal in the sheet and also of the contraction of the metal in the weld as it cools. Another method of reducing expansion is to put in short sections at intervals, welding one layer at a time, starting at the centre and working alternately toward either end. Then put one layer in the open sections, and continue in the same way till the weld is completed. The welded section of any layer should not match those in the layer below or above, the joints being broken as in laying brick work.

The welding of complicated shapes such as fly-wheels and some castings may require pre-heating at certain points to produce initial expansion, which will be overcome as the weld cools. In some cases the entire piece must be preheated and, in some cases, after welding the whole piece must be annealed. This is sometimes done by heating the piece uniformly, then covering it with sand-asbestos and allowing it to cool slowly.

Preparation

In welding cracks in plates, forgings, or castings, the crack should be chiseled out to get a good bevel. This chiseling should extend entirely through the plate with ⅛ to 3-16 in. clear opening on the back or to the bottom of the crack in castings or forgings. Sometimes in boiler work ½ in. holes are drilled well beyond the ends of the crack and the crack chiseled, beveled, and welded.

In welding with the metallic electrode the arc should be kept short, not over ⅛ in. long. The current should not be greater than that recommended for the given electrode diameter. Excessive current causes burnt or porous metal to be deposited. The arc should be kept constant in length to ensure uniformity in the metal deposited. In welding a seam the electrode should be moved in a zigzag or circular path advancing along the seam. The metal will adhere only to the surface on the work actually played on by the arc, so care must be used to

bring the arc in contact with the whole surface to be welded.

The electrode must be connected to the negative terminal. If the polarity is reversed the arc will be more difficult to maintain and the deposited metal will not be as good as it should be. In starting the arc, the electrode should be just touched to the work and withdrawn immediately to the required distance. If the electrode is held too long in contact it will weld to the work causing some delay in freeing it and starting again.

The operation of welding overhead is the same as in normal welding. The difficulty lies largely in holding the electrode steady in the cramped position usually required. If the arc length is kept constantly short the metal will be successfully deposited. The appearance of an overhead weld is sometimes marred by projecting drops of metal or by uneven thickness of the deposited metal, but this can be overcome by proper manipulation of the electrode. A rest for the arm will sometimes assist the operator to hold the electrode steady.

When using the carbon electrode the holder should grip the electrode from 4 to 5 inches from the end. For ordinary work the electrode should be tapered to a blunt point at the working end to keep the arc from wandering over the end of the electrode. As the electrode burns away with use, the holder is moved back along the electrode to keep the length of working carbon constant. The burning away of the electrode will tend to keep the taper approximately constant.

The arc is struck in the same manner as with the metallic electrode, but a longer arc should be used. From 1 to 1½ inches is the average. The arc should not be too short when welding or depositing metal as there is danger of depositing carbon and probably causing a hard weld. In cutting or in melting off metal the arc should be kept short, about ½ in. being an average length.

To cut metal (for which purpose the carbon electrode must be used) the arc is operated like a gas torch. It is held in one place long enough to fuse the metal and allow it to run off. For thin plates laid flat, a hole is melted by holding the arc on one spot, then the electrode is slowly advanced along the desired line, the molten metal dropping out below. For thick pieces, such as shafts and castings, it is desirable to start at the top on one edge and work down, allowing the molten metal to run down through the cut. It is often necessary to follow the molten metal with the arc to keep it melted until it runs off.

The width of the cut will depend on the size of the electrode used and on the skill of the operator in keeping to a straight line. The cut must be slightly wider than the diameter of the electrode in order to allow the arc to be played on the bottom of the cut. The cut will be wider for thick sections than for thin ones. The edges of the cut will not be smooth because some of the molten metal will not run away and also because the arc will tend to jump from one point to another and cause an uneven cut.

To deposit metal with the carbon electrode, the arc is struck as above, but is not held in one place long enough to melt through. A pool of molten metal is established and a melting rod of metal is fed into the arc and melted on the work. It should all be heated thoroughly to ensure a complete union before more metal is added.

Since heavier current can be used with the carbon electrode than with the metallic, faster work can be done in depositing metal. The quality of the weld is not quite so good as when the metallic electrode is used. However, for filling holes in castings, building up worn spots, etc., the carbon weld is satisfactory and should be used. Because of the high temperature and large amounts of heat liberated when using the carbon electrode, the electrode holder is likely to become hot, and under some conditions to melt at the end. When the holder begins to get hot it should be plunged in a receptacle of water kept conveniently near the operator.

Cast iron, because of its properties, is unsatisfactory for welding by any method. Its low strength and brittleness causes it to break from expansion and contraction strains unless precautions are taken, and even then a successful weld cannot be ensured. Pieces of simple cross-section and heavy pieces present much less difficulty than complicated shapes, but because of the undependable nature of cast iron, care is required in all cases. The experience and skill of the operator are large factors in determining whether or not a given weld will be successful.

SAFETY BY MOVING PICTURES

Continued from page 272

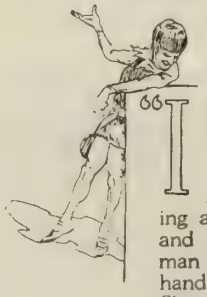
With one accord the men jump up and throw him out of the factory. They next run out into the factory, and, after a long skirmish, succeed in catching his seven imps of trouble. They drag them through the office, then throw them out beside the King, who is now dethroned.

After ejecting them, the manager of the company congratulates his men upon their splendid enthusiasm. He promises that if they do their part to keep the safety thought alive, he will endeavor to do his part by installing proper safeguards, etc.

With all working together in harmony, we leave the concern free from carelessness and determined to reduce the number of accidents to the lowest possible minimum.

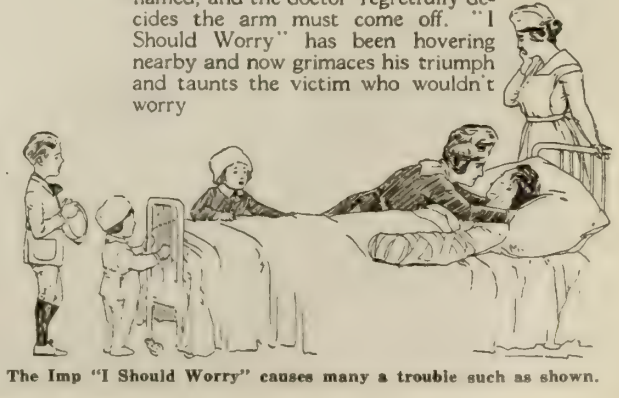
Having thus told our little tale of safety as portrayed by the pictures, we cannot refrain from adding our own personal comment on this novel method of presenting the cause of safety.

To our mind the scheme is deserving of the heartiest of co-operation. We cannot too strongly boost the cause of safety, for its need is more apparent every day. Carelessness is a monarch whom we should not only sit on, but squeeze the life out of, so, in order that readers can get a good idea of certain scenes in the picture described, we illustrate throughout the article some of the most striking scenes.



"I Should Worry"

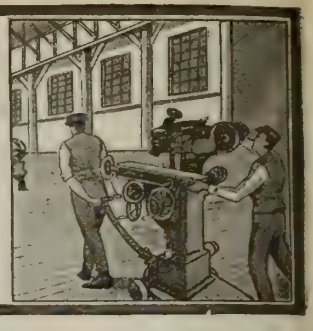
The impish pleasure of "I Should Worry" is in encouraging a disregard for scratches, burns, and bruises. Approaching a workman who has just slightly bruised his hand while handling castings, "I Should Worry" wins out against the workman's comrade who thinks the doctor should be visited immediately. The victim, about-to-be, plants a cud of tobacco on the wound, binds it in a soiled hankerchief and trusts to luck. But the hand begins to swell, sending the man to the hospital. The infection spreads, the arm becoming inflamed, and the doctor regretfully decides the arm must come off. "I Should Worry" has been hovering nearby and now grimaces his triumph and taunts the victim who wouldn't worry



The Imp "I Should Worry" causes many a trouble such as shown.



DEVELOPMENTS IN SHOP EQUIPMENT



GARVIN FORM MILLER

The distinguishing feature of this machine over that of previous designs is the change from vertical spindle to that of horizontal type, bringing with it certain other desirable modifications as hereafter described.

It is designed for cutting either flat or cylindrical cams. Illustration, Fig. 1, shows it arranged for flat cam work. In this set-up, it will be noted that the work is mounted on the end of the work arbor, toward the spindle, with the former at the outer end of the arbor. Worm and worm gear drive the work arbor from the universal power feed shaft, to be seen at the front of the machine. Power is transmitted through spur gearing, giving three changes of feed for the flat cam cutting fixture only.

The arm containing the work arbor pivots on the forward end, and is guided at the rear end by guides, all mounted on the same table. The arm has, in addition to its own weight, that of detachable weights to keep the former pin against the former, offsetting the stress of the cutter. These weights can be added to either end of the arm, and are made so as to release the pressure on former when cutting steep angle cams.

Illustration No. 2 shows the machine arranged for cutting cylindrical cams. In changing the flat cam fixture to the cylindrical fixture, the entire slide shown bolted to the saddle of the machine can be taken off and laid aside. The power feed universal joint shaft readily detaches for this purpose, and attaches to the cylindrical fixture.

In operation, the feed rotates the work on the work arbor, the work being mounted on the far side of the fixture and the former on the other end of the work arbor. The former pin, shown in the front of the machine, is kept against the former by weights.

The movement of the cylindrical fixture is very sensitive, as it works on large balls in a V-shaped, tool stool track. The feed of both attachments can be disconnected by clutch, giving hand feed control by wrench. This will be found very handy in setting up for cams that are cored, also for helping over steep angles. The feed of both attachments can be disconnected by clutch feed control by crank wrench.

The worm shaft is provided with a square end to receive the crank. The spindle of the machine is of Garvin standard milling machine construction. All gearing is housed, protecting it from damage or injury to the operator. There are two changes of feed provided on the machine when using the fixture for cutting cylindrical cams. Following are its principal dimensions:

Capacity, any type of cam	1" to 12"
Taper hole in spindle	No. 10 B. & S.
Size of cutter used	3/16 to 2"
Number of feed changes by four-step friction cone pallet	9
Cylinder cam throw	9½"
Flat cam throw	6"
Number of feed changes on flat fixture only	3
Number of feed changes on cylindrical fixture	2
Swing of cylindrical fixture	12⅞"
Speed of friction pulleys on countershaft	120-160
Floor space	44" x 54"
Domestic shipment, crated weight (with both fixtures)	2700 lbs.
Foreign shipment, tight boxed (with both fixtures)	3000 lbs.

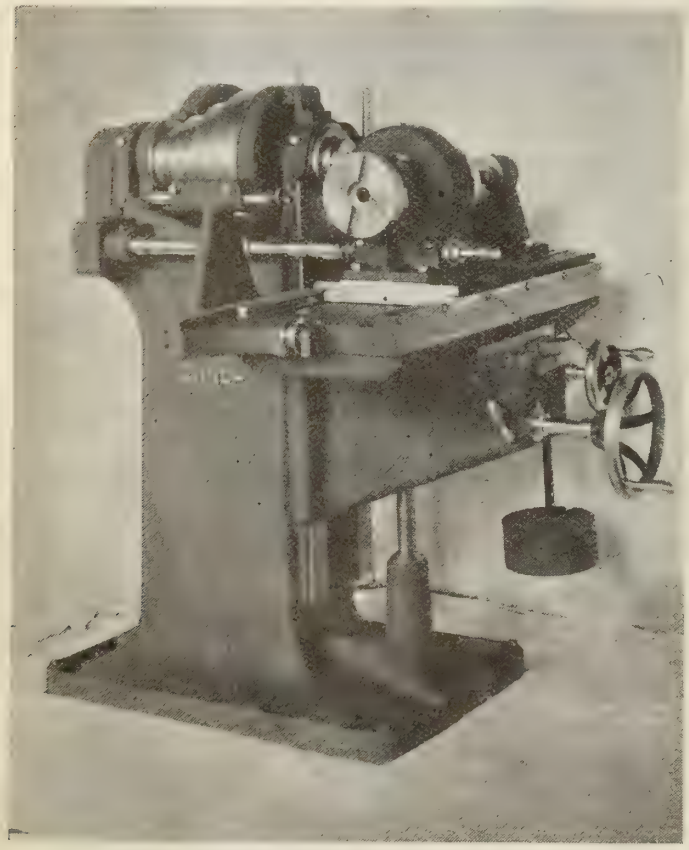


FIG. 1. THE MACHINE ARRANGED FOR FLAT CAMS

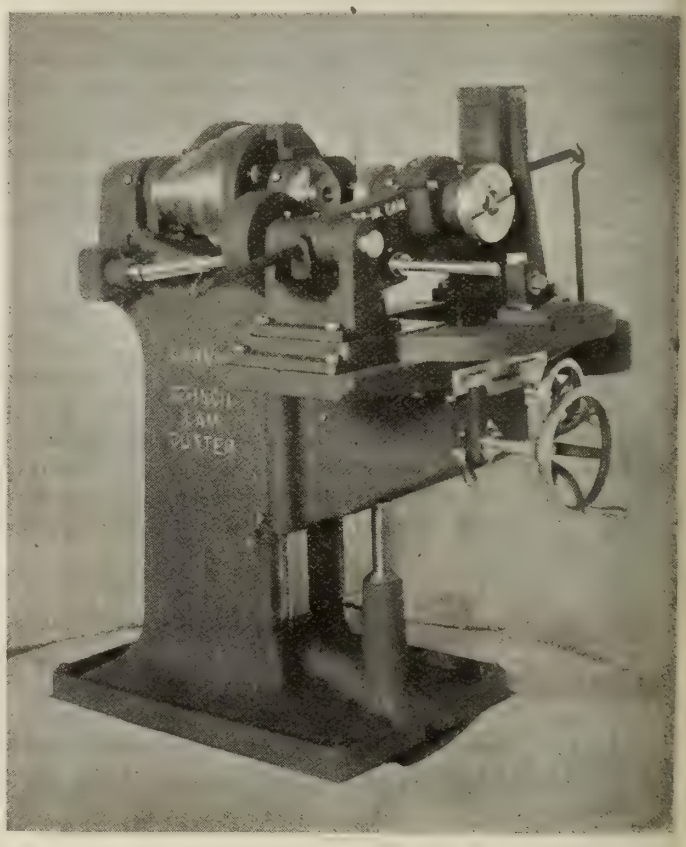


FIG. 2. THE MACHINE EQUIPPED FOR CYLINDRICAL CAMS

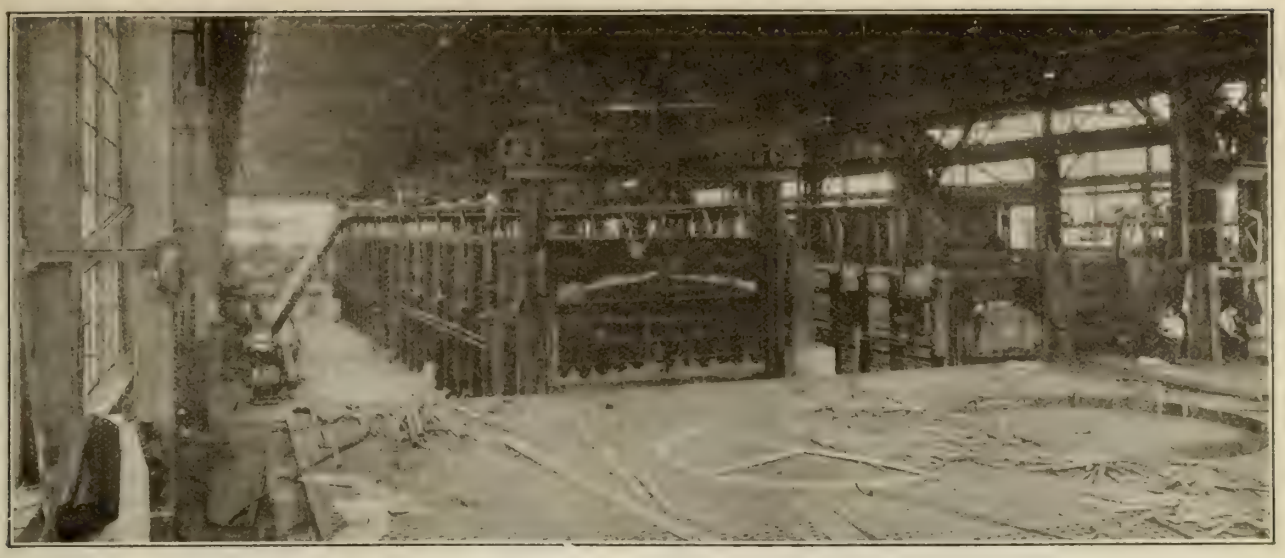


FIG. 2. PLATE AND ANGLE HEATING FURNACES

ROCKWELL FURNACES

The W. S. Rockwell Co., New York, have placed on the market some shipyard angle and plate heating furnaces, which are herein described. Both furnaces illustrated are typical furnace equipment of any shipyard engaged in building merchant ships.

The angle heating furnace illustrated at Fig. 1 is of double-end construction, permitting the charging and heating of material from both ends. This type of furnace is built in any chamber width, height or length required, and with door opening on one or both ends.

The plate heating furnace is illustrated at Fig. 2. The doors on this furnace are quite large and heavy, and, to facilitate opening and closing, are mechanically operated. Chamber width, height and length may be made to suit the character of the work and production requirements, and the furnace may be built either single or double end.

These angle and plate heating furnaces are generally built for the use of oil or gas fuel, although coal-fired furnaces may be used when local conditions are such that coal must be used. When oil fuel is used, 25 pounds pressure per square inch will do. At any rate, not more than 50 pounds is necessary. The pressure should be perfectly uniform, whatever the amount.

The air pressure may be from 12 to 16 ounces. Higher pressure increases the power cost and is not necessary. While somewhat lower pressure may be used, the atomizing effect on the oil is then not quite so satisfactory.

The same air pressures may be used for gas fuel.

Burners can be furnished that either fuel can be used, or simultaneously if desired.

Belleville.—The ice on the river here is of such an unusual thickness that grave fears are entertained that there will be a flood when the river opens up. In order to try and prevent this, a channel will be cut in the ice just north of the river mouth. The ice will be sawed and ploughed for a distance of about 1,000 feet, so that when pressure from upstream occurs, the ice will break away. The work will take about a week. The flood which occurred two years ago caused damage amounting to nearly $100,000 on both sides of the river.

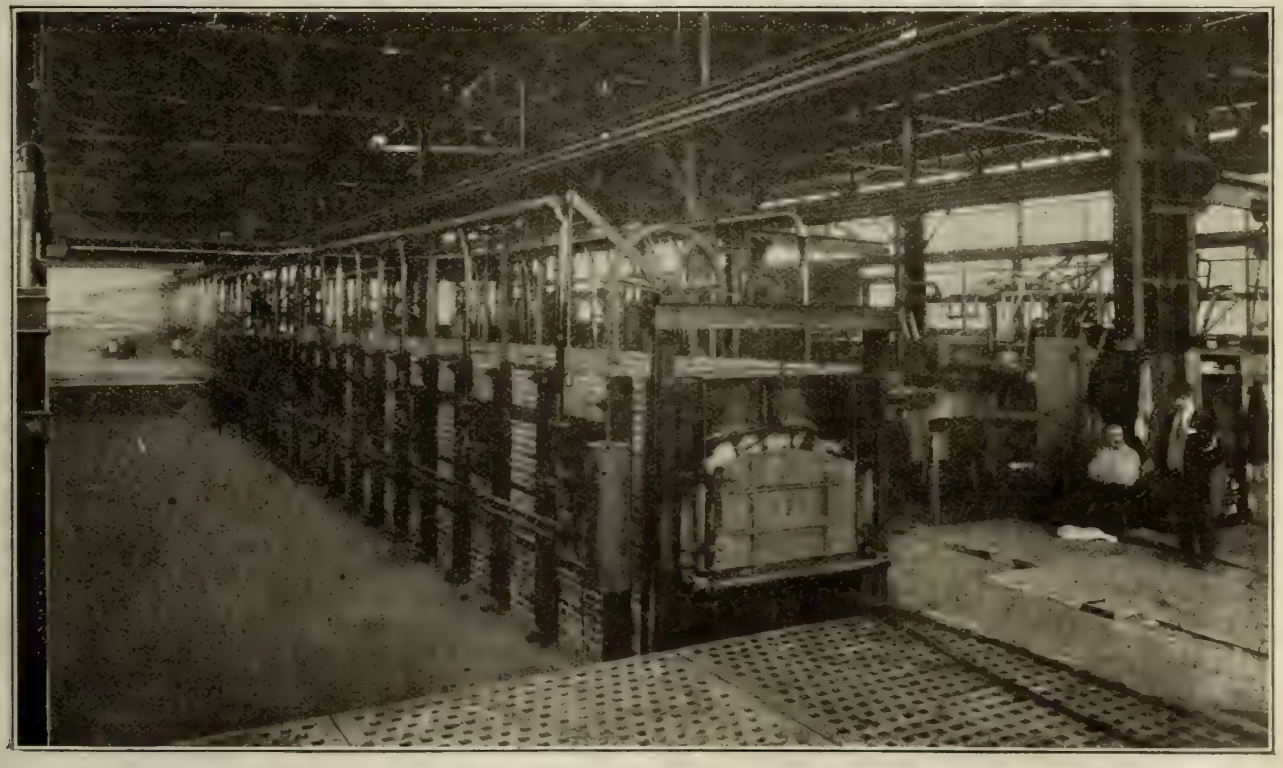


FIG. 1. DOUBLE-END ANGLE HEATING FURNACE

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Where Are Prices Going?

WHERE are prices of steel and iron going to land? You have heard this question asked a good many times in the last few months. It is easy enough to sit back, and on your fingers reckon it out that the peak has been surpassed, and that prices are now operating on an ultra-peak, or something like that. It is not difficult to say that the purchasing power of the last buyer is the final test of the market, and your own purse will wander along and bear eloquent testimony to the fact that the buying power of the individual is worm-holed and shaky.

And after you have done all these things, come on around and walk with the man who prepares the market reports on iron, steel and machinery.

We drop into a machine tool warehouse. The conversation turns to exchange, prospects, supply and delivery. Talking on exchange gives people a good opportunity to get tied up in mental cramps and arrive at no place at all. It is not long before this happens. The dealer thumbs over a lot of letters he has put to one side for you. He tosses a couple over—"Ten per cent. increase on boring mills." Said boring mill may be worth from eight to twelve thousand dollars, and the increase is from eight to twelve hundred. So much for that.

Next for the steel trade. Here's a jobber who handles a lot of material. He tells you that the base price on bars goes up to 5.50 a pound. Not long ago they moved to 5c per pound, and he was sure they would stay there. He's not sure they will stay at 5.50.

The next firm has material coming in. They got a chance to get some sheets at a premium. They took the chance, paid the price and exchange, and announce that their resale price will be at least 9 cents. Just then we happened to think that a few days ago we were looking back at figures in 1913 and found that quotations at the end of that year were 2.70 per pound. Plates are also marked at 7.25, against the 1913 price of 2.20.

Just here it is interesting to note the way these prices held for a number of years, and then to see their present strength. The above prices have been, it must be remembered, warehouse figures.

Take Pittsburgh, for instance. The term "composite steel" has been brought into use to show the bulk movement of prices of finished steel products, excluding rails. For instance, in composite steel are included bars, plates, shapes, pipe, wire nails, sheets and tin plates. For January, 1915, the price of composite finished steel was 1.4500 per pound.

Pittsburgh quoted sheets as follows:—

Year	High	Low
1896	2.45	2.15
1897	2.15	1.95
1898	2.55	1.80
1899	3.35	2.00
1890	3.25	2.90
1901	3.85	3.00
1902	3.10	2.75
1903	2.70	2.35
1904	2.30	2.00
1905	2.40	2.15
1910	2.40	2.15
1911	2.20	1.75
1912	2.25	1.80
1913	2.35	1.80
1914	1.95	1.80
To-day	6.00	5.00

Before stopping, go to the scrap markets. Dealers are marking up the prices they are willing to pay for material. That means they are going to ask more from the melters, the steel mills and foundries. For instance, they raise the price for No. 1 machinery scrap iron to $33 per ton. The chances are that were a nice tonnage of this to be offered, something better would be offered. Dealers, were they selling, would ask $40 or more at the consumer's yard. And yet at the beginning of 1914 the price the dealers would pay only $12 per ton, not one-third of the present figure. Heavy melting steel is quoted now at $18, against $8.50 in 1914.

Dealers are quoting tin this week at 76c per pound, a price well down from the level it reached during the war. For instance, local dealers in the month of July, 1918, named $1.25 per pound at the market value. In 1914, at the start of the year, the price was from 39c to 40c.

Many managers who follow markets and tendencies very closely, claim that we are in the peak zone. This claim is not new. We have heard it for weeks, and for months that are getting stretched out into years. It is hard to see where lowered prices are going to come from in the immediate future. Of course, the bolt from the blue could accomplish it, but the bolt does not generally fall on an empty market.

Appreciated the Letters

A LARGE manufacturing concern sent frequent and urgent demands to a certain delinquent dealer, and, being unable to get so much as a response, sent a representative to wait upon him personally.

"Why haven't you paid your account, or at least written us concerning the matter?" the representative asked.

"My dear sir," responded the delinquent smilingly, "those collection letters from your firm are the best I have ever seen. I have had copies made and am sending them out to the trade, and it's wonderful the number of old accounts I have been able to collect. I haven't paid my bill, as I felt sure there was another letter in the series. I have some hard customers to deal with and I need that last letter."—*Coal Trade Journal.*

AS FAR as Canadian buyers are concerned, the exchange situation continues to "sore."

Factory or Farm?

HERE is something that ought to make people sit down and think seriously.

A Toronto man was coming down on the train from Bruce county a few days ago. At one of the small stations in the farming community there got on three men, father and two sons, apparently of German extraction, and they had tickets for a well-known Ontario furniture and industrial centre. The course of their conversation was quite easy to hear, and put together, it mounted to this:

"We are going to work in the factories. We can make from six to seven dollars a day there and work only eight or nine hours a day. That is far more money than we have ever made on the farm, and in far less time. At home we have to work long hours and we do not get such a quick and sure return. So we have left only one boy with his mother on the farm, and we are going to work in the factory. When things get bad there we will go back to the farm."

Now, what are you going to do with your "back to the land" cry in the face of that? Back to the land is only a slogan, and a catch-phrase. Leaving the land and flocking to the cities is a reality and a mighty serious one.

It's all very well to explode about such things, and to say that the place for these people is on the land. Forget it. What would you do yourself? If you are the average man, you would do just exactly what those German farmers are doing. You would put your best effort in on the shop payroll and your farm would become sort of a safety-first place where you could go if the worst came to the worst.

It is well that the people should know exactly the trend of events and of people. It requires very little reasoning to see that, by the conditions that industry is creating in the large industrial centres, they are jockeying the whole system of production into such a corner that some day we will wake up to find that we are a very hungry people.

THE papers had a story a few days ago about a hired man and a cow that were lost in 20 feet of snow near Montreal. There's many a man in Ontario who has brought in a shipment of Montreal stuff, and he has seen drifts that would make a 20-foot affair look like a mere sprinkling.

DO YOU notice how cheap the family can live in this country since the prices of things have all been controlled!

Do Fashions Change in Engineering?

LUBRICATION experts have told us for a long time that acid of any kind in lubricating oils was dangerous and should never be tolerated. Corrosion troubles, under certain conditions, and other disadvantages were supposed to result from any lubricant not almost chemically free from either mineral or fatty acids.

Along came two investigators who, in a paper before the Society of Chemical Industry, claim that this is all wrong, and that by adding a small proportion of fatty acids the lubricating qualities of the oil are vastly improved.

The authors use the expression "germ process" to describe the oil made by using one or more fatty or other acids with one or more mineral oils, because the world has been taught for generations to look upon acid as the deadliest enemy to good and safe lubrication. Had they not used guile of some kind to cover the leopard's spots, "peaceful penetration" had been almost impossible.

The word germ has been used in this sense since, while the fatty acid germ is not alive in the sense that germs are, it is very active and so, it is claimed, affects the properties of the oil in a profound manner. Compounded oils have, of course, long been known, and many specifications call for so much mineral oil and so much of some particular vegetable or animal oil. Formerly all specifications and other requirements strictly limited the amount of free acid in compounded oils to a very small amount, and in mineral oils to none at all.

These investigators have upset all this, and instead of vegetable or animal oils and fats, they add fatty acids to mineral oil and eliminate the organic oil. The fatty acid produces an oil with varying properties as desired and it is quite possible to produce an oil which will work well in the crank-case of forced lubrication engines without emulsification.

For a good, heavy marine engine oil it has always been considered necessary, and is so to-day, to use from 10 to 25 per cent. of a thickened or blown oil—as a rule, thickened rape oil. This gives great viscosity, also very good "lathering" properties to the oil. A marine engineer must see the oil "lather" well, or it is no use.

The standard specification for marine bearing oil for one of the semi-Government departments in Great Britain is a compound of about 20 per cent. "of fatty oil"; but the total fatty acid content must not exceed 1 per cent. This department was considered most conservative, yet germ-process-marine-engine oil is doing, and has done for about eighteen months, the same work for which a 20 per cent. compound oil was previously considered essential.

In the power plant and on board ship it is quite possible that this new lubricant may effect considerable changes.

A TEAM of donkeys sold in the States a few days ago at $700, so don't be offended if some person calls you a jackass.

Ask Yourself—

Am I hitched up right, or am I a round peg in a square hole?

Do I feel every drop of blood and every fibre in me tugging away at my ambition, saying "Amen" to my work?

Am I backing up my chance in life in every possible way, or am I sliding along the lines of least resistance?

Am I keeping myself fit to do the biggest thing possible to me every day of my life?

Am I working along the line of my talent, or am I getting my living by my weakness instead of my strength?

Am I strengthening my weak points, making my strong points stronger, and eliminating the things which are keeping me back, the enemies of my success?

Do I decide things quickly, finally, or am I forever on the fence, fearing to make definite decisions which I cannot reconsider?

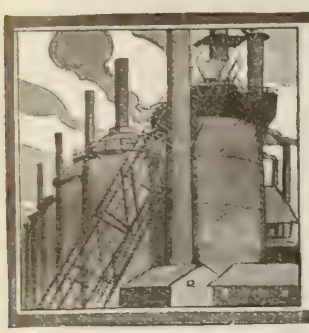
Have I the initiative which begins things without being told to; which does things without waiting for others' instructions?

Do I dare to attempt the thing I instinctively feel capable of doing, and I know that I ought to do?

Have I the courage which dares to branch out in an original way, dares to make mistakes that may humiliate me if I should not happen to succeed?

Do I try to develop that bigger man back of the smaller man I am, by obeying the God-urge that ever bids me up and on to greater endeavor?

If you can answer the above questions in the right way, you will bring out a hundred per cent. of your ability instead of the fifty per cent. that the majority of young men are content to develop; you will attain your ambition and be what you long to be.—*Success.*



MARKET DEVELOPMENTS



Getting the Goods is the Real Problem to Face Now

Prices Keep Going Up, But They Do Not Interfere With the Volume of Business—Scrap Prices Are All Marked Up This Week

THE question has been asked many times lately: When are prices going to break? A study of the steel, iron and machinery markets week after week would lead to the conclusion that such a happening is not seriously considered now. The problem is not a matter of price. It is a question of securing the material to fill the demand. This week prices for cast iron scrap were moved up to $33 per ton, and the chances are that a good tonnage would bring considerably over that mark. At the beginning of 1914 that same metal was being bought by dealers at $12 per ton. At that time bar iron was selling from Toronto warehouses at 2 cents per pound, while to-day the same places are quoting 5.50 per pound. Machinery dealers have ceased to be particularly interested by announcements of ten per cent. increases, and there are machines on which these increases will make a difference of a thousand dollars quite readily.

The march of prices has not put a peg into the volume of business that is offering. Inquiries are good, orders the same, and there is no trouble about collections.

The Leaside munition plant, the last in this district to survive in any shape, went out during last week to Toronto scrap dealers. They disposed of some of the machines, but at least 50 or 60 per cent. will be scrapped.

There is talk of some of the steel mills starting in to buy scrap on a fairly large scale now. In such a case they will have to compete with the American price for heavy melting steel. Some of them have been out of the scrap market in the hope that prices would ease off. However, they can hold out no more, and it looks as though they would have to buy and increase their costs.

Several of the large houses in this district stated this week that they could see nothing in the situation at present that hinted at any slowing up of industrial development. The demand was increasing rather than decreasing.

MONTREAL PORT GETTING IN SHAPE FOR COMING OF SPRING

Special to CANADIAN MACHINERY.

MONTREAL, Que., March 11.—There appears to be every indication that business in general is gradually getting back into its normal state of activity. Labor troubles are not affecting production as it did during the past six months, and the coming of spring may mark a beneficial development throughout the country. The storm and heavy snowfall of the past few days has seriously interfered with railroad operations, and transportation has been delayed in consequence. Preliminary preparations are being made for resuming marine activities at the port here, but nothing definite can be said as to the date of the opening of navigation. The ice on the river is quite thick this year, and even with the aid of the two Government ice-breakers, the clearing of the river will entail no small amount of work.

Canadian shippers of goods to the United States will likely have to content themselves with the ruling of the railways in their regulations regarding prepayment charges. The Board of Railway Commissioners has decided not to interfere with the action of the railways, so that, for the time being, charges on goods shipped to the United States will be collected at destination. The board has likewise given an important decision regarding the application of shippers for the adoption of the average demurrage system as operated in the States. The board has decided to continue the demurrage rates as now effective.

Steel Demand Increases

The change in the American railway policy has already resulted in a refitting programme that was expected to develop in consequence of the Government relinquishing control. This has not been confined to the States, as Canadian roads during the past week or two have been heavy purchasers of railway equipment. The total business for Canadian roads runs well up to $50,000,000. Canadian steel mills are very active at the present time and the demand for every class of material continues heavy.

The new steel mill of the Dominion Steel Corporation is now an active producer of plate, so that less dependence will be placed on the American mills for Canadian requirements of heavy plate. There is a feeling that, with the successful operation of the Dominion plate mill the producers in the States will be more considerate in the delivery of this class of material to Canadian consumers. There is still a marked scarcity of sheets and early supplies are generally obtained on the premium basis. Little warehousing of sheets is yet possible. The same condition virtually obtains in tubes and the recent advances reflects the strong character of the current market. Sheets are now quoted at 8½ cents for both 10 and 28-gauge, this price representing an advance of $5 per ton over that of a week ago. Canada dull plates are now $9 per hundred. Nominal quotations are again given here on Premier galvanized sheets, the prices being 10½ cents and 11 cents for 28-gauge, and 10¾ oz. respectively. Plates are up again and the local quotataions are 7¼ cents for sizes up to 3-16 inch and 6½ cents for ¼ inch and upwards. An advance approximating 8 per cent. has been placed on several sizes of boiler tubes. Changes will be noted in the selected list.

Metals Firm on Steady Demand

The movement of the non-ferrous metals is steady but the volume of business is comparatively light. Railroad buying is expected in the near future. Copper demand is not active and a slightly weaker tendency is apparent.

Interest is still displayed in the tin situation but buying is only on the basis of urgent requirements. The market is a little easier at 76 cents per pound. Spelter is also lower, the quotation of 12 cents being a drop of ½ cent per pound. Other metals are firm and unchanged.

Machine Tool Outlook Improving

While the present volume of business cannot be said to have shown any marked improvement over past weeks, the outlook for the spring months is of a promising character as most dealers are anticipating extensive buying on the part of many industrial interests. The railways are expected to be in the market for considerable quantities of machinery to augment equipment that has been overworked during the post-war period. There has been a good general demand for machinery of every description and the movement of supplies has compared favorably with similar periods in former pre-war years. The upward climb of prices still features the market and the buyer of tools is frequently surprised when a repeat order goes through at the previous figure. The volume of used tools that are being disposed of marks the evident inability to secure new machines, and this is accountable, partly, by the high cost to the buyer of American machinery.

Scrap Looks Better

While dealers cannot report an actual improvement in trade, they are nevertheless looking forward for better buying before the month is out. This is the general impression of some of the dealers here as a result of the increased activity that is developing in all lines of industry. The demand for machine cast iron cannot be adequately supplied and almost any price can be obtained for this material. "The market is almost without a price and that quoted is as good as any." This remark by a dealer signifies the character of prevailing conditions. The iron and steel market is more active than the non-ferrous scraps. Prices are unchanged and nominal.

POINTS IN WEEK'S MARKETING NOTES

Increases were marked up all through the scrap metal prices this week. The difference between old and new prices is particularly marked in the iron and steel prices.

It is likely that some of the steel mills will be coming into the market more than for some time past, and the chances are that they will have to pay a pretty stiff price for their supplies of heavy melting steel.

The base prices on iron and steel bars, which covers a large variety of material, have been raised in Toronto to 5.50, a high mark for some time.

Dealers, speaking of the high levels of steel, now predict further increases, claiming that they cannot see where a drop can come in the present condition of the market.

Machine tool trade states that it can see no let-up in the demand for equipment, the big problem being in securing the goods to meet the demand.

New York depends largely on the railroads now to come in and keep up the demand for machine tools in a large way.

The last of the Leaside munition plant went to Toronto scrap dealers —at least the great bulk of it did. Some of the machines have been disposed of, but fifty or sixty per cent. will be scrapped.

ONLY LIMIT NOW IS TOOL SUPPLY

Demand is Good, But Securing of the Goods is Another Matter—Scrap Metals Are Up

TORONTO.—One dealer, sizing up the situation, brought out something that gives a pretty fair index to trade conditions in the machine tool line. His point was, "The way business is going just now makes it almost impossible to train salesmen for machine tool lines. About six to ten years ago we had to get out and hustle for business. A prospect was something and the signed orders was another. But it is all different now. All that is necessary is that the salesman be able to tell the prospect that he knows where he can get a machine for him."

It is a fact that the shortage of machinery and the sustained demand have helped to bring business to a peculiar basis in this country.

Dealers, at the same time, generally recognize that these are abnormal conditions, and they are not altering their sales policies to any extent. They realize that they have to keep before the trade, for the time will undoubtedly come sooner or later when they will find it necessary to get out and chase business as they had had to do in the past.

The question was asked of several of the machine tool dealers in Toronto this week if they could see anything in sight that would indicate a holding-up of the demand for machine tools, or for the other lines they were handling. In every case the answer was the same, and that was that the only thing that was holding up trade was their inability to get the goods to meet the demand.

A few more notices have come through during the week, regarding the process of machine tools. These are accepted as a matter of fact now, although a ten per cent. boost on top of some of the machines that run into some thousands of dollars means money.

The machinery in the old Leaside munition plant, the property of the U. S. Government, went under the hammer a few days ago. Most of it was taken in by Frankel Bros., and, according to a statement by that firm, a good bit of it will go for scrap metal. There is a decided scarcity for anything that has any weight of cast iron.

Many Prices Advanced

The steel trade marked up a good many items this week. The base price on iron and steel bars is now at $5.50 at practically all the jobbers in this district. There has been for some time a change in effect for the selling of cold rolled shafting. The old list that has been worked on for some time was prepared in pre-war days, and was not at all representative of conditions now. It made the dealers and mills take the position of raising the figure they would have to add to the list all the time. This really became a top-heavy way of doing business, and it was a rather complicated affair. The plan employed at present by dealers here is to put $6.25 per pound base. For lots of less than 1,000 pounds there is an extra of 35 cents, making $6.60. The base size is 2¼ in. to 3 in. Anything outside of that scope comes as an extra for size.

There is a fairly good tonnage moving in certain lines. As a general thing, though, considerable of the material that is coming in now has been bought at quite a premium in order to secure delivery. The firms receiving this are not anxious to take it into stock, hence the movement is quick, in and out again, and as a result the warehouses are as bare as ever, although certain of the manufacturers may be better off—but at a price.

When will prices cease to rise? Here is the answer of one Toronto steel man: "We look for still higher prices." It is a fact that some of the Canadian steel mills will have to purchase scrap before very long. Some of them have held out for quite a while, hoping that prices would sag in the meantime, and in this way they would not have to increase their selling prices. It begins to look as though, were they to come into the market now, they will have to meet the U. S. prices, and it must be remembered that exchange is quite an inducement to sell into the American market just at this time.

Small Tools Are Busy

There is a nice line of business in small tools and supplies generally. Prices, since the last advances, remain firm. Some fairly heavy buying was done in the last week or so, as buyers who watched market reports closely knew that price changes were coming. One dealer had quotations in with a concern that does not take kindly to price changes after a bid is in. He had put in his price on the old figures, and learned shortly after that prices were

going to move. He took a chance on securing the business and placed the order to get the price. He was awarded the business as he expected, and was in this way able to fill it and still have his margin of profit.

General Advance in Scrap

All classes of scrap iron and brass and coppers went up in the scrap market this week. There is nothing to show any improvement in the cast iron or stove plate situation. In fact there is a greater demand than previously for iron and steel. The steel mills in some cases are in the market again, and they buy in large tonnage. The call for material for the steel mills has been somewhat hung up lately in the hope that the peak of prices might be passing. The result is that when they do come in now they will find that they will have to face a market that is fairly well depleted. Heavy melting steel is hard to obtain and any holders that may have some in stock, if there is a stronger demand for it, may ask their own good price and be fairly certain that they will get it. The breaking down of the last of the munition plants is sending a certain tonnage of scrap to the yards, but many of the machines that are scrapped are of the lighter variety, so that the total is not very much.

RAILROADS LOOKED UPON AS THE BEST PROSPECTS IN U.S. TOOL TRADE

NEW YORK, March 11.—Although inquiries for machine tools have fallen off in the East, and to some extent in other sections of the country, a good volume of business is still being done in certain lines. Railroad business is looming up as an important factor. This week the American Car & Foundry Co. is placing large orders for all of its plants against a list issued two or three months ago. The New York, New Haven & Hartford Railroad, which has inquired for 21 engine lathes and 14 radial drills, is expected to close very soon for this equipment. The Pennsylvania Railroad, which has received a great many quotations in the past two or three months for estimating purposes, may close soon on a quantity of tools for its shops at Trenton, N.J. The railroads are sure to buy large numbers of locomotives and cars and the makers of such equipment, together with those who make parts and accessories, will before the end of the year be rushed with work. It goes without saying that many of them will need to renew their machine tools. Deliveries on tools are so far extended that some of the roads have come into the market to see what can be procured in used tools that will satisfy urgent needs. Makers of the special railroad tools, such as axle lathes, journal trueing lathes, car wheel and driving wheel lathes, car wheel borers, hydraulic wheel presses, etc., are rushed with other work and there is doubt as to how soon the needs of the railroads for this class of special equipment can be filled if the demand should develop into large proportions.

A large buyer of the past week is the Federal Shipbuilding Co., Kearney, N.J., which is now equipping some of its shops which were built during the war, but not completed, equipped at that time. Most of its purchases are large tools, orders having been placed for a 16-ft. planer costing about $80,000 and an 80-in. lathe.

There is a good demand from Canada for second-hand tools and quite a number of sales have been made for shipments to your side of the border. Orders for used tools are coming in at a good rate, the long-deferred deliveries of new tools forcing manufacturers to satisfy their requirements, when urgent, by taking whatever can be had the quickest.

The Columbia Graphophone Co., Bridgeport, Conn., has placed more orders for its Toronto and Baltimore plants. This, it is believed, about completes its buying, which has been of large proportions.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., is in the market for considerable new equipment.

The American Brass Co. has purchased eighteen small cranes from the Pawling & Harnischfeger Co., Milwaukee, Wis.

U.S. SCRAP METAL

The pig iron market is somewhat unsettled, some districts reporting good sales, while others are dull. Following are reports from various U. S. points:

PHILADELPHIA.—There have been some good-sized tonnages of heavy melting and steel scrap during the week. A Pittsburgh interest bought 20,000 tons heavy melting steel at $29, delivered, while other sales varied from $26.50 to $25 delivered. Wrought iron pipe is at $25.50, delivered. Stove plate has brought $33, delivered.

BOSTON.—The car situation is preventing much business being done from New England points, and some of the roads which are still accepting shipments are unable to give deliveries. A small lot of cast scrap was sold at $47, delivered, and a few hundred tons of heavy melting steel at $43.40 shipping point.

NEW YORK.—The market is dull, and prices are inclined to drop, stocks being plentiful. Consumers are receiving delayed shipments as the railway situation has improved during the last week.

BUFFALO.—Some heavy sales have been made of heavy melting steel for delivery to Pittsburgh, the price being equivalent to $26.10, Buffalo, or $29, delivered, Pittsburgh. Cars are more plentiful.

PITTSBURGH.—After some activity caused by a large interest buying a good quantity of heavy melting steel, the market has settled down to dullness again. This has extended to the foundry grades, and a slight drop in price is apparent over the whole range

CLEVELAND.—The market is weak, a slight reduction having occurred in many grades. Heavy melting is now at $25.50 to $26. Old steel rails and drop forge flashings have dropped $1.50 and 75 cents. Snow melting steel has been bought in the valley at $27.

CHICAGO.—The market reveals a little better sentiment, although prices are still slightly on the decline. The labor situation is bad, and some railroad lists have had to be withdrawn on account of it being impossible to get men to load the cars.

ST. LOUIS.—Trading is light and the market is weak, but there has been no drop in prices. Mills and foundries are running to capacity, and this feature tends to improve the situation.

PIG IRON TRADE

Although there has been good buying in some quarters, the general tone of the market has been quiet. New England melters are facing a serious situation by reason of the continued embargo on iron. Following are reports from various centres:

CHICAGO. — Although there is a period of quietness just now, a further large buying movement is expected to materialize before long. 1.75 to 2.25 silicon foundry iron is now quoted $43 furnace, last half delivery.

PHILADELPHIA.—There has been an active buying week in this district, the price being $43 to $44 Eastern Pennsylvania furnace for 1.75 to 2.25 silicon and $44.25 to $45 for 2.25 to 2.75 silicon. Bessemer has been sold for export to Italy at $45 Eastern Pennsylvania furnace.

PITTSBURGH.—There has been a good quantity of basic iron sold at $41.50 valley furnace basis, for March and April delivery. The $43 price does not seem to be sustained, though some prompt iron was sold at this price furnace.

CLEVELAND.—Basic is in strong demand, and is firm in price. $43 furnace seems to be the minimum. Foundry iron is $42 to $43 furnace for 1.75 to 2.25 silicon, for last half, but iron for prompt shipments is quoted at $45 furnace, and very little available.

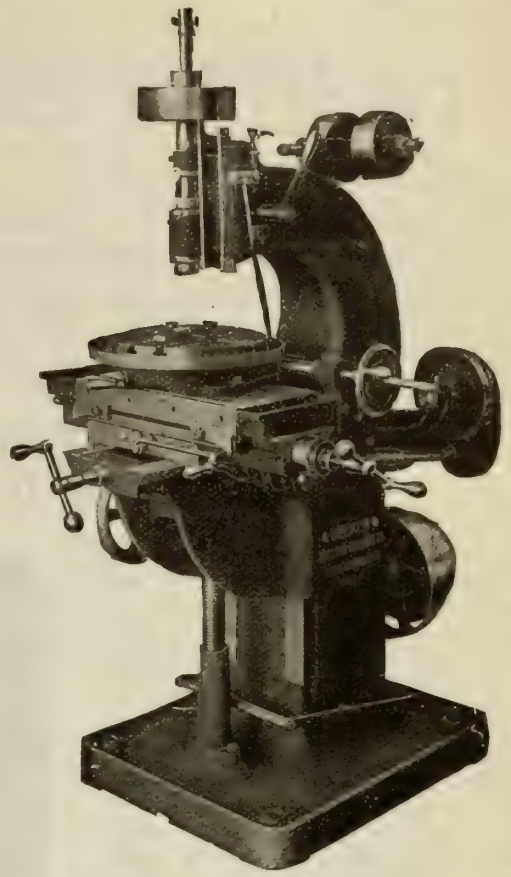
BOSTON.—The embargo on iron entering New England points is still in force, with the result that resale iron is reaching high figures. 2.25 to 2.75 silicon has sold at $60 on this basis. Iron for last half is quoted for No. 2 X at

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$49 delivered, or $46.25 Eastern Pennsylvania furnace.

NEW YORK.—There has been an awakening of the market following the quiet of last week. Prices retain the same level, $43 for 1.75 to 2.25 silicon Eastern Pennsylvania furnace. Most of the iron was for early or spot delivery, and a good deal of the buying was by melters who find they have underestimated requirements.

BUFFALO.—Although most makers are supposed to have sold their product for the rest of the year, a fair tonnage of iron was sold during the week. The sales were on a basis of $45 for No. 2 foundry, with $46.25 and $48 for the next two grades. Canadian Steel Foundries of Hamilton are in the market for 10,000 tons basic, the last sale of this grade being at $44.

ST. LOUIS.—There is not very much enquiry, and furnaces are accumulating some iron in their yards, due chiefly to the car shortage. No. 2 Southern iron is quoted from $40 to $43 for 1.75 to 2.25 silicon.

BIRMINGHAM.—The selling market is quiet, and furnaces are trying to get production and delivery on a better basis. Illness among the workmen and the car shortage is causing great trouble.

MUST CONSERVE OUR NATIONAL RESOURCES IS WARNING GIVEN

IN his presidential address to the Canadian Mining Institute at the opening of their twenty-second annual meeting in Toronto on March 8, D. H. McDougall sounded a note of warning and made a plea for the conservation of our natural wealth. While Canada has great natural resources, she has none to waste, and the former idea of the inexhaustible nature of our minerals, timber and coal must be modified in the light of our ever-increasing population. It was accordingly necessary to take stock of available resources and "cut the cloth accordingly."

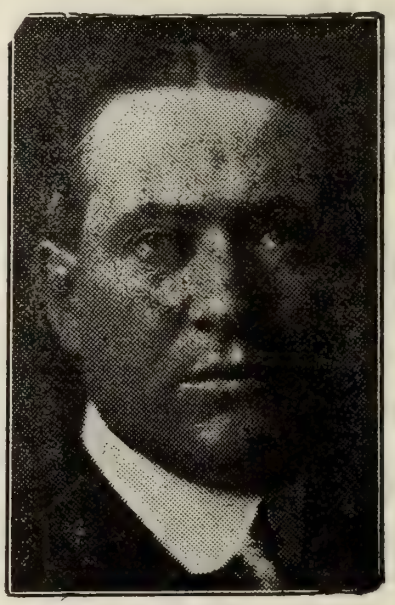
The speaker pointed out the situation in Canada with regard to the three basic sources of wealth and industry, coal, iron and wood. Our coal deposits do not include anthracite, except in small quantities, and although we have large quantities of excellent bituminous coal in the Maritime and Pacific Provinces, the central portion of Canada is almost totally dependent upon the United States for its coal supply.

The iron ore situation in Canada was unsatisfactory from many points of view. They were, in many cases, of low iron content and unsuitable for reduction by present methods. Their future will thus, in large measure, depend upon the advancement of science. Our timber resources were rapidly vanishing and Canada's position in this respect was indeed alarming, but as an offset to this, Mr. McDougall emphasized Canada's advantage in having control of the world's supply of nickel, cobalt and asbestos.

When the convention opened the Hon. Harry Mills, Ontario Minister of Mines, welcomed the institute on behalf of the province, while Mayor Church extended similar courtesies on behalf of the city of Toronto. Thomas W. Gibson, Deputy Minister, presented a summary of the mineral production in Ontario for 1919, which exceeded that for 1913 by $4,349,802. R. E. Hore, consulting geologist, urged greater Governmental publicity as to the exact conditions and prospects in mining in Ontario.

The afternoon session Monday was given over to a number of technical papers, together with a report by Dr. Goodwin on the activities of the educational committee. W. H. Collins gave an interesting paper on the iron ranges of the Michipicoten district in Ontario. The Helen mine has been the largest producer in Ontario, having been worked since 1919, but it is now exhausted. Steps are being taken to develop the adjoining property, which contains, at a conservative estimate, 100,000,000 tons of ore. The mining and treatment are no longer in the experimental stage, since the Magpie mine has been in operation since 1913 and valuable experience been gained. Siderite ore consists of carbonates of iron, calcium, magnesium and manganese and calcination; by driving off the carbon dioxide gas raises the iron content from 35 to about 55 per cent. Other siderite deposits, while of no economic importance at the present time, will prove valuable later on.

The iron formation is of much interest geologically, and the geologist is able to give valuable aid to the prospector and miner.



D. H. McDOUGALL,
President C.M.I.

Major Percy Barbour, of New York, gave an address on "What the Mining Engineer Did in the U. S. During 1919," and stated that his work had apparently little to do with the strictly engineering side of mining, but was connected with various other aspects of the industry. The speaker dealt with the licensing of engineers in the United States, and with other points of contact between the Government and the engineer. He also spoke of the labor difficulties under which the engineer was laboring.

One instance cited by Major Barbour was that of the Miami Copper Company, who were under the necessity of cutting wages or curtailing hours of work, and by the expedient of calling in the shift bosses the matter was satisfactorily explained to the men and carried through.

M. E. Wilson read a paper on Molybdenite in the Ottawa Valley, and the paper, together with the lantern slides, gave a wealth of information concerning this mineral.

At the evening session on Monday the members were shown lantern slides, showing the mining and smelting operations of the International Nickel Company of Canada, and moving pictures of underground operations at the Cobalt silver fields and of the operations at the Alfred peat bog.

The convention continued during Tuesday and Wednesday, and trips were arranged to the Port Colborne refinery of the International Nickel Company of Canada and to the Toronto plant of the Goodyear Tire and Rubber Company.

Other papers read during the convention were:

"Coal Mining Industry in the Province of Alberta," by J. T. Sterling; "Fuel Problems of Western Canada," by W. J. Dick; "Coal Supply of Canada," by F. W. Gray; "Lignite in Saskatchewan," by A. McLean; "Briquetting Industry," by E. Stansfield.

"Future Prospects for Oil and Gas Production in Ontario," by M. Y. Williams; "Natural Gas in Ontario," by E. S. Setlin; "Oil Possibilities in Western Canada," by D. B. Dowling; "Oil Problems in Canada," by T. O. Bosworth.

Discussion on Institute's Prospecting Scheme, following an address by J. A. Campbell, M.P., on "Attitude of Canadian Governments toward Mining Development"; "Britannia Mines, British Columbia," by S. J. Schofield; "Progress Notes on the Investigation of the Quebec Asbestos Deposits," by R. Harvie and E. Poitevin; "Asbestos Mining," by J. G. Ross.

Discussion on nickel coinage: "Lost Placers of Ontario," by A. P. Coleman; "Recent Developments in Mining in Northern Ontario," by J. G. McMillan; "Geology of Silver Islet and Vicinity," by T. L. Tanton; "The Nipissing Mine," by H. Park; "Minerals of Eastern Ontario," by J. W. Evans.

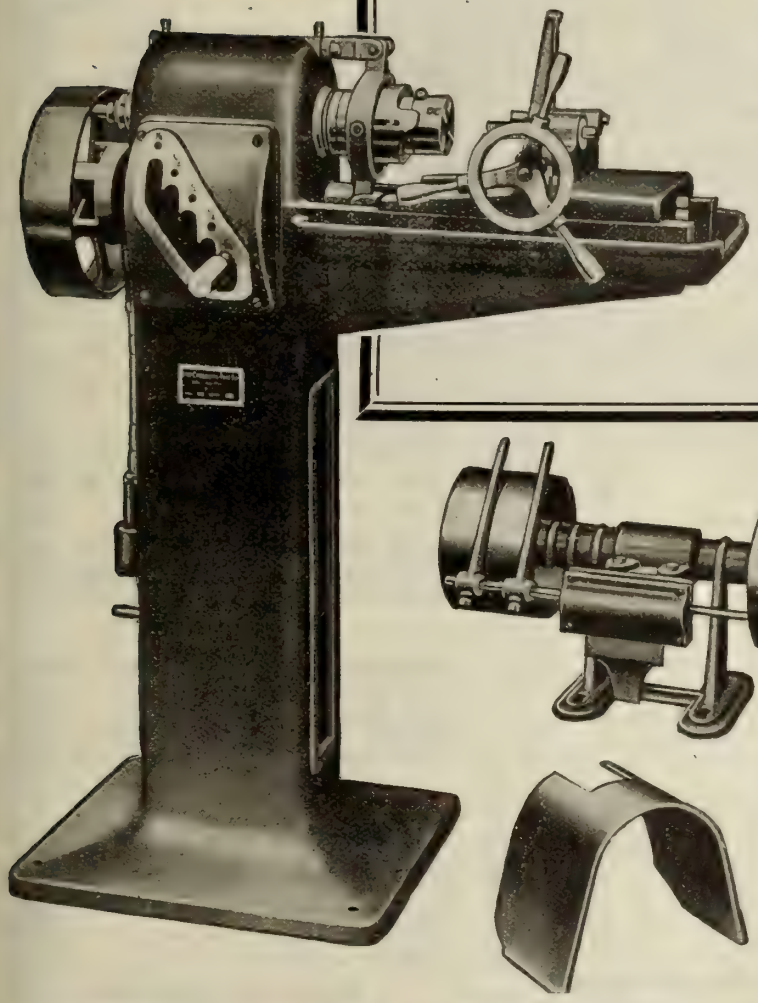
THE GEOMETRIC WAY

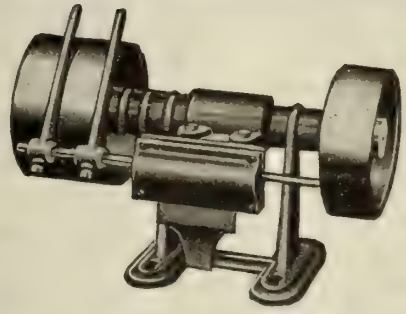
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NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A.-R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N.B.

Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

	Per 100 Pounds. C.L.	L.C.L.
Pittsburgh to Following Points		
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	76 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

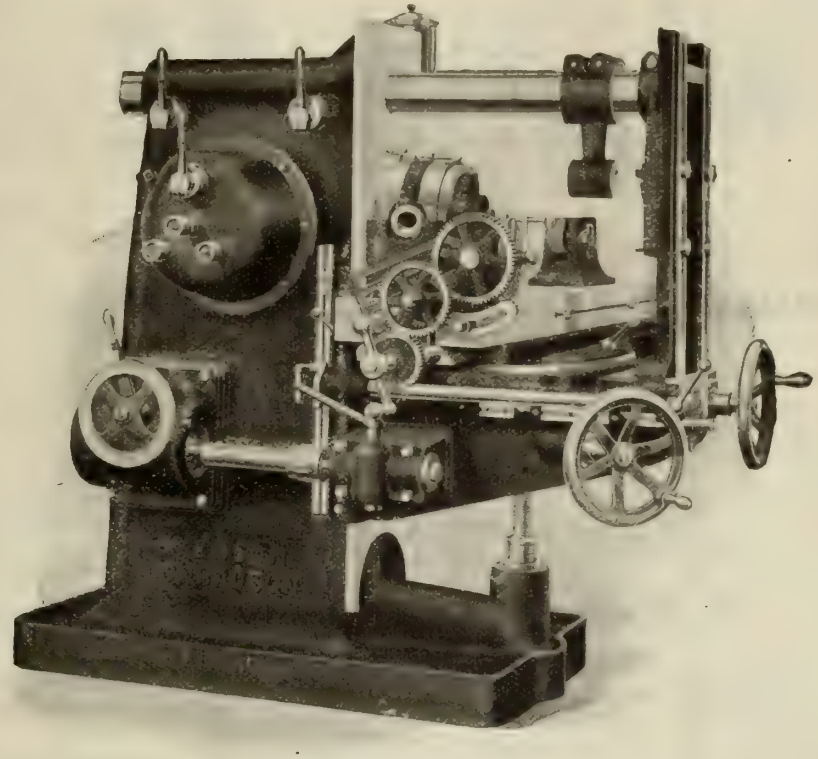
POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

Announcing the New

No. 3 Ryerson-Conradson High Power Universal Milling Machine

In Stock for Immediate Shipment



In designing this machine we not only aimed to meet, but also to anticipate modern milling requirements. Our main object was to provide a tool with great power, rigidity, convenience of operation and adapted to light and heavy manufacturing and jobbing work.

The most striking feature in the design of this machine lies in the application of the helical drive. We have overcome the inability to secure a sufficient range of speeds when using helical drive gearing, and can secure 12 spindle speeds ranging from 17 to 290 R.P.M. in practical geometrical progression.

The new Bulletin 5015-E gives complete information.

ESTABLISHED 1842 INCORPORATED 1888

JOSEPH T. RYERSON & SON

CHICAGO, ILL., U.S.A.

MACHINERY

Canadian Representatives:

Garlock-Walker Machinery Co., Ltd.

MONTREAL 32-34 Front Street, TORONTO WINNIPEG

If interested tear out this page and place with letters to be answered

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus 20 to	40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED SHAFTING

At warehouse ..... 6.25 base

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, no. 28	$ 8 50	$ 8 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	9 50
Premier, 10¾ oz.	11 00	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	28 00
1¾ in.	31 50	30 00
2 in.	30 00	28 75
2¼ in.	35 00	29 00
2½ in.	42 00	35 75
3 in.	50 00	45 75
3¼ in.	.....	46 00
3½ in.	63 00	49 00
4 in.	85 00	62 50

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	.....
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, anhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Xinc sulphate	.08

Prices per lb. unless otherwise stated



Six
Things to Remember

MORROW'S

Make of

Twist Drills
Reamers
Files
Set Screws
Cap Screws
Nuts

Order these products by name "Morrow's" and you will be sure you have the best quality obtainable.

"Morrow" High Speed Forged Drills do more holes with less regrinding.

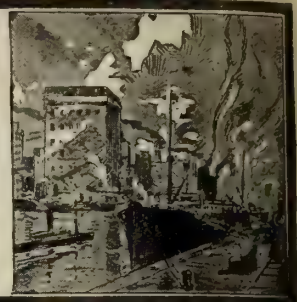
JOHN MORROW SCREW & NUT CO.
LIMITED
INGERSOLL - CANADA

If interested tear out this page and place with letters to be answered



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Increase Given.—A general increase of 10 per cent. to all employees was granted by Butterfield & Co., March 1, 1920. This affects office and shipping departments as well as the factory.

Baldwin's Take Out Permit.—Baldwin's, Ltd., the large tinplate firm which has located in the buildings of the British Munitions at Ashbridge's Bay, have received a building permit for the erection of a plate mill building to cost $200,000.

Another New Foundry.—The town of Georgetown has become the possessor of a new industry in the shape of the Central Foundry Co., which has commenced operations with a staff of 20 men. The president is A. L. Wynston, and the secretary-treasurer, H. J. Selfred.

Further Car Orders.—The Canadian National Railways have ordered from the Hart-Otis Car Co., Ltd., Montreal, 350 fifty-ton Hart convertible ballast and general service cars. These cars are for use in track maintenance and new line construction. The amount of the order will be $1,500,000.

Needle Works Changes Hands.—The F. W. Corey Needle Works, of Hamilton, has been acquired by the Canada Needle Works, and the business is being moved to Georgetown. A big extension of the Georgetown plant will be made, and the present capacity doubled.

Commutation Rates Suspended.—The Hon. F. B. Carvell has wired instructions to Mr. G. T. Bell, general passenger traffic manager of the Grand Trunk Railway, to suspend for the time being all increases in commutation and trip tickets. This order is to hold until the conclusion of the present investigation now being carried on by the Railway Commission. Similar instructions have been given the C.P.R.

Officers Elected.—At a recent meeting of the stockholders of the Buffalo Forge Company, new officers were appointed, as follows: Henry W. Wendt, president; Edgar F. Wendt, vice-president and treasurer; Henry W. Wendt, Jr., vice-president and secretary; C. A. Booth, vice-president and sales manager. The new directors include the above-named officers, and, in addition, Mr. H. S. Whiting.

A Big Incorporation.—The British Canadian Machine and Tool Co., Ltd., has been incorporated with a capital of $500,000, divided into 5,000 shares of $100. The new company have taken over the assets and goodwill of the International Machine and Tool Co. and the Reliance Motor and Tool Co., Ltd. The directors of the new company are Mr. Thomas L. May, Harry A. Newman and John Geo. Baukat. The business of the company is being caried on at present at 183 George Street and 111 Adelaide Street. They will probably erect an extensive plant in Toronto.

TUBE COMPANY TO START BUSINESS

Capacity of From 25,000 to 30,000 Feet Per Day—Investigation Covered Long Period

In our industrial news column of last issue, we gave a brief notice of the formation of a new company, to engage in the manufacturing of steel welded tubing. We are now able to give some further details of what is an absolutely new industry in the Dominion. The Tube Company of Canada, as the new firm is called, have premises at 233 Dufferin Street, Toronto. The process by which the tubes are made has been developed by the principals of the company, and is a combination of oxy-acetylene and electric welding, in the first instance, the tubes being drawn to size after welding and formed to the required shape, either oval, or round, or square. The capacity of the plant will be 25,000 to 30,000 feet per day, either hot or cold finish. The product will be used in the building of bedsteads, automobiles, aeroplanes, bicycles, farming implements, and similar articles.

The president, Mr. H. W. Carter, and the secretary-treasurer, Mr. P. Sorley, were pioneers of the welding business in Canada, and the making of the tubes will be carried on under their close personal spervision. The general manager, Mr. J. F. Lawson, has had a wide experience in the United States and Canada in tube and metal work, and for the past nine years was superintendent of the Pedlar People, Oshawa. The company, before starting to manufacture, have been carrying on investigations and experiments for the past four years.

Received Orders.—A representative of the Robb Engineering Works, Amherst, speaking of conditions there, said: "We have at present under construction in our shops an order for fifty "Tillsoil" tractors. Ten of these have been ordered by the Highway Commission of the Province of Nova Scotia, and the balance is for the Canadian North-West. Special tools and equipment have been installed for the manufacture of these tractors in order to ensure a large output. We have also received an order from the Rock Plaster Manufacturing Co. of New York for a 150 h.p. tubular boiler and a 150 h.p. Robb, Armstrong engine for their new plant at Walton, N.S."

Woodstock Industry.—Standard Tube & Fence Co., Ltd., of Woodstock, Ont., have acquired the Canadjan patents of Marshall B. Lloyd, covering acetylene and electric welded tubing, and have formed a close working arrangement with the Standard Parts Company of Cleveland, Ohio, to manufacture many of the latter's line of welded products. The Standard Tube Co.'s product has heretofore been confined to close joint tubing, but with the purchase of the Lloyd's patents will now be in a position to supply welded tubing required by the automobile, bicycle, bedsteads and other trades. Extensive additions to the plant in Woodstock are contemplated for this spring. Meanwhile equipment is being installed in its present buildings and the company expects to be ready in a few weeks to deliver the first welded tubing of this kind made in Canada.

MARINE

New York.—Keeping in wireless communication with a station in the United Kingdom during the whole trip across to the United States is the record achieved by the "Imperator" on a recent trip. The station was at Aberdeen, Scotland.

Toronto.—After thirty-two years' service with the Toronto Ferry Co., Capt. Bob William is retiring from active life. During the whole of this time he has been engaged in the transportation of passengers between the city and the Island, and has never had an accident. The captain is 78 years of age, and was born at Oakville. In recognition of his services, he will be retired on full pay.

Toronto. — As soon as navigation opens, it is the intention of Deputy Harbor Master Allen to hold a life-



In analyzing your shop costs have you considered a possible saving in your tool room?

How Many Prices Are You Paying for Making Your Tools?

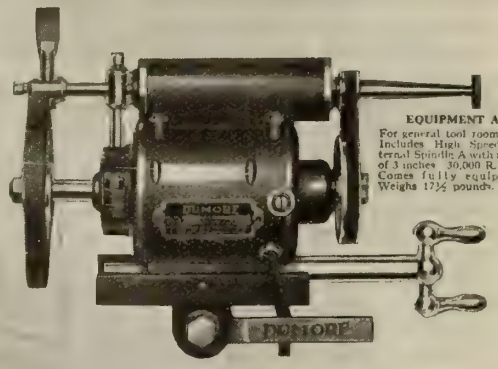
An analysis of the operation of departments from a "dollars and cents" point of view, and particularly those departments directly affecting production, invariably discloses abnormal costs.

One sure means of reducing costs and, at the same time, of obtaining highest quality tools, is found in the **DUMORE** portable grinder. The two chief reasons for this are **balance** and **speed.** The perfect running balance eliminates vibration and chatter—the big range of speeds from 10,000 to 50,000 R. P. M. gives even the small wheels the correct cutting speed, thus insuring work free from taper or bell-mouth. In addition to these reasons, the **DUMORE** is portable, permitting the mechanic to carry it to the many jobs being constantly set up in all parts of the shop.

Your dealer sells **DUMORE** grinders. Ask him for a demonstration.

WISCONSIN ELECTRIC CO.

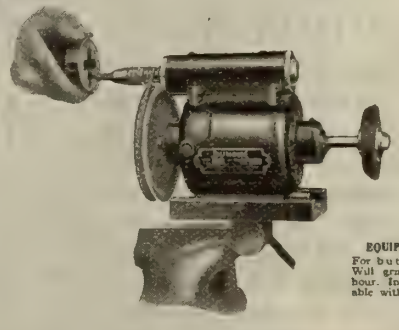
2919 16th Street RACINE, WIS.



EQUIPMENT A
For general tool room use. Includes High Speed Internal Spindle A with reach of 3 inches 30,000 R.P.M. Comes fully equipped. Weighs 17½ pounds.



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B.

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered

saving demonstration along the waterfront through the medium of the life-saving crew. All the men employed on dredges and boat-houses will be brought together, and given a lesson in the manner of handling a person who has fallen in the water, and the methods of resuscitation after the rescue is made.

Ottawa.—Mr. J. E. Armstrong, M.P. for East Lambton, has given notice of a bill to amend the railway act, which would bring all lake steamship traffic under the jurisdiction of the Railway Commission. This bill has been up before on several occasions, but has been defeated. Mr. Armstrong is also seeking the appointment of a commission to govern all steamship traffic between Canada and the United Kingdom.

Ottawa.—The Deputy Minister of Marine and Fisheries in speaking of the report that the steamer Montcalm was in a critical state, due to ice pressure in the Gulf of St. Lawrence, remarked: "There is absolutely no truth in this statement." He went on to say that the two men quoted in the report of the steamer's critical condition had deserted from the Montcalm, and were probably trying to justify this action on their part. Captain Hearn, who is in charge of the Montcalm, and Captain Reid, who commands the Prince Edward Island car ferry, are among the best officers in the world as far as ice service is concerned, and Mr. Johnston said that the former would, without doubt, have advised the department immediately if his vessel was in very serious danger.

The last report received by the department is to the effect that its conditions are now a little easier, and that the Montcalm has sighted open water for a distance of about ten miles. She is trying to reach the Magdalen Islands with a cargo of supplies for the inhabitants.

The crew of the Montcalm numbers 64 men all told.

PERSONALS

Fifty-eight years in the service of the Grand Trunk and still at work is the record of Mr. George Clark, foreman of the blacksmith shop at the Stratford works of the railway. Mr. Clark, who has been receiving the congratulations of the officers of the company, is enjoying the best of health and is attending to his duties with the same regularity that he has shown throughout his long career with the road. Mr. Clark's father was also with the Grand Trunk, being employed at the Point St. Charles shops and having come to this country with Messrs. Peto, Brassey and Betts, in connection with the building of the Victoria Tubular Bridge over the St. Lawrence. It was at Point St. Charles that Mr. George Clark entered the railway's service in 1862, but he has been stationed at Stratford since 1871.

BAWDEN MACHINE CO., LTD., TORONTO, ACQUIRE ENGLISH LICENSES

Following three visits to the United Kingdom by Mr. A. G. Hill, and negotiations which have covered a year, arrangements have been completed by which the Bawden Machine Co., Ltd., of Toronto, will manufacture under license several well-known varieties of British machinery. They will keep on hand a large stock of parts for repair of machines already erected here, thereby obviating the necessity of sending to England with the accompanying delay. This difficulty has often stood in the way of making sales of British machinery in Canada, and the new arrangements should be a great help to the sales efforts of the firms included in the agreement. The Bawden Co. will build up a competent engineering sales staff, and Mr. Hill is of the opinion that a very good business can be built up, especially under the present exchange rate, which is favorable to developing trade with English firms.

The firms whose lines will be carried will include some of the best known manufacturers in the United Kingdom, whose names carry a guarantee of excellence. They are Robey & Co., Lincoln, England, manufacturers of steam and oil engines, of the stationary and portable types, and boilers; Alley & McLennan, Ltd., Glasgow, Scotland, makers of air compressors, steering gears and water works supplies; John Thompson, Ltd., Wolverhampton, Eng., makers of water-tube boilers and corrugated furnaces; David Bridge & Co., Ltd., Castleton, Eng., makers of the Bridge clutch, rubber and textile making machinery; E. S. Hindley & Co., Ltd., Bourton, Dorset, Eng., high-speed steam engines; Brown Bros., Ltd., Edinburgh, Scotland, makers of telemotors, steering gears and marine auxiliaries; Bow McLachlan, Ltd., Paisley, Scotland, making the same lines.

The Bawden Company will continue the manufacture of the lines they have been making for several years, including pumps, valves, hydrants, rubber mill supplies, printing presses and automatic machinery and hydraulic presses. The new venture should ensure an era of continued prosperity for this enterprising firm.

The Return of the Railroads



Darling in the New York "Tribune."

The American railroads were this week returned to private control by the Government.

Garlock-Walker's List of Machines in Stock and for Immediate Shipment

LATHES

1—7A Cataract Precision Lathe. NEW.
1—7B Cataract Precision Lathe with compound rest. NEW.
1—11 x 5 Seneca Falls Screw Cutting.
1—14 x 5 Engine Lathe with Taper Attachment. USED.
1—15 x 6 Porter Three-Step Cone. USED.
1—16 x 10 McKechnie Four-Step Cone. USED.
6—16 x 6 Reed Prentice Single Purpose, Semi-automatic. NEW and USED.
1—16 x 8 Reed Plain Screw Cutting.
1—18 x 8 Rae QCG DBG Engine Lathe. NEW.
1—18 x 8 Milwaukee DBG QCF Engine. NEW.
1—18 x 8 Ryerson Cincinnati QCG DBG Engine. USED.
1—18 x 10 McDougall QCG DBG Engine. USED.
1—18 x 12 McGregor Gourlay Engine. USED.
1—20 x 8 Bridgeport Plain Screw Cutting. USED.
2—20 x 8 Prentice QCG DBG Engine. NEW.
1—20 x 10 McKechnie Bertram Plain Screw Cutting. USED.
1—20 x 12 McKechnie Bertram Plain Screw Cutting. USED.
1—24 x 10 Ryerson Milwaukee DBG QCF Engine. NEW.
1—24 x 10 Porter 5-Step Cone Engine. USED.
1—24 x 14 Prentice QCG DBG Engine. NEW.
2—26 x 12 Pond Engine Lathes. USED.
1—30 x 16 Advance DBG QCG Heavy Engine. NEW.
1—36 x 16 Bridgeford Heavy Duty. NEW.
1—36 x 18 Putnam, Comp. & Steady Rests. USED.
1—50 x 40 Ryerson Fifield Heavy Engine. NEW.

TURRETS.

3—Davis 24" Turrets, 2" Hollow Spindle. USED.
3—Oliver Turret 2½'' Hollow Spindle. USED.
1—Oliver 18" 2½ Hollow Spindle. USED.
1—Oliver Johnson 18", 1¾" Hollow Spindle. USED.

DRILLS

2—No. 1 Burke 10" Sensitive Bench Type. NEW.
1—13" Pollard Ball Bearing Sensitive. USED.
1—14" Perfect Senstive. USED.
1—13" Reed Sensitive. USED.
1—16" Single Spindle High Speed Edlund. NEW.
1—20" Barnes Auto. Stop. Return Feed. NEW.
2—20" Champion P. W. & L. Feed. NEW.
1—24" Aurora Sliding Head. NEW.
1—25" Barnes Auto. Stop, Return Feed. USED.
1—32'' McK. Bertram Heavy Duty. USED.
1—36" Bertram Heavy Duty. USED.
1—D8' Colburn Heavy Duty. USED.
1—4' Ryerson Radial Gear Box. NEW.

SHAPERS

1—Rae 16" Back Geared Crank Shaper. NEW.
1—Steptoe 24" Single Pulley Drive. NEW.
1—Milwaukee 16" Back Geared. NEW.
1—McDougal 20" Back Geared. USED.
1—Rhodes 7" Horizontal. USED.

PLANERS

1—18 x 18 x 4' McKechnie Bertram. USED.
1—24 x 24 x 8' Bertram One Head. PSED.
1—24 x 24 x 10' Butler Motor Drive. USED.
1—28 x 28 x 6' Putnam. USED.
1—30 x 30 x 8' London. USED.
1—36 x 30 x 12' London. USED.
1—36 x 48 x 16' Ryerson Martin. USED.
1—48 x 48 x 14' Powell Motor Drive. USED.
1—48 x 48 x 18' Ryerson Multi-Speed Four Heads. NEW.

GRINDERS.

1—No. 2, Bath Universal. NEW.
1—8 x 36 Fitchburg Cylindrical. NEW.
1—Stevens Universal, complete. NEW.
1—Yankee Twist Drill Grinder. USED.
1—U.S. Electrical Portable Grinder. USED.
1—Ford Smith 16" Disc Double Ring. USED.
1—No. 12 Gardner Disc, 18" Discs. USED.
1—No. 1 Cincinnati Universal Tool and Cutter. USED.
1—No. 1 Wilmarth & Morman Tool and Cutter. USED.
1—No. 1 Wilmarth & Morman, Style BPT Yankee Drill. USED.
1—No. 65A Blount Wet Tool. USED.
Several Pedestal Grinders.
1—14 x 72 Norton Plain Grinder, complete. USED.

MILLING MACHINES.

1—No. 3 Ryerson, Conradson Blain; Helical Geared; Single Pulley Drive. NEW.
1—No. 3 Ryerson Conradson Universal. NEW.
1—No. 3 Ryerson Owen Universal. NEW.
1—No. 2 Ford Smith, Plain. NEW.
1—Type A Gooley & Edlund 16" Traverse Briggs. USED.
1—No. 4 Cincinnati Plain Single Pulley Drive. USED.
1—No. 1½ American Plain. USED.
6—Burke No. 1 Bench Millers. USED.

PUNCHES SHEARS PRESSES

Several Small Punches and Shears. Capacity to ¼''. NEW.
1—Ryerson Rotary Bevel Shear. Capacity 1". NEW.
1—Ryerson Double Housing Type Splitter. Cap. ¾''. NEW.
1—Ryerson Kling Punch, 1¼ x 1"; 48" Throat. NEW.
1—Styles Parker Punch Press, Stroke 1¼". USED.
1—Brown, Boggs Single Crank Double Arch Geared Press, 4" Stroke. USED.
1—No. 200 Brown, Boggs Prese 1¾" Stroke. USED.
2—No. 13 Stoll Plain Inclinable Open Back Presses. NEW.
1—No. 57½ Toledo Geared Press. USED.

AUTOMATICS

1—No. 2 Garvin Automatic Screw Machine Wire Feed. USED.
1—No. 2 Brown & Sharpe Screw Machine Wire Feed. USED.
1—National Acme Auto. Screw Machine, Four Spindle, Cap. ⅞". USED.
1—National Acme Auto. Screw Machine, Four Spindle, Cap. 1". USED.
1—National Acme Auto. Screw Machine, Four Spindle, Cap. 1⅛". USED.
1—National Acme Auto. Screw Machine, Four Spindle, Cap. 1 7-16". USED.
10—Cleveland Single Spindle, Capacities ¾" to 1 3-16". USED.
1—Cleveland Single Spindle, Capacities ⅝". USED.
6—Brown & Sharpe Auto. Screw Machines. Various Capacities.

MISCELLANEOUS.

2—Brown & Sharpe Polishing Lathes.
1—Generator 125 K.W. D.C. 110 Volt.
1—Type 3 Geometric Threading Machine, ½" Cap. USED.
3—Packard Vacuum Pumps.
3—66" Bement Miles Vertical Tire Boring Mills. USED.
3—42" Bullard New Era Type Vertical Turrets. NEW.
1—1200-lb. Steam Drop Hammer. USED.
1—No. 9 Beaudry Belt Driven Power Hammer. USED.
1—Ingersoll Horizontal 10x18 Belt Driven Air Compressor. USED
1—Sullivan 10x10 Air Compressor. USED.
2—Racine Power Hack Saws. USED.
1—No. 16 American Gas Furnace for Tool Room with Blower. USED.
1—Warner Swasey Double Spindle Valve Miller. USED.
1—American Tool Single Spindle Valve Miller. USED.
1—Warner Swasey Three Spindle Valve Grinder. USED.
Several Items Moulding Shop Equipment.
Shafting Pulleys, Belting and Hangers.
Full Equipment of THOR Pneumatic Drills, Hammers and Grinders.
Full Equipment of THOR Electric Drills and Grinders.

ENGINES

1—21 x 30 Right-hand Heavy Duty Goldie Corliss. Speed 150 r.p.m. Rites Governor and 75-foot drive belt 37 in. wide, Tightener.
1—20 x 40 x 42 Cross Compound Goldie Corliss Rope Drive with Condensor.
1—13 x 14 Robb High Speed Engine, with 70 K.W. Generator, 60-cycle, 3-phase, 220-V. Direct Connected — with Exciter.
1—18 x 18 Robb Armstrong High Speed Belt Drive.

Full particulars of machine listed, or any other equipment required will be forwarded on request.
Your inquiries are solicited.

Garlock-Walker Machinery Limited

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"Everything in Woodwork and Metalworking Machinery"

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The Week's Events in Montreal Industry

After conferring with representatives of the different freight departments, the Board feels that interference would not be justified at the present time. Therefore, prepayment of charges on goods going to the States will not be accepted by Canadian roads.

* * *

Following the protest of many Canadian shippers on the action of the railroads, asking for freight charges to be paid at destination, the Canadian Board of Railway Commissioners has decided not to interfere with the policy of the railroads.

* * *

R. W. Ashcroft, formerly advertising manager of the Canadian Consolidated Rubber Co., and for the past four years in a similar capacity with the United States Rubber Company, has been appointed director of publicity of the Ames, Holden, McCready System.

* * *

The return of the American railroads to the control of the respective companies has necessitated important administration changes in many instances. H. E. Whittenberger has been promoted to the position of general manager of the Grand Trunk lines west of Detroit and St. Clair River.

* * *

The Dominion Welding Manufacturing Co., of 576 St. Timothee St., will build a new plant on the present site to take care of their increasing business. They will manufacture the Presto instantaneous water heaters for domestic and industrial use. At present their activities will be devoted to the smaller size for house service, but eventually they will make the larger units for factory and manufacturing purposes.

* * *

W. R. Davidson, who has been general superintendent of Eastern lines for the past two years, will be transferred to a similar position on the Western division. R. H. Fish will take the position of general superintendent for Eastern lines. These changes will become effective immediately.

* * *

D. B. Hanna, president of the Canadian National Railways, has just announced the appointment of William Phillips, director of the Robert Reford Co., to the position of European manager of the C.N.R. and C.G.M.M., with headquarters in London. Mr. Phillips returns to an office that is not new to him, as he was in charge of the C.N.R. European business before the inauguration of the merchant service.

* * *

The McCormick Machinery Co. of Montreal, has leased a two-storey brick building at 58 Prince St., which the company is using for a storage warehouse for a large part of their present stock. A portion of the ground floor will be reserved for a machine shop for the repairing and rebuilding of used equipment. In a short time the offices of the company will be removed from the present location, 30 St. John St., to the warehouse site.

* * *

The decision of Sir Auckland Geddes to accept the office of American Ambassador to Washington, necessitated the resignation of the principalship of McGill University, to which office he was appointed some months ago, and while he was still in the service of the British Government. Nothing definite has been done towards filling the vacancy at McGill, but it is rumored that several names of distinguished scholars in the United Kingdom have been mentioned for the position.

* * *

Another milestone in the progressive development of the telephone was passed last week when through conversation between Montreal and Winnipeg was successfully carried on by L. B. McFarlane, president of the Bell Telephone Co. of Canada, and his son, H. B. McFarlane, in Winnipeg. The demonstration was made at the Mount Royal Club in Montreal before a gathering of interested parties. Several days will be required to place this new long distance service in practical operation.

Due announcement will be made by the telephone company when the new service is open for business.

* * *

D. B. Hanna, president of the C.N.R., in an address before the Canadian Club at Ottawa, predicted a rosy future for the Canadian roads. He does not anticipate any repetition of disastrous consequence as a result of the Government taking on additional railroad responsibilities, but believes that the acquirement of the roads will be of an entirely beneficial character. He stated that the United States had taken possession of the railways as a war measure, while in Canada the roads were taken over for economic reasons. The object of the U. S. was to effect unified service during the war, regardless of cost. In Canada, he stated, they were taken over for adequate and efficient service. Politics will be kept out of the administration affairs of the roads.

The "Labor Gazette" (February) says: The lockout of moulders at Brantford, and the strikes in the moulding trade at Sherbrooke and Toronto, which commenced on May 1, September 23 and May 1, respectively, were still unterminated, although in all three disputes most of the orignal strikers had secured work elsewhere. The strike of shipbuilders at Sorel, which commenced on August 12, was also unterminated. Four strikes in this group commenced during January. The most important of these was the strike of 120 machinists, involving five firms, at St. John, N.B. This strike commenced on January 27. The men demanded a minimum of 68 cents per hour and an eight-hour day, instead of the former minimum of 50 cents per hour and a nine-hour day. Later developments of this dispute would seem to indicate that the principle of union recognition was also a factor. This group closed for the month with eight disputes unterminated, involving 943 employees and an approximate time loss of 21,202 working days.

TENDERS

The city of Montreal wants tenders for the manufacture, delivery, and erection of two 30,000,000-gallon motor-driven pumps, tenders to be mailed not later than March 15, 1920. Specifications and information can be obtained from the Director of Public Works, City Hall, Montreal, P.Q.

The Department of Public Highways will receive tenders up to March 17 for the supply of from one to five horse-drawn steel gasoline tanks, capacity about 400 gallons for storing and moving gasoline. Prices f.o.b. factory. Tender envelopes can be obtained at the office of the Department, Toronto.

The Department of Public Highways require tenders for wagon loaders, tenders to be in by March 24, 1920. They are to be gasoline-driven mechanical waggon loaders, one f.o.b. Beamsville, and one f.o.b. Cainsville, delivery not later than May 17, 1920. Specifications can be obtained at the office of the Department of Public Works, Toronto.

The Department of Public Works of the Province of British Columbia is calling for tenders for the construction of a highway bridge over the Columbia River, Brisco. Tenders must be delivered by March 13, 1920, and plans and specifications can be obtained at the Public Works Dept., Victoria; District Engineers' Office, Vancouver; or the District Engineer's Office, Golden, B.C.

STATUS OF ELECTRIC FURNACE

(Continued from page 273)

verted into iron (Fe) at 700° C., and the reaction becomes more rapid with increasing temperature until a temperature of 800° C. is reached when it is complete, all the iron being in a spongy metallic state. The sponge iron is all melted when temperatures of 1100° to 1300° C. are reached, there being some variation in the heat required according to the analysis of the iron.

Efforts have been made to utilize iron sponge in various types of processes, and heretofore the main difficulty has been the prevention of re-oxidation when the highly-heated sponge comes into contact with the air. In the process at present being considered the arrangement of the reducing furnace and the electric furnace in which the melting down takes place is such that this difficulty is obviated.

This process is particularly adapted to the production of iron or steel direct from many of the Canadian ores which at the present time are not usable in their raw state and which have to undergo some treatment such as sintering before being in a suitable condition for the blast furnace.

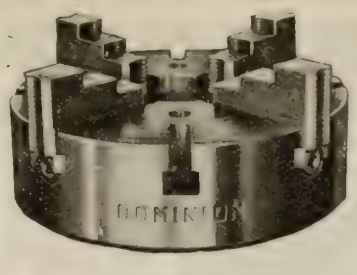
INTERESTING CATALOGUE

The Lakewood Engineering Co., Cleveland, Ohio, have issued a very interesting catalogue dealing with their Tier-Lift Truck. The action is explained and various comprehensive photographs are given, showing the truck in action. Various transportation problems are discussed, and the solutions to them shown. Anyone requiring a truck of this nature will be interested in this catalogue.



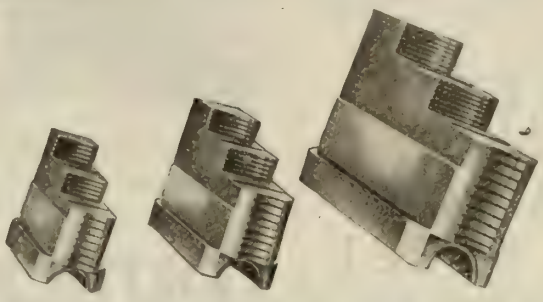
—Morris for George Matthew Adams Service

Uncle Sam: "See who's coming to keep house for us."



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

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3

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Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.

THE KIMBER & HILLIER MFG. CO.,
Thorold Road, St. Catharines, Ont.

A manufacturing opportunity. The LITTLE TWISTER Belt Power Transmitter for Ford and Dodge cars.

This is the simplest, lightest, best selling device of its kind. A twelve months' test of selling direct has netted 25% of sales from all inquiries.

500 LITTLE TWISTERS in daily use giving testified satisfaction. Entire patent rights are for sale. Thorough investigation invited from responsible manufacturers.

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Order "Hawk Vanadium" for your End Mills and cutters. Once known—always used.

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SEND US YOUR ENQUIRIES.



A Drinking Water Service that will last a LIFETIME

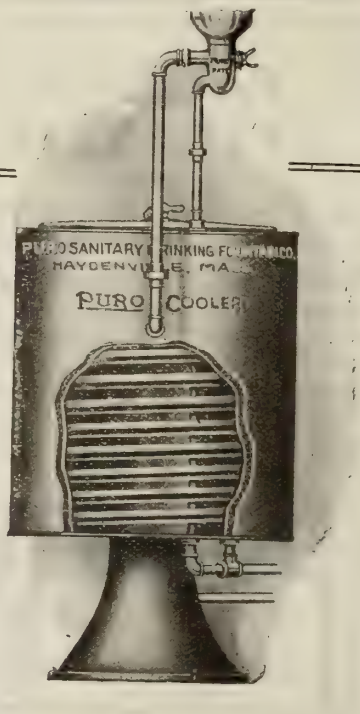
What you pay for a few ordinary drinking cups will meet the cost of the

PURO SANITARY DRINKING FOUNTAIN

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DRINKING CUPS ARE UNSANITARY but the "Puro" delivers clean, fresh water at a reduction of 15 per cent. to 35 per cent. in water bill.
"PURO" WILL SAFEGUARD THE HEALTH OF YOUR EMPLOYEES and protect your staff against disorganization by sickness.
Easily attached. Simply unscrew the ordinary faucet and put on the "Puro."
Write us to-day for full information regarding the cost of installation of the "PURO" Sanitary Drinking Fountain Service.

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WELDING OF LOCOMOTIVE CYLINDERS

By L. A. North

The welding of locomotive cylinders and other parts has been made possible and very successful by the introduction of oxy-acetylene and electric welding. It has been possible to weld locomotive cylinders which formerly would have been scrapped or repaired with either a brass patch or a dovetailed insert of some other metal, the weld in the majority of cases making a substantial and satisfactory job provided the expansion and contraction had been properly taken care of.

Experience has taught us that in order to properly weld a locomotive cylinder or a casting of any make or design, it is necessary to thoroughly pre-heat to insure a uniform temperature in order to properly take care of the contraction and expansion and to avoid cracking after the weld has been made and the metal has been allowed to cool off. The success of any weld of this kind depends largely on the care used in the pre-heating and the judgment of the operator making the weld. We cannot be too particular in the selection of the operator for this class of work.

Some difficult welds have come to my observation, one in particular, where the entire upper portion of the cylinder at the port area had been totally destroyed. This was repaired by having a grey iron patch cast in the foundry, fastened to the cylinder by means of clamps and welded in place. The cylinder was preheated to a uniform temperature to take care of the expansion and contraction. After the weld had been made and the cylinder had cooled down, a reinforcement was added to this weld by drilling through between the stud holes and securing the additional support by tap bolts which were tapped and screwed into the main barrel.

It is possible to weld broken bridges in slide valve cylinders successfully. Recently this was done and effected a saving of two cylinders in place of the one, which was cracked, as the cylinder which was repaired was an obsolete pattern, and had we not been able to make this weld the application of an entire pair of cylinders to this engine would have been necessary. As this engine was one that in a few years will be placed in the scrap pile, I am satisfied that the weld will outwear the present cylinders.

Not having experience with electric welding on cast iron, I am not prepared to enter into a discussion of this method to any great extent, but I have examined a number of castings which have been repaired with the electric welding process, and careful examination failed to disclose any flaw or fault in the weld.—"Welding Engineer."

THE REMOVAL OF PAINT FROM IRON AND STEEL SURFACES

By F. A. McLEAN.

Scraping or burning paint from the surface of iron and steel structures previous to the application of a new coat is a slow and laborious process. An easier and more rapid way of doing this work is the method used by the United States Coast Artillery, for cleaning the exterior portions of the big guns and gun carriages in their care.

In practice, a one pound can of concentrated lye is dissolved in three quarts of boiling water, and to this mixture sufficient lime is added to emulsify the solution. This solution is freshly mixed each time it is to be used and is applied with a brush and allowed to remain until it is almost dry. It is then removed and unless the paint is very old and thick it will come off with it. If one application of the mixture does not remove all of the paint, the surfaces are washed off and a second coating applied. Before a new coat of paint is put on, the surface of the metal should be thoroughly cleansed with a solution of washing soda (in the proportion of one-half pound to two gallons of hot water), and well dried either by wiping with soft cloths or by the application of heat.

The Lignite Utilization Board of Canada will receive tenders at its offices, 2 Youville Square, Montreal, for three horizontal return tubular boilers, 72 in. by 18 feet, 160 lbs. per square inch working pressure, to be built to the requirements of the Province of Saskatchewan, together with accessories and fronts. Specifications can be obtained from the Board at the above address.

TENDERS

The Bruce County Council are asking for tenders for a bridge over the Teeswater River on the Brant and Greenock Township line. One tender is for concrete abutments and pier and reinforced concrete span. Tender No. 2 is for 105 feet steel through truss. Plans and specifications can be seen at the office of the County Engineer, Mr. Fred B. James, Walkerton, Ont. The latest date for tenders to be received is March 15th.

The City of Niagara Falls, Ont., is asking for tenders, to be received up to March 15th, for a standard-built motor pump of 100 to 110 housepower, rotary pump of 600 gallons capacity, chemical tank 35 gallon capacity, Sewell cushion wheels, and standard equipment. Proposals to be addressed to the W. J. Seymour, City Clerk, and place where apparatus may be seen in action must be stated.

The Department of Public Highways will receive tenders up to March 23rd of the supply of from 25 to 40 tank car lots and 300 to 600 barrels of 50 per cent. asphaltic road oil prior to October 1st, 1920. Specifications and tender envelopes may be obtained at the office of the Department of Public Works and Highways, Toronto.



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Canadian Patent 161863 for Gearing.
Canadian Patent 1920099 for Cutting double helical teeth in Gear Wheels.
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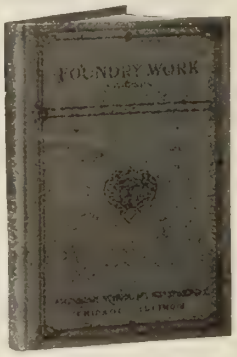
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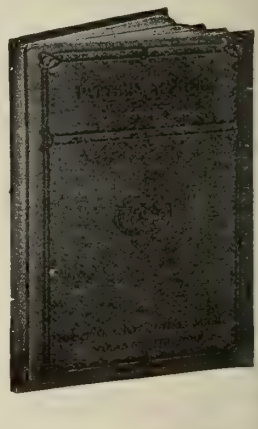
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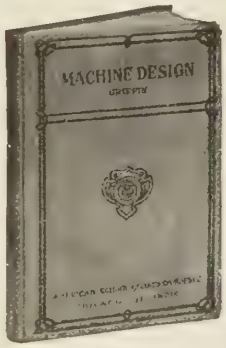
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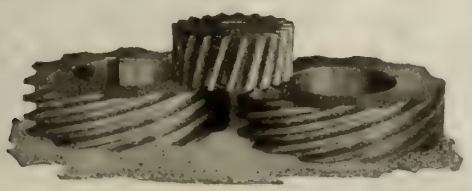
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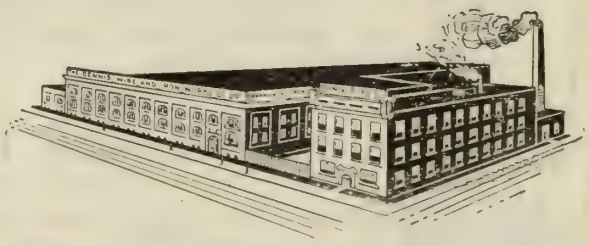
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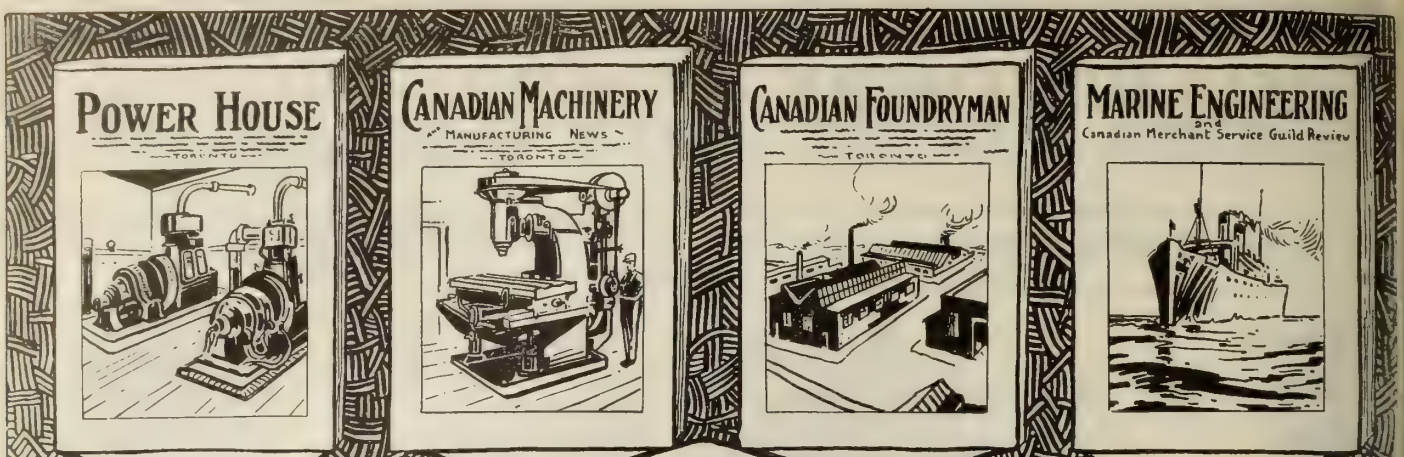
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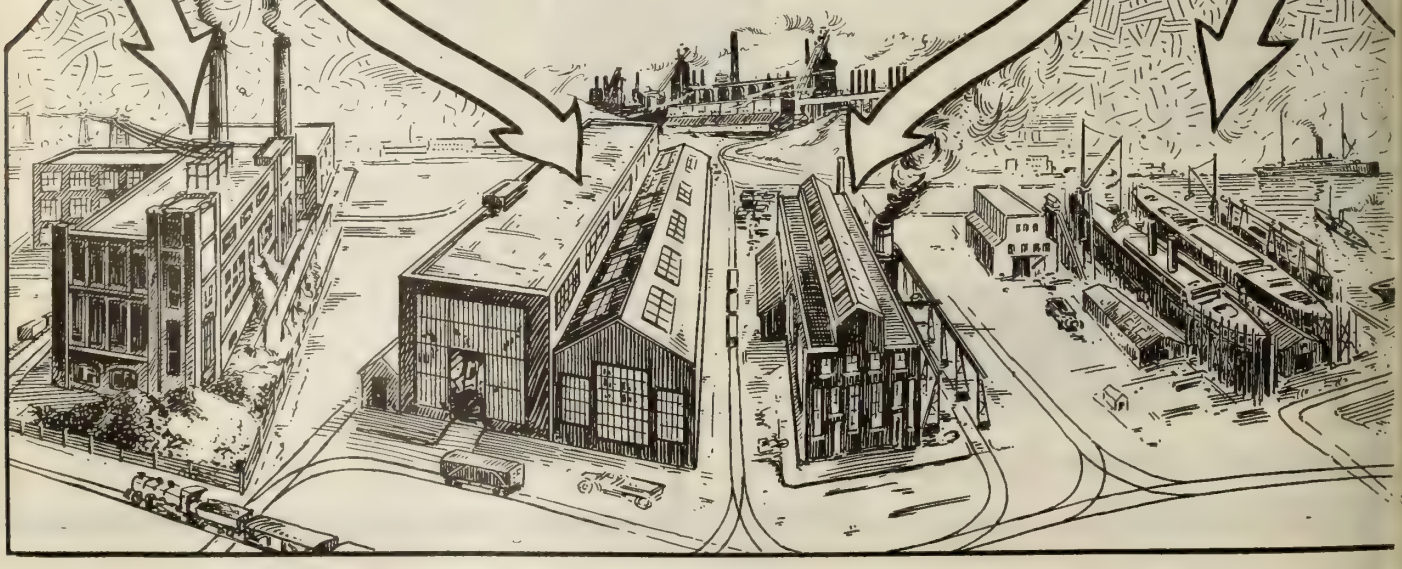
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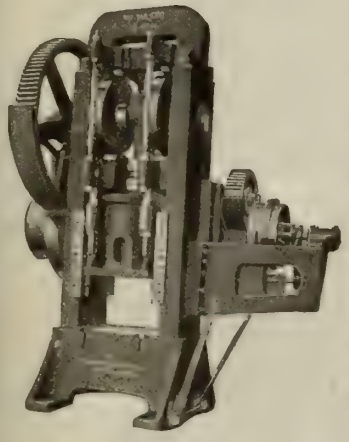
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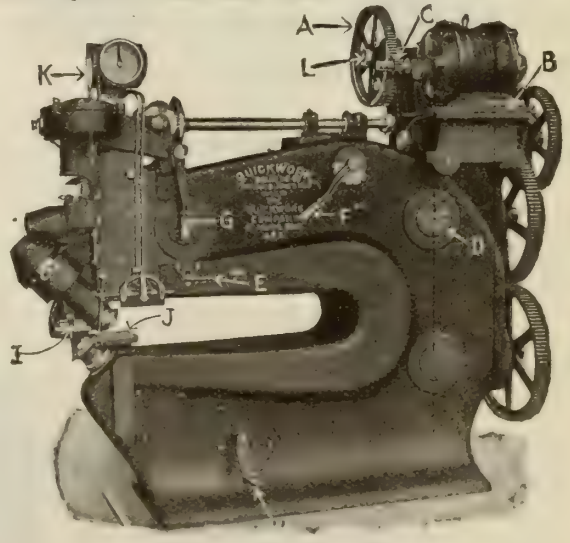
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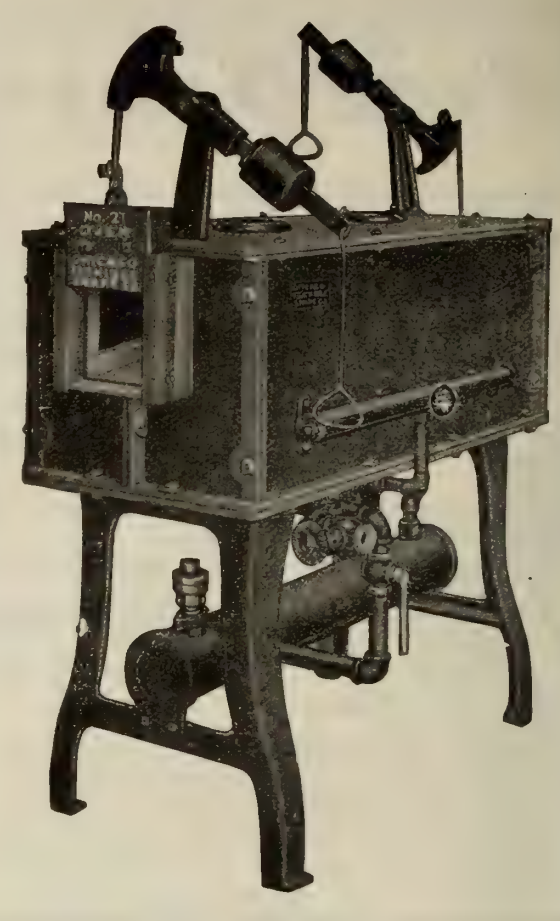
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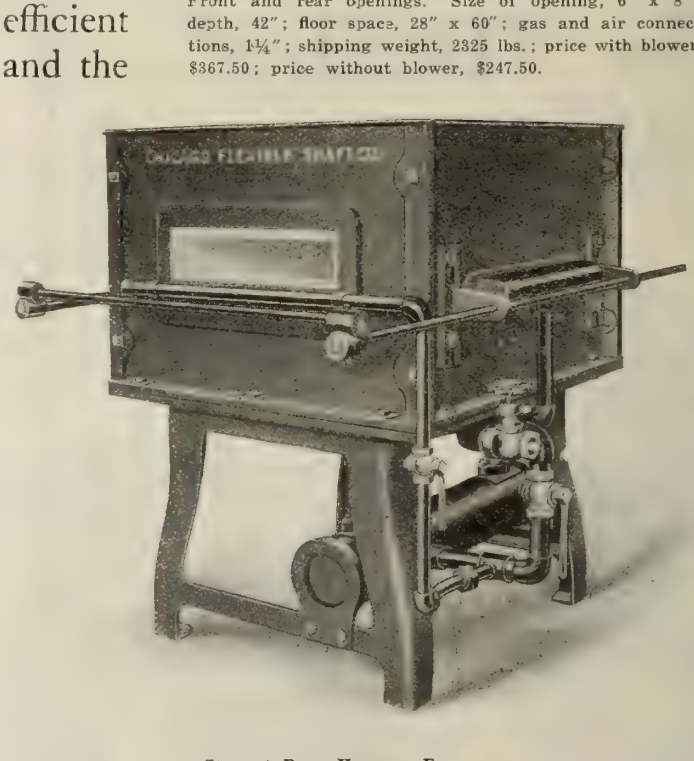
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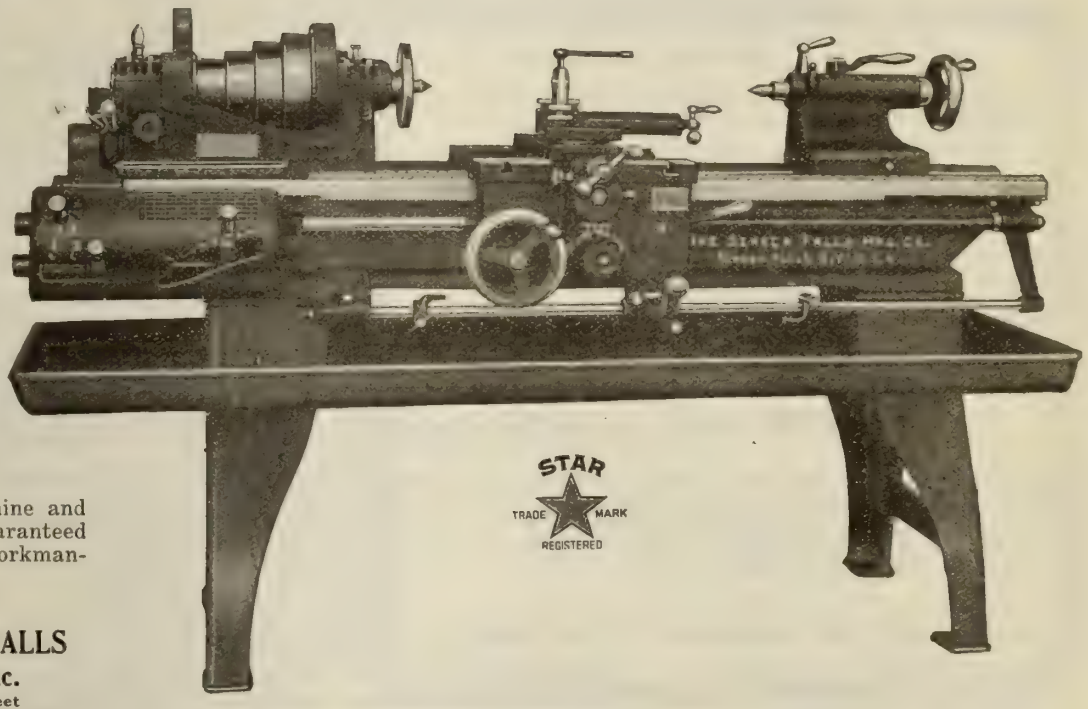
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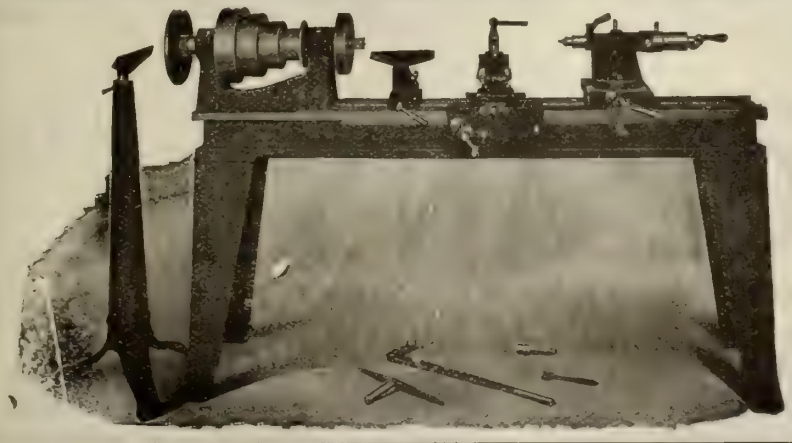
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THIS prediction is made by J. K. Munro in the March 1st issue of MacLean's, now on sale. He carefully reviews the situation that has developed at Ottawa and indicates the straws which show that the wind is setting in the direction of the Ex-Finance Minister: A clear and shrewd summing up of the situation written in semi-humorous vein.

This article is one of a great many unusual and vital articles in this number. For instance:

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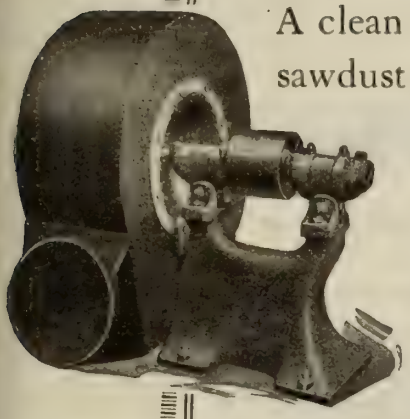
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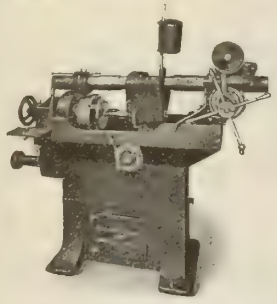
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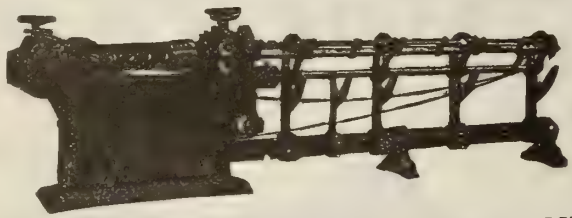
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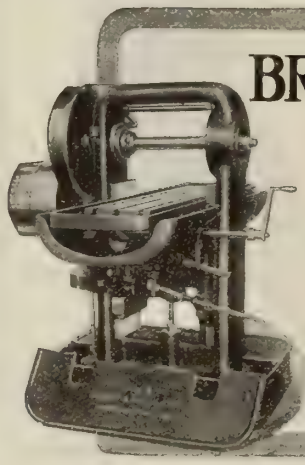
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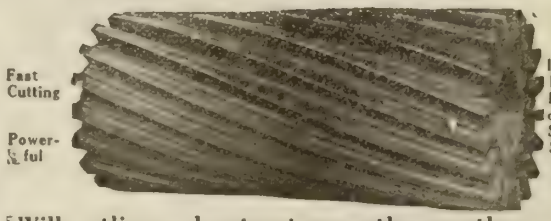
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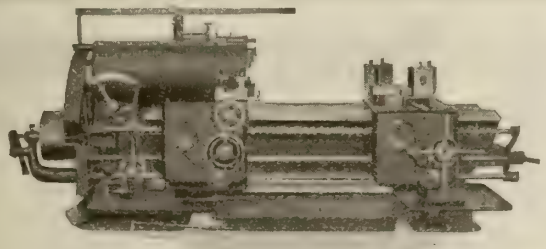


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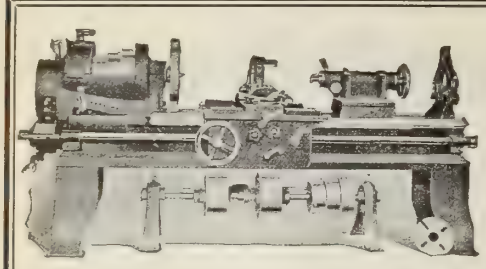
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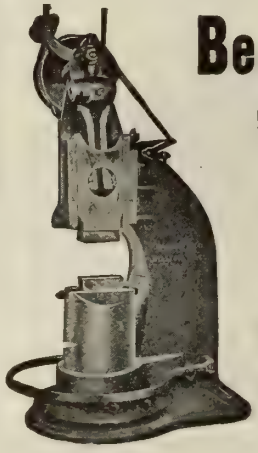
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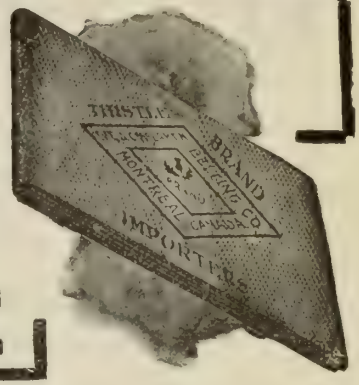
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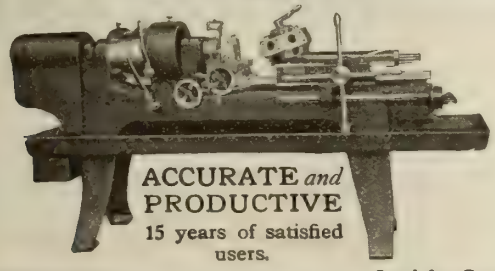
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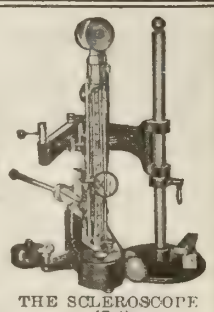
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ARCHITECTURAL IRON
Page Steel & Wire Co., Adrian, Mich.

ARCHITECTS' SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

ARRESTERS, DUST
Northern Crane Wks., Walkerville, Ont.
Pangborn Corporation, Hagerstown, Md.

ASH HANDLING MACHINERY
Canadian Mead-Morrison Co., Limited, Montreal, Que.

AUTOGENOUS WELDING AND CUTTING PLANTS
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
St. Lawrence Welding Co., Montreal
Welding & Supplies Co., Montreal, Que.

AUTOMATIC MACHINERY
Baird Machine Co., Bridgeport, Conn.
Davis-Bournonville Co., Toronto, Ont.
Garlock-Walker Machy. Co., Toronto.
Gardner & Son, Robert, Montreal.
National Acme Co., Cleveland, Windsor
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC RAILWAYS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Furniss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal Que.

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
C. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St Lawrence Welding Co. Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto
Jardine, A. B., & Co., Hespeler, Ont
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal, Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
St Lawrence Welding Co. Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILER HOUSE EQUIPMENT
Canadian Mead-Morrison Co., Limited, Montreal, Que.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co, Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co.,, J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gast Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach. Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., W aynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mche. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal, Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke Que.
St Lawrence Welding Co, Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd. Walkerville.
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BUNKERING EQUIPMENT
Canadian Mead-Morrison Co., Limited, Montreal, Que.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CABLEWAYS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd. Montreal
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CAR DUMPERS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CAR PULLERS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd,, Orillia, Ont

CARRIERS
COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS. NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd., Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

CLAY FIRE
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Gisholt Machine Co., Madison, Wis.
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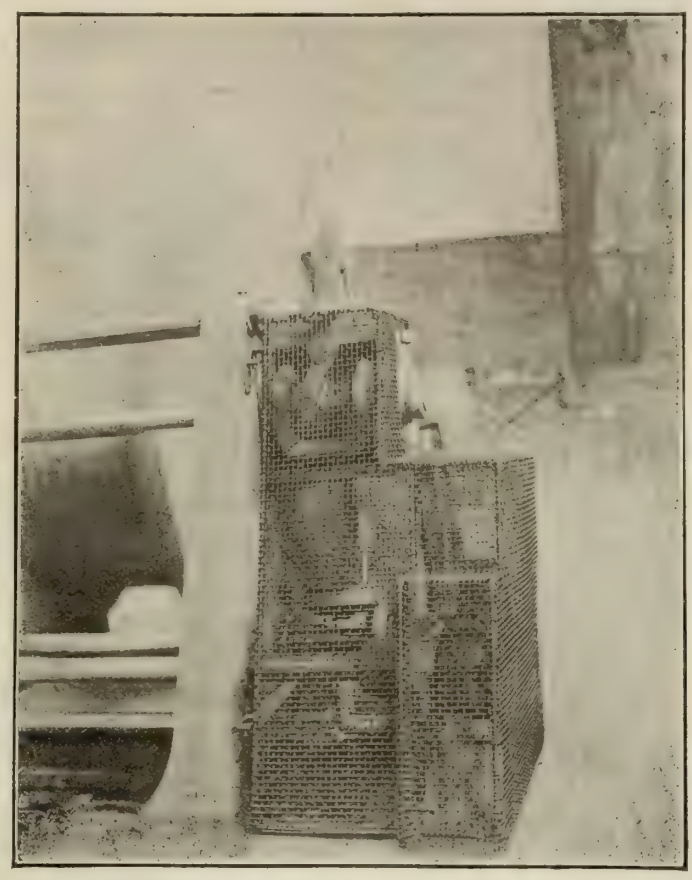
CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
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Petrie, Ltd., H. W., Toronto.
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Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

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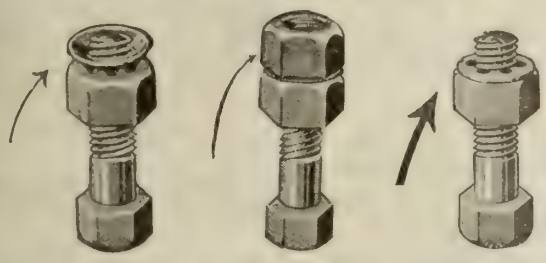
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Knowing the size Bolt use same size Nut; Lock. Place over Bolt—as shown above.

Screw another Nut onto Nut Lock and Depress it as shown above.

Remove Second Nut and Nut Lock will Look as shown above.

The Hold Tite Nut Lock cannot come loose when it is compressed into the thread of the Bolt. Compressing will not destroy the thread.

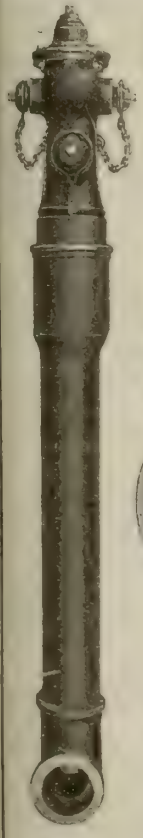
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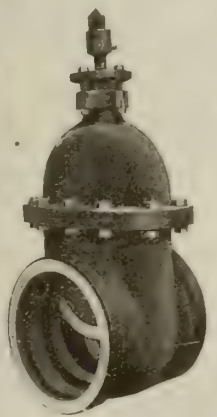
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Made by Canadian Workmen

Needle Grinding Test Proves that

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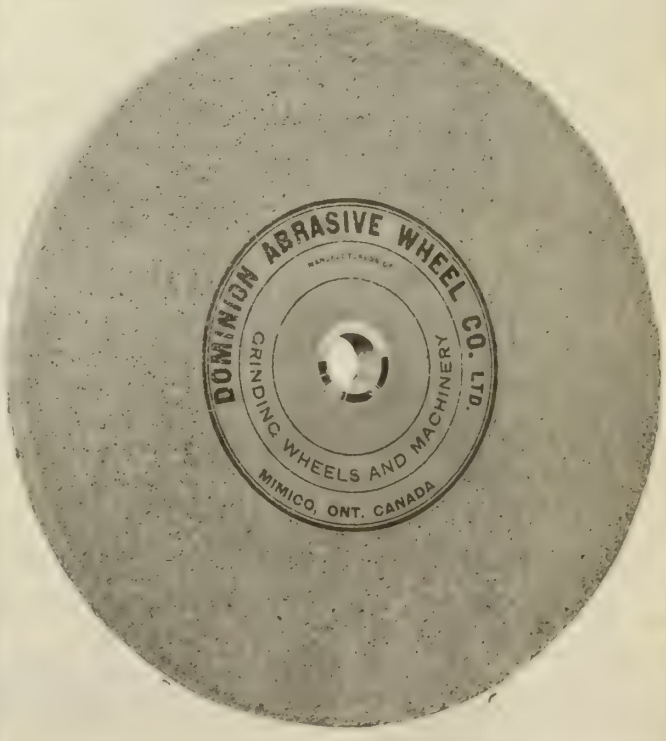
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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
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R. McDougall Co., Galt.
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Silver Mfg. Co., Salem, Ohio.
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Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
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Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co., of Can., Walkerville

DRILLS, BLACKSMITH AND BIT STOCK
Alkenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

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Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Alkenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

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Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

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Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

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Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
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Globe Engineering Co.

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Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

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Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

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Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

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Pangborn Corporation. Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

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Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
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Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

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Oliver Machinery Co., Grand Rapids, Mich

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Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

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Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
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Wheel Trueing Tool Co., Windsor Ont.

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Sturtevant Co., B. F., Galt, Ont.

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A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

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ESCUTCHEON PINS
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Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

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Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

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City of St. Johns, Quebec.

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Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

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Morrow Screw & Nut Co., J., Ingersoll, Ont
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Nicholson File Co., Port Hope, Ont.
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Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.

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Bamy Mfg. Co., Chicago, Ill.

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Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

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Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

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Northern Electric Co., Ltd., Montreal Que

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Elec. Steel & Metals, Welland, Ont.

FLUMES
William Hamilton Co., Peterboro, Ont.

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Can. Blower & Forge Co., Kitchener.
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Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

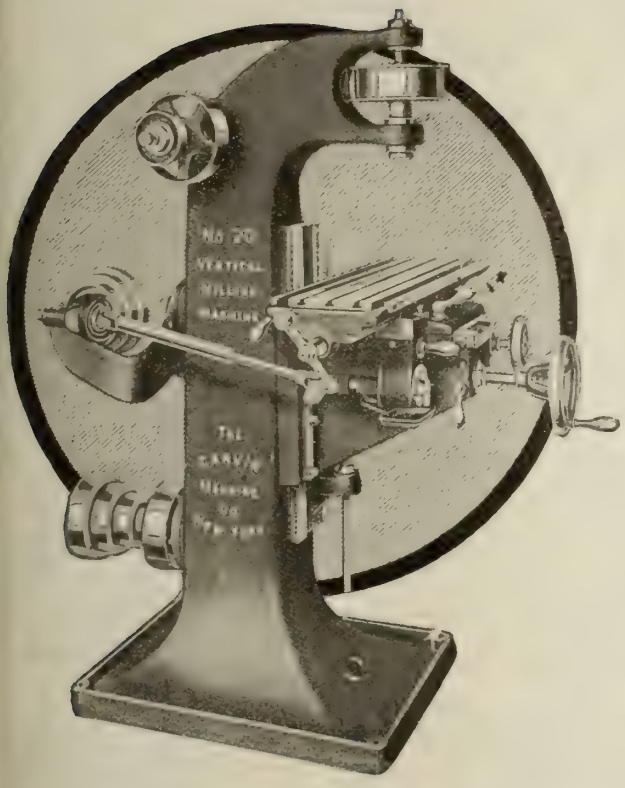
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Taylor Instrument Co., Rochester, N.Y.

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Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
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Dom. Forge & Steel, Hamilton, Ont.
Kaiser-Ellison & Co., Ltd., Montreal
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Kahn Foundry, Galt, Ont.

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Petrie, Ltd., H. W., Toronto.
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Can. Link-Belt Co., Ltd., Toronto, Ont.

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Dominion Bridge Co., Montreal, Que.
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Elliott & Whitehall, Galt, Ont.
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Hull Iron & Steel Found., Ltd., Hull, Q.
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Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Kaine Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
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Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
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National-Acme Co., Cleveland, Ohio.

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Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Con.
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, MANUFACTURING
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Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

GRINDERS, PLAIN CYLINDRICAL
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Fitchburg Grinding Mach. Co., Fitchburg, Mass.

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Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
Heald Machine Co., Worcester, Mass.
Independent Pneumatic Tool Co., Chicago
MacGovern & Co., Montreal, Que.

GRINDERS, PROFILE
Cleveland Milling Machine Co., Cleveland.

GRINDERS, ROTARY SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
Bristol Machine Tool Co., Bristol, Conn.
Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
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Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

GRINDERS, VERTICAL, SURFACE
Brown & Sharpe Mfg. Co., Providence, R.I.
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Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

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Wausau Abrasives Co., Chicago, Ill.

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Cincinnati Elec. Tool Co., Cincinnati, O.
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
Hall & Sons, John H., Brantford, Ont.
Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Wisconsin Electric Co., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.

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Norton Co., Worcester, Mass.

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Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., E. C., Hamilton, Ont.
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Carborundum Co., Niagara Falls, N.Y.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal
Norton Co., Worcester, Mass.

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Canada Machinery Corp., Galt, Ont.
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Diamond Saw & Stamping Wks., Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Kaiser-Ellison & Co., Ltd., Montreal.
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Pilot Steel & Tool Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
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Rice Lewis & Son, Toronto, Ont.
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Williams Mchy Co., A. R., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York City.
Victor Saw Works, Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Diamond Saw & Stamping Wks., Buffalo
Foss Mchy. & S'ply Co., G. F., Montreal
Ford-Smith Machine Co., Hamilton.
Perfect Machine Co., Galt, Ont.
Starrett Co., L. S., Athol, Mass.
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Oliver Engineering Co., Montreal.
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Kennedy & Sons, Owen Sound, Ont.
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Northern Crane Works, Walkerville, Ont.
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HOLDERS, ELECTRIC
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Clipper Belt Lacer Co., Grand Rapids.

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William Hamilton Co., Peterboro, Ont.
Toronto Iron Works, Ltd., Toronto, Ont.

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Niles-Bement-Pond Co., New York.
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Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES
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Garvin Machine Co., New York.
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Hardinge Bros., Inc., Chicago, Ill.
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Williams Machy. Co., A. R., Toronto.
Wood Turret Machine Co., Brazil, Ind.
Worcester Lathe Co., Worcester, Mass.

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Protection against rust and corrosion, protection against the deteriorating effect of exposure to weather, smoke, fumes and gases is the kind of building protection you'll find in Robertson Process Metal.

You can have this kind of protection on your roofs and siding, on flashings, gutters, downspouts and building trim. You can have it even in your ventilators where corrosion and rusting are most apt to take place—and you can have it on the metal parts of your skylights.

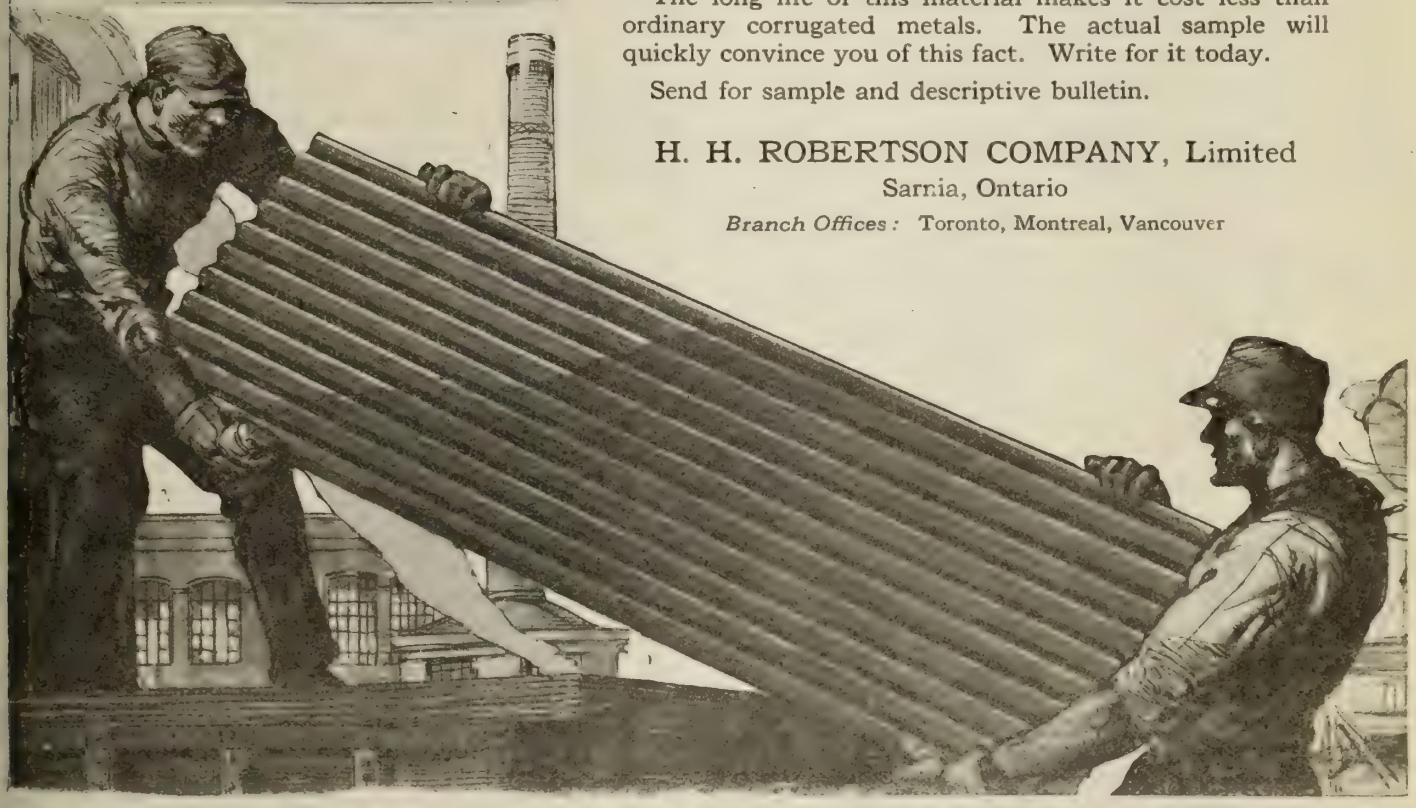
You'll be convinced that it is very real protection when you examine the process illustration shown. This illustration shows the three processes of protecting the steel sheet in making Robertson Process Metal: (a) shows the specially annealed steel, (b) the thick layer of asphalt firmly adhered to the steel, (c) the asbestos felt that is pressed into the asphalt while it is still hot, (d) the waterproof coating that forms the final weather resisting surface.

Send Today for Process Sample

The long life of this material makes it cost less than ordinary corrugated metals. The actual sample will quickly convince you of this fact. Write for it today.

Send for sample and descriptive bulletin.

H. H. ROBERTSON COMPANY, Limited
Sarnia, Ontario
Branch Offices: Toronto, Montreal, Vancouver



ROBERTSON PROCESS METAL FOR ROOFING AND SIDING

TRADE MARK REG. U. S. PAT. OFF.

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Garvin Machine Co., New York.
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Kempsmith Mfg. Co., Milwaukee, Wis.
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Cleveland Milling Machine Co., Cleveland.
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Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machy. Co., Toronto, Ont.
Garvin Machine Co., New York.
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Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
Knight Metal Products, Toronto.
Niles-Bement-Pond Co., New York.
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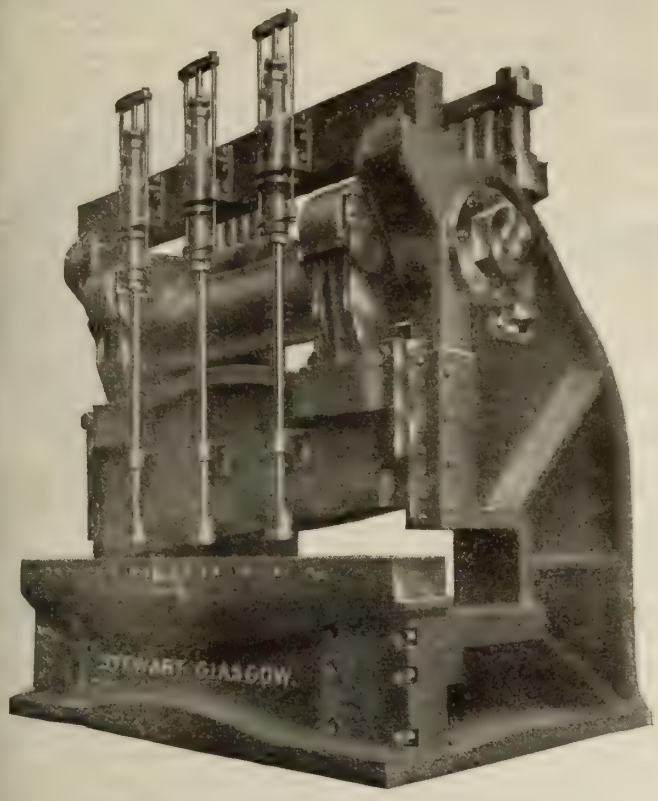
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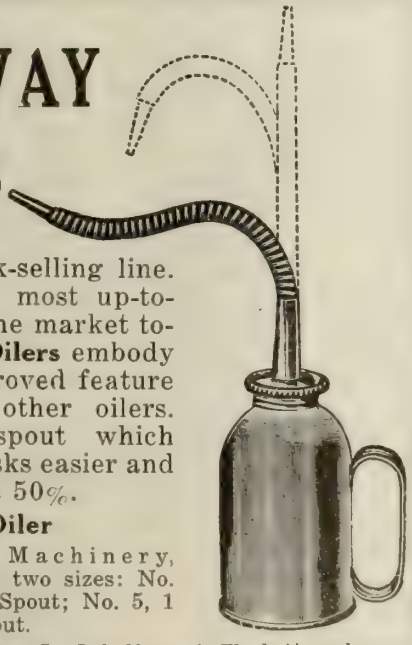
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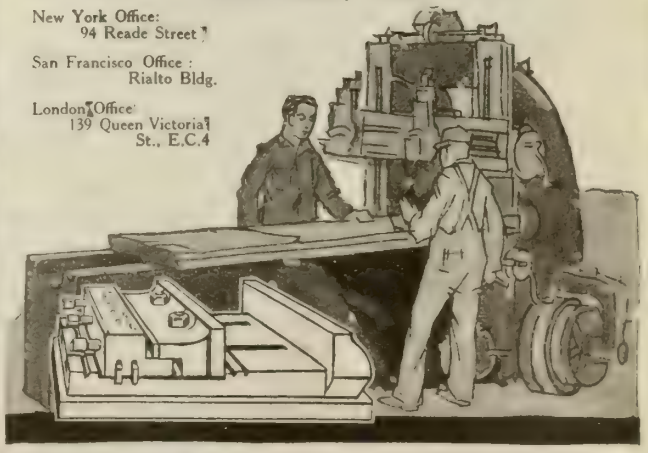
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Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Herbert Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

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Haskins & Co., R. C., Chicago, Ill.

POWER TRANSMISSION MCHY.
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PRESSED STEEL PARTS
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Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
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Bliss Co., E. W., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.

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Smalley-General Co., Inc., Bay City, Mich

PRESSES, PNEUMATIC
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Dom. Steel Products Co., Ltd., Brantford.
Metalwood Mfg. Co., Detroit, Mich.
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Can. Fairbanks-Morse Co., Montreal.
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Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
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Metalwood Mfg. Co., Detroit, Mich.
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Manhattan Machine & Tool Co., Grand Rapids, Mich.
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Bernard Industrial Co., Fortierville, Que.
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Petrie, Ltd., H. W., Toronto.
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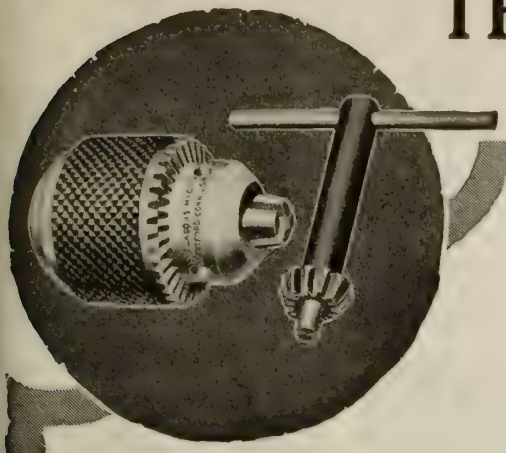
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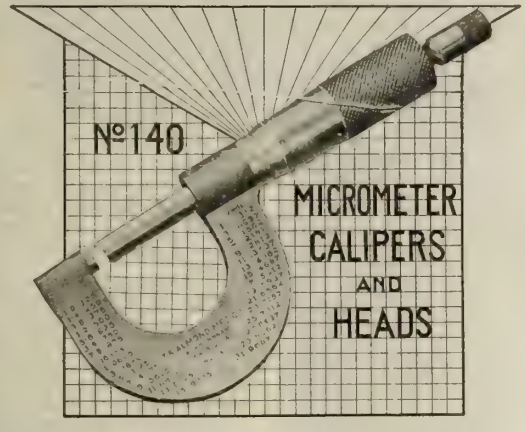
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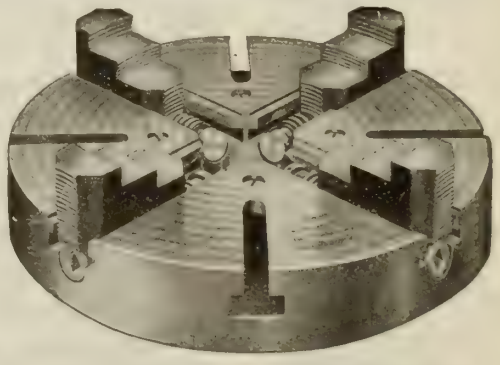
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SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co. New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington

SHEARS, IRREGULAR AND CIRCLE CUTTING
The Quickwork Co., St. Mary's, Ohio.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL MACHINERY
Peck, Stow & Wilcox Co., Southington, C.

SHEARS, SERPENTINE
The Quickwork Co., St. Mary's, Ohio.

SHEARS, SQUARING
Brown, Boggs & Co., Hamilton, Ont.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, STEEL, BLACK AND GALVANIZED
Benjamin & Co., M. & L., Samuel, Toronto, Ont.
Dominion Sheet Metal Corp., Hamilton.

SHEET METAL WORKING MACHINERY
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEET METAL WORKING TOOLS
Baird Machine Co., Bridgeport, Conn
Barber Mchy. Co., Ltd., Toronto, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton.
Peck, Stow & Wilcox Co., Southington, C.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Inc., Buffalo, N.Y.

SHEETS, CRUCIBLE, CAST
British Smelting & Refining Co., Ltd., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal

SHEETS, BLACK AUTO AND GALVANIZED
Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST. ALLOY
Can. Driver-Harris Co., Ltd., Walkerville

SHELVING, STEEL
Dennis Wire & Iron Works, London.

SHIPYARD MACHINERY, SHOP FURNITURE
Dennis Wire & Iron Works, London.

SIDE TOOLS
Armstrong Bros. Tool Co., Chicago.
I. H. Williams & Co., Brooklyn, N.Y.

SILENT CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SLEDGES
Aikenhead Hardware Co., Toronto, Ont
Rice Lewis & Son, Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont

SLEDGES, CAST IRON
Katie Foundry, Galt, Ont.

SLICING CLAMPS
Peck, Stow & Wilcox Co., Southington Conn.

SLINGS, CHAINS
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

SLOTTERS
Betts Machine Co., Rochester, N.Y
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York

SMOKESTACKS
William Hamilton Co., Peterboro, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
St Lawrence Welding Co, Ltd., Montreal

SNIPS, TINNERS AND SHEET METAL WORKERS
Kearney & Trecker Co., Milwaukee, Wis.
J. Morrow Screw & Nut Co., Ingersoll, Ont.

SOCKETS
Brown & Sharpe Mfg. Co., Providence.
Butterfield & Co., Inc., Rock island, Que
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
J. Morrow Screw & Nut Co., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

SOIL PIPE FITTINGS, CAST IRON
Katie Foundry, Galt, Ont.

SOLDERING IRONS
Aikenhead Hardware Co., Toronto, Ont.
Brown, Boggs & Co., Hamilton, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

SOLDER
British Smelting & Refining Co., Ltd., Montreal, Que.
Aikenhead Hardware Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.

SPELTER
British Smelting & Refining Co., Ltd., Montreal, Que.

SPEED REDUCING GEARS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal.

SPRINGS, MACHINERY
Barnes, Wallace Co., Bristol, Conn.
Can. Steel Foundries, Ltd., Montreal
Cleveland Wire Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Garlock-Walker Machinery Co., Toronto.

SPECIAL MACHINERY
Baird Machine Co., Bridgeport, Conn.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram, John, & Sons Co., Dundas.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada.
Brown Engineering Corp., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
Gooley & Eglund, Inc., Courtland, N.Y
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
Stoll Co., D. H., Buffalo, N.Y.
Victoria Foundry Co., Ottawa, Ont.
William R. Perrin, Ltd., Toronto.

SPECIAL TOOLS, MACHINERY
Crescent Mche. Co., Ltd., Montreal, Que.
Globe Engineering Co., Ltd., Hamilton.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Wilton & Mfg. Co., Boston, Mass.

SPRING COILING AND WINDING MACHINERY
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

SPRING MAKING MACHINERY (AUTOMATIC)
Baird Machine Co., Bridgeport, Conn.

SPRINGS, SPIRAL, TOOL
The Dunbar Bros. Co., Bristol, Conn.

SPROCKETS, COMPENSATING
Morse Chain Co., Ithaca, New York.

SPROCKETS, SPRING
Morse Chain Co., Ithaca, New York.

SPROCKETS, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Grant Gear Works, Boston, Mass.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
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The Dunbar Bros. Co., Bristol, Conn.

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Can. Link Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Ltd., Montreal
Perrin, Wm. R., Toronto.

SPROCKET WHEELS, CHILLED THREAD
Katie Foundry, Galt, Ont.

SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.



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Oliver Mach. Co., Grand Rapids, Mich.

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Dom. Forge & Stamping Co., Walkerville
Globe Engineering Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.

STAMPING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs, & Co., Hamilton, Can.
Canada Machinery Corp., Galt, Ont.

STAMPS AND DIES, STEEL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STAMPS, STEEL ALPHABET, FIGURES
Hoggson & Pettis Mfg. Co., New Haven Conn.
Matthews, Jas. H & Co., Hartford, Conn.

SAFETY CYLINDERS
Oliver Mach. Co., Grand Rapids, Mich.

STEAM APPLIANCES
Darling Bros., Ltd., Montreal, Quebec.

STEAM SEPARATORS AND TRAPS
Can. Fairbanks-Morse Co., Montreal.

STEAM HOISTING ENGINES
Canadian Mead-Morrison Co., Limited, Montreal, Que.

STEAM TURBINES
General Combustion Co., Ltd., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

STEEL BALLS
See Balls Steel.

STEEL, CRUCIBLE TOOL
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Baines & David, Toronto.
Illingworth Steel Co., John, New York.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.

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Armstrong, Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal
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Lincoln Electric Co. of Canada, Ltd Toronto, Ont.
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Peckovers, Ltd., Toronto, Ont.
Samuel Osborne (Can.), Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.

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Davidson Mfg. Co., Ltd., Montreal, Que.

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Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

STEEL CHROME NICKEL
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

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Can. Elec. Steel Casting Co., Aurora, Ont
Dom. Iron & Steel, Sydney, N.S.
Joliette Steel Co., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound
Electric Steel & Metals Co., Welland.
Nova Scotia Steel & Coal Co., Windsor
Swedish Crucible Steel Co., Windsor.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Drawn Steel Co., Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co. Ltd., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, NICKEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Peckovers, Ltd., Toronto, Ont.

STEEL, HIGH SPEED
Armstrong-Whitworth of Can., Montreal
Baines & David, Toronto.
Wm. Atkins & Co., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal
Deloro Smelting & Refining Co., Ltd Toronto, Ont.
H. A. Drury Co., Ltd., Montreal.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Illingworth Steel Co., J., New York.
Kayser Ellison & Co., Sheffield, Eng.
Latrobe Electric Steel Co., Latrobe, Pa
Marshall, Son & Bunney, Toronto, Ont
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd, Winnipeg, Man.
Pilot Steel & Tool Co., Montreal, Que.
Ralph B. Norton, Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Swedish Steel & Importing Co., Ltd., Montreal.
Vanadium-Alloys Steel Co., Pittsburgh

STEEL, CHROME, MANGANESE
Joliette Steel Co., Montreal, Que.

STEEL, OPEN HEARTH
Illingworth Steel Co., John, New York

STEEL PRODUCTS AND MACHINERY
Dom. Steel Products Co., Ltd., Brantford

STEEL, ROCK DRILL
Armstrong, Whitworth of Canada, Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd. Toronto, Ont.

STEEL, SPRING AND REINFORCING
Peckovers, Ltd., Toronto, Ont.

STEEL, STRUCTURAL
Algoma Steel Corp., Sault Ste. Marie
Dom. Iron & Steel Co., Sydney, N.S.
MacKinnon Steel Co., Sherbrooke, Que.
Peckovers, Ltd., Toronto, Ont.

STEEL, TOOL
Armstrong, Whitworth of Can., Montreal
Atkins & Co., Wm., Sheffield, Eng.
Baines & David, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Drury Co., H. A., Montreal, Que.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Firth & Sons, Thos., Montreal, Que.
Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
Latrobe Electric Steel Co., Latrobe, Pa.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son Toronto, Ont.
Vanadium-Alloys Steel Co., Pittsburgh.

STEEL, VANADIUM
Wm. Atkins & Co., Ltd., Sheffield, Eng.
Armstrong, Whitworth of Can., Montreal.
Drury, H. A., Co., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Vanadium-Alloys Steel Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

STEEL WELDING
Peckovers, Ltd., Toronto, Ont.

"STELLITE"
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.

STENCILS
Hoggson & Pettis Mfg. Co., New Haven, Conn.

STOCK RACKS FOR BARS, PIPING, ETC.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

STOCKS AND DIES
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros., of Can., Galt. Ont.

STOCKS, PIPE
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros., Co., of Canada, Galt, Ont.

STONES, COMMUTATORS
Lyman Tube & Supply Co., Ltd., Montreal

STRAIGHTENING MACHINERY
Baird Machinery Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland.

STRAND
Dom. Steel Products Co., Ltd., Brantford.
Page Steel & Wire Co., Adrian, Mich.

STRIP STEEL
Peckovers, Ltd., Toronto, Ont.

SURFACE PLATES
Brown & Sharpe Mfg. Co., Providence, R.I.

STRUCTURAL STEEL WORKS
William Hamilton Co., Peterboro, Ont.

SUPPLIES, RUBBER MFRS.
Hoggson & Pettis Mfg. Co., New Haven, Conn.

SWITCHBOARDS
Northern Electric Co., Ltd., Montreal Que

SWITCHES, RAILWAY
Can. Steel Foundries, Ltd., Montreal.

TABLES, DRAWING
Economy Drawing Table Co., Adrian, Mich.

TABLES, SAND-BLAST
Pangborn Corporation, Hagerstown, Md.

TAPPING MACHINES (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.

TANKS, AIR, EXPANSION
Can. John Wood Mfg. Co., Ltd., Toronto

TANKS, GASOLINE, KEROSENE AND OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Can. John Wood Mfg. Co., Ltd., Toronto
Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
U. S. Ordnance, Toronto, Ont.

TANKS, LEAD LINED
Can. Hanson Van Winkle Co., Ltd.,

TANKS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.
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TANKS, PNEUMATIC AND CLOSET
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TANKS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.
St Lawrence Welding Co. Ltd., Montreal

TANKS, STEEL, WATER PRESSURE
Bowser Co., Ltd., S. F., Toronto, Ont.
Dominion Bridge Co., Montreal, Quebec.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal, Que.
Toronto Iron Works, Ltd. Toronto.

TANK WAGONS
MacKinnon Steel Co., Sherbrooke, Que.
St. Lawrence Welding Co., Montreal.
Toronto Iron Works, Ltd., Toronto.

TANKS, WELDED
Can. John Wood Mfg. Co., Ltd., Toronto
Can. Hanson Van Winkle Co., Ltd.,
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.

TANKS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
William Hamilton Co., Peterboro, Ont.

TAPER PINS
Galt Machine Screw Co., Ltd., Galt, Ont.

TAPES, MEASURING
James Chesterman & Co., Ltd., Sheffield, Eng.
Rice Lewis & Son, Toronto, Ont.

TAPPING MACHINES AND ATTACHMENTS
Bertram, John & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchy Machine & Tool Co., Detroit.
Niles-Bement-Pond Co., New York.
Rickert-Shafer Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
L. S. Starrett Co., Athol, Mass.
Whitney Mfg. Co., Hartford, Conn.

TAPES, MEASURING, STEEL AND WOVEN
Lufkin Rule Co. of Can., Windsor, Ont.

TAPES, POCKET
Lufkin Rule Co. of Can., Windsor, Ont.

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Butterfield & Co., Rock Island, Que.
Geometric Tool Co., New Haven.
Ingersoll Mach. Co., Ingersoll, Ont.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pilot Steel & Tool Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

TAPS, GUN, HAND, BOILER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE RELIEVED
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, MACHINE SCREW
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

TAPS, PIPE
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
Wells Bros. of Can., Galt, Ont.

TAPS, SPECIAL
Elliott & Whitehall, Galt, Ont.

TAPS, STAYBOLT, TAPPER
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

TAPS, DIES AND WRENCHES
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Foss Mchy. & Sply. Co., G. F., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Mach. Co., Ingersoll, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Mchy. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Rice Lewis & Son, Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Taylor, J. A. M., 318 Stair Bldg., Toronto.
U. S. Ordnance, Toronto, Ont.
Wells Bros. of Canada, Galt, Ont.

TAP EXTRACTORS
Walton Co The, Hartford, Conn.

TENSILE MACHINES, STORAGE
U. S. Ordnance, Toronto, Ont.

THERMOMETERS, INDUSTRIAL ENGRAVED TEMPERATURE AND PRESSURE
Taylor Instrument Co., Rochester, N.Y.

THERMOMETERS, RECORDING AND INDEX
Bristol Co., Waterbury, Conn., U.S.A.
Taylor Instrument Co., Rochester, N.Y.
U. S. Ordnance, Toronto, Ont.

TESTING INSTRUMENTS, METALLURGICAL
Shore Instrument & Mfg. Co., New York.

TENOVERS
Oliver Machy. Co., Grand Rapids, Mich.

TESTING LABORATORIES
Toronto Testing Laboratory, Toronto.

THREAD-CUTTING MACHINES
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Mach. Co., Ltd., Toronto.
Geometric Tool Co., New Haven.
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National-Acme Co., Cleveland, Ohio.
National Machy. Co., Tiffin, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREAD GAUGES
Wilton Mfg. Co., Boston, Mass.

THREADING TOOLS
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Canada, Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

THREADING MACHINES FOR BOLTS, NUTS AND PIPES
Greenfield Tap & Die Corp., Greenfield.
Petrie, Ltd., H. W., Toronto.
Wells Bros. Co. of Canada, Galt., Ont.

THREAD MILLING MACHINES
Taft-Pierce Mfg. Co., New York, N.Y.
Gray Ball Bearing Co., Ltd., Toronto.
Smalley-General Co., Bay City, Mich.

THUMB SCREWS AND NUTS
See Screws.

TIGHTENERS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

TIN—PIG AND BAR
British Smelting & Refining Co., Ltd., Montreal, Que.

TINSMITHS' TOOLS
Brown, Boggs & Co., Hamilton, Can.
Petrie, Ltd., H. W., Toronto.

TIRE BENDERS
Jardine & Co., Ltd., A. B., Hespeler.

TIRE SETTING MACHINES, HYDRAULIC
Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.

TOOL CASES
Rice Lewis & Son, Toronto, Ont.

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Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOL MAKERS
Samuel Osborne (Can.), Ltd., Montreal.

TOOL POSTS, LATHE
Armstrong Bros. Tool Co., Chicago.
Williams & Co., J. H., Brooklyn, N.Y.

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Canada Wire & Iron Goods Co., Hamilton.

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Rice Lewis & Son Toronto, Ont.

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Kelly Reamer Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto.

TOOLS, ELECTRIC
Independent Pneumatic Tool Co., Chicago.
Williams Machy. Co., A. R., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
U. S. Electrical Tool Co., Cincinnati, O.

TOOLS, FORMING
Davidson Tool Mfg. Co., New York, N.Y.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.

TOOLS, LUMBERING
Thos. Pink & Co., Pembroke, Ont.

TOOLS, LATHE, PLANER, SLOTTER
Armstrong Bros. Tool Co., Chicago.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SCREW MACHINE
Foster Machine Tool Co., Elkhart, Ind.

Don't Keep It--Sell It

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue TORONTO, ONT.

A Little Act of Courtesy That is Good Business

BY simply mentioning CANADIAN MACHINERY when writing to our advertisers you will be doing something which will prove of three-fold benefit.

First—It will benefit you because it enables the advertiser to immediately associate your enquiry with the product advertised, resulting frequently in quicker service.

Second—It will benefit the advertiser because it enables him to identify and classify enquiries and to give credit where credit is due.

Third—It will benefit **your** paper because in the records of the advertiser it will receive the credit for your enquiry, instead, perhaps, of some less deserving medium.

We are always grateful for favors of this kind. It costs the reader nothing, and yet as we said before, it is of three-fold benefit.

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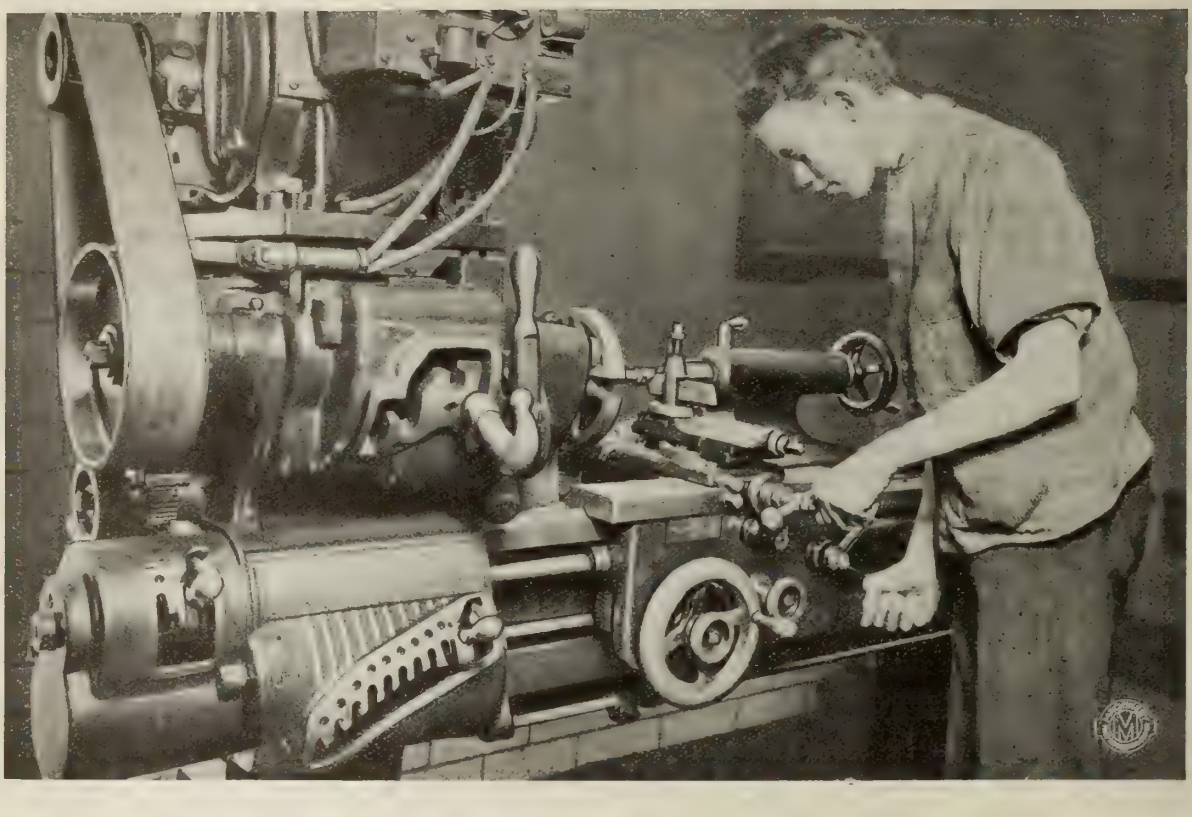
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GEARED HEAD MANUFACTURING LATHE



Used in the Technical Department of the William L. Dickinson High School, at Jersey City

What Better Testimony of *Worth* Than This!

When a technical school installs machine tool equipment it invariably installs the best, and it is the rule to thoroughly investigate the merits of the equipment first. When Technical Department of the William L. Dickinson High School, at Jersey City, installed the Hendey Lathe shown in the above illustration it did so only after rigid tests. It was proven that the Hendey possesses all the essentials of a high-class lathe, a lathe appropriate for engineers-in-the-making to gain experience. Hendey represents standard equipment. It is the lathe that experts recommend for rapid, accurate work—they know Hendey is a safe choice!

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Time, Labor and Money
by using the
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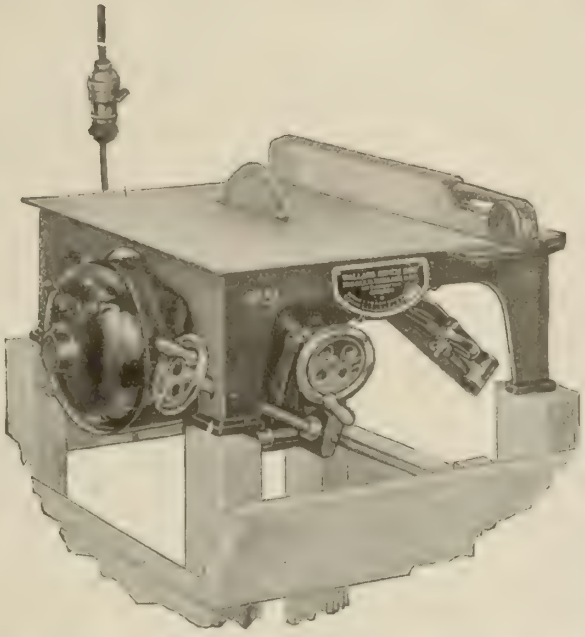
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Driven by ½ H.P. Motor, Either Alternating or Direct Current

Handles 80% of Your Cutting Work at Minimum Cost

It's *the* Saw That Every Keen Management Has Been Looking For

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Size of Table	17 x 20 Inches
Size of Motor	½ Horse Power
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Speed of Saw	5,200 R.P.M.
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Height—Including Stand	36 Inches

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117

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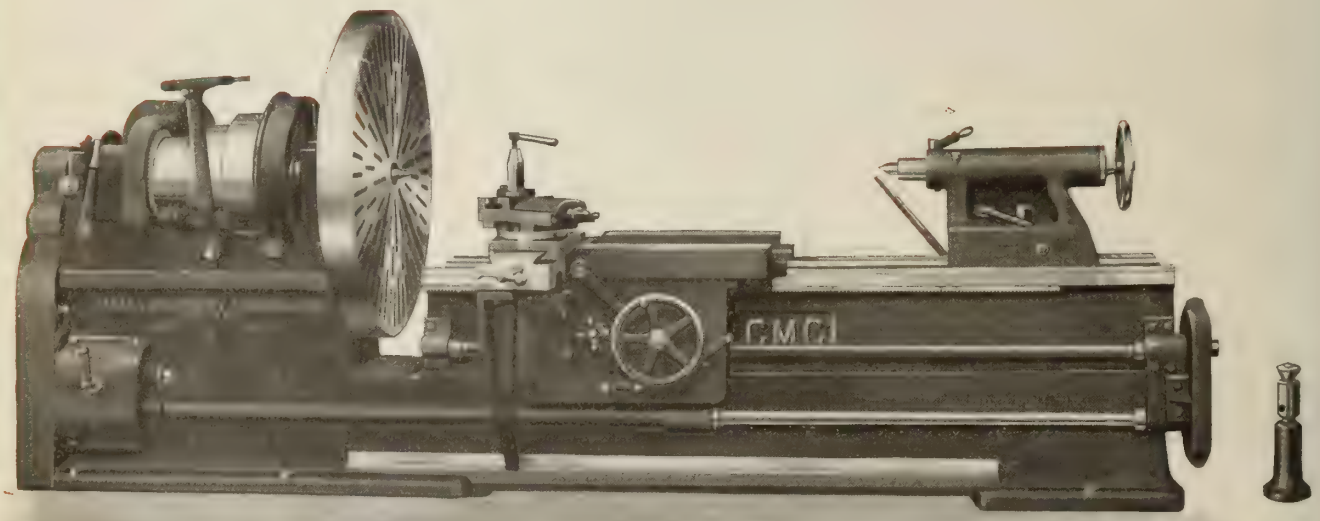
It also embodies the general features and the many points of excellence of our regular line of engine lathes.

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TORONTO OFFICE AND WAREROOMS: BROCK AVENUE SUBWAY



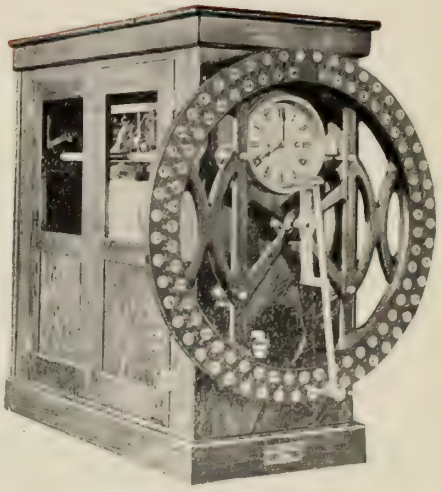
CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

Vol. XXIII., No. 12 Publication Office: Toronto, March 18, 1920 $3.00 per year. Subscription Price

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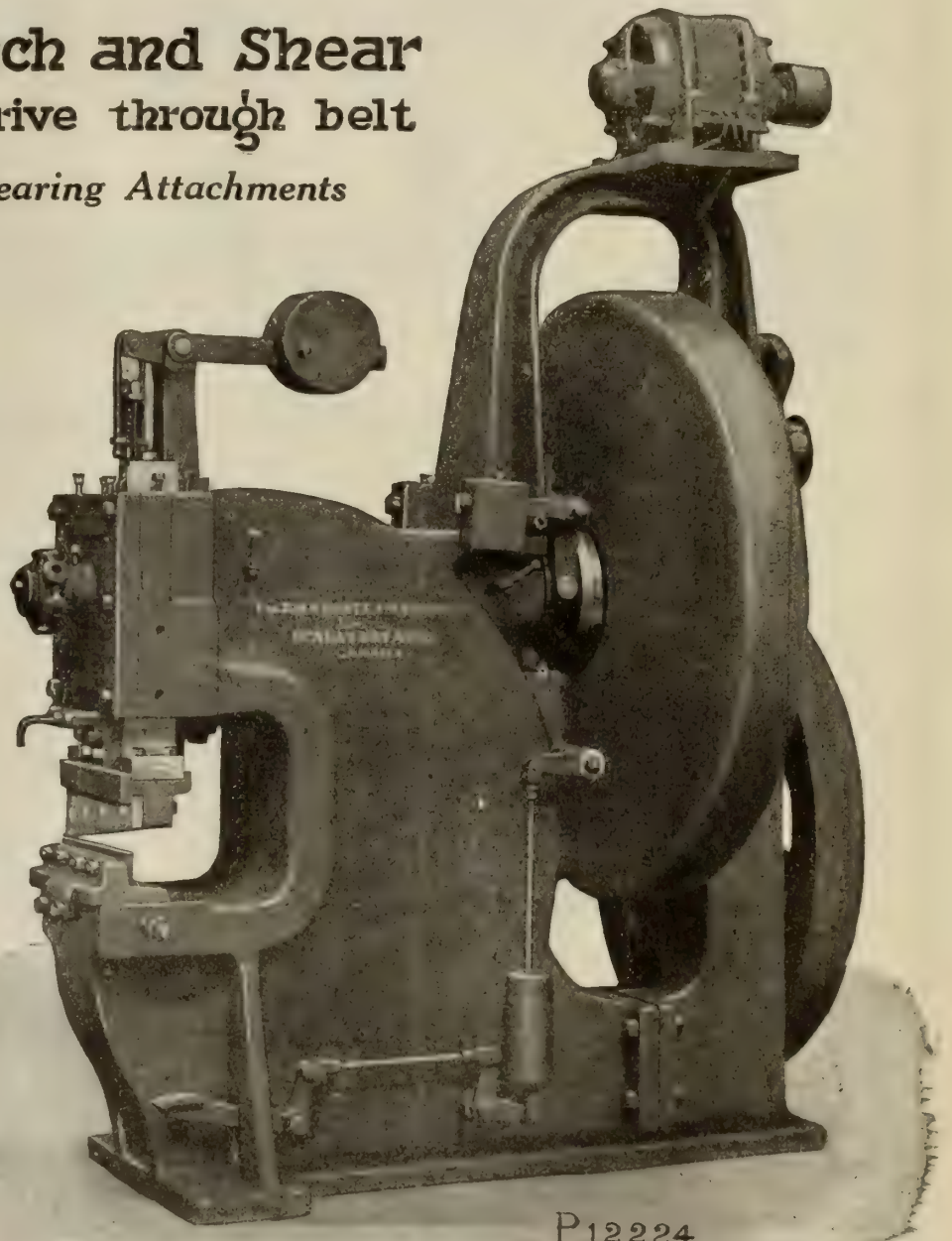
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Fitted with Plate Shearing Attachments



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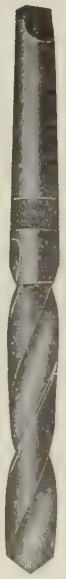
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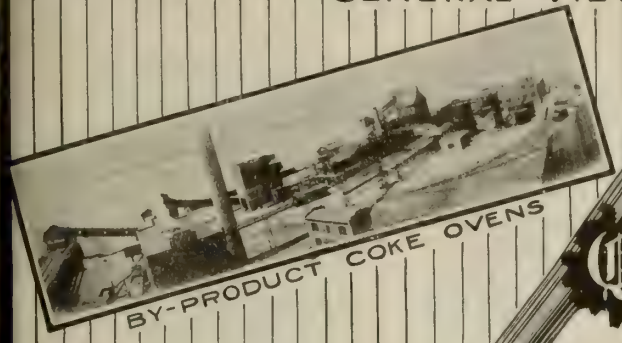
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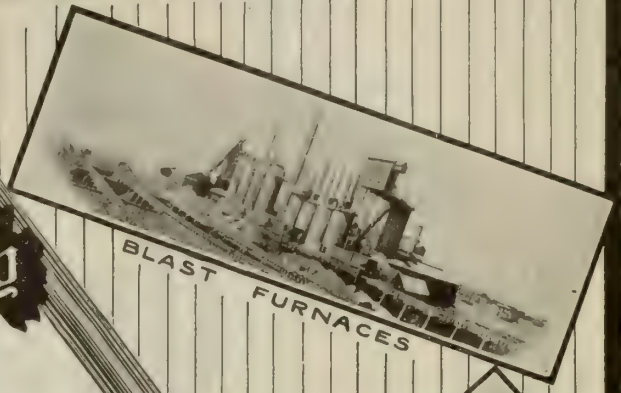
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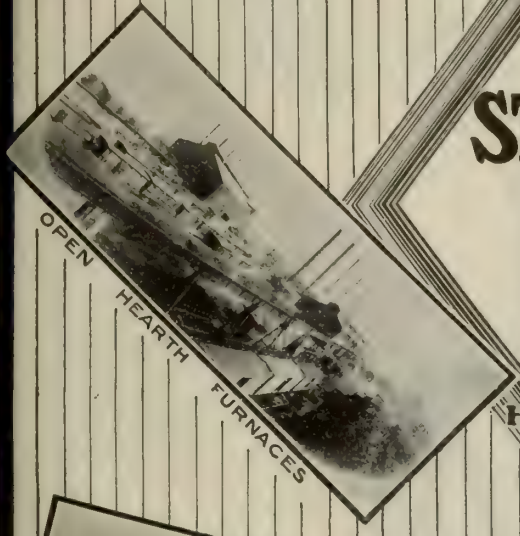
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Quality

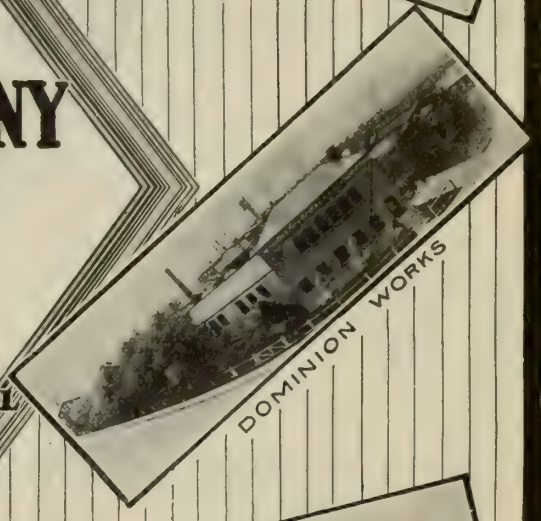
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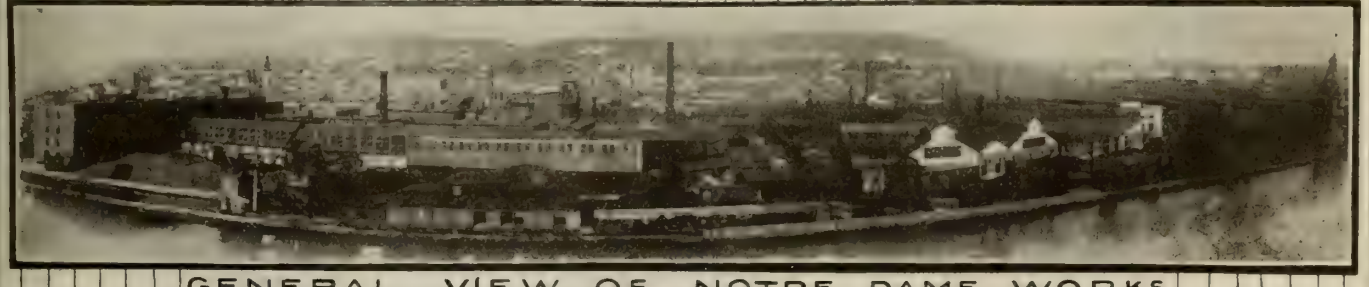
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TWIST DRILLS, REAMERS AND MILLING CUTTERS



"There's a Tool You can Depend upon"

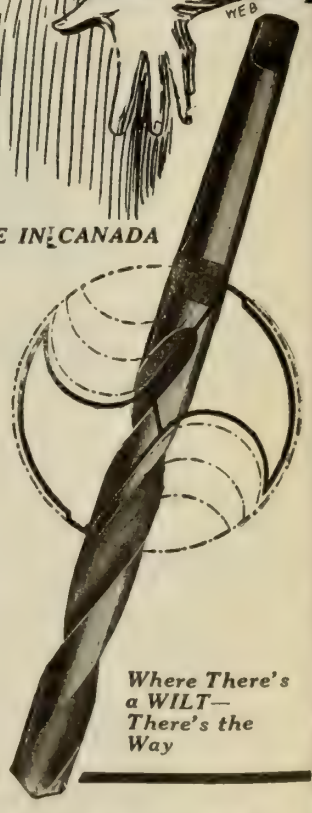
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Use Wilt Products for dependable and economical service

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WALKERVILLE ONTARIO

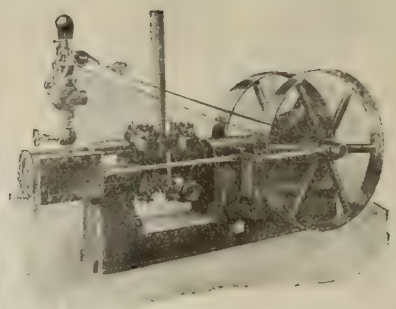
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Belt Driven Compressors



Compressed Air and "Little David" tools will go a long way towards solving your production problems.



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Carbon and Alloy Steel Forging Ingots

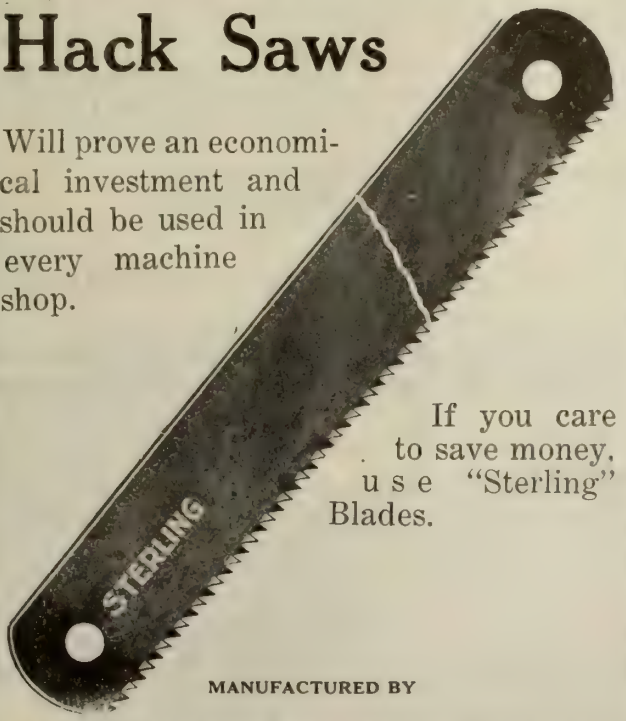
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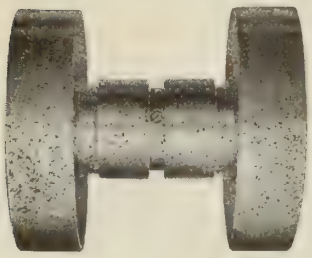
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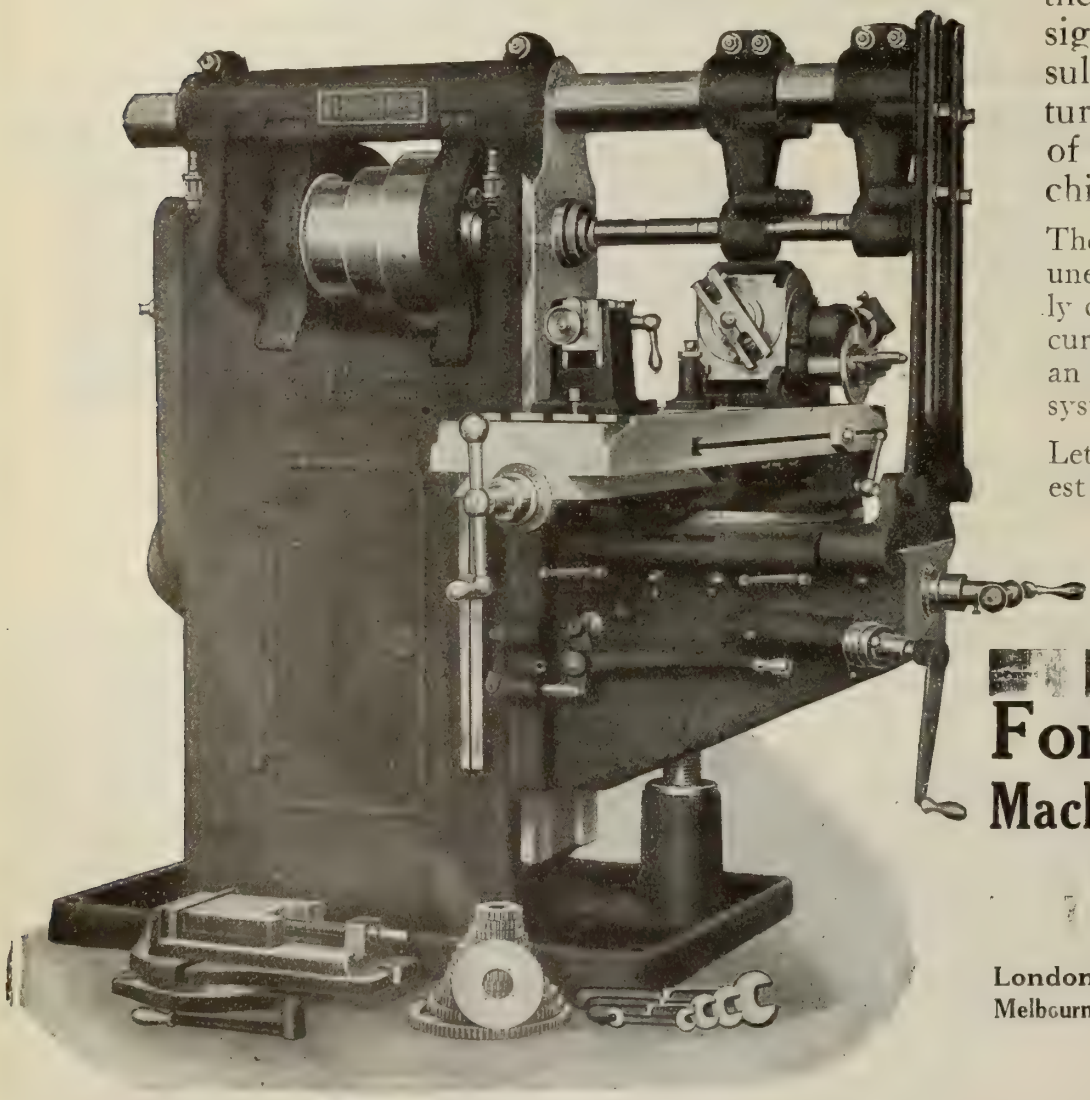
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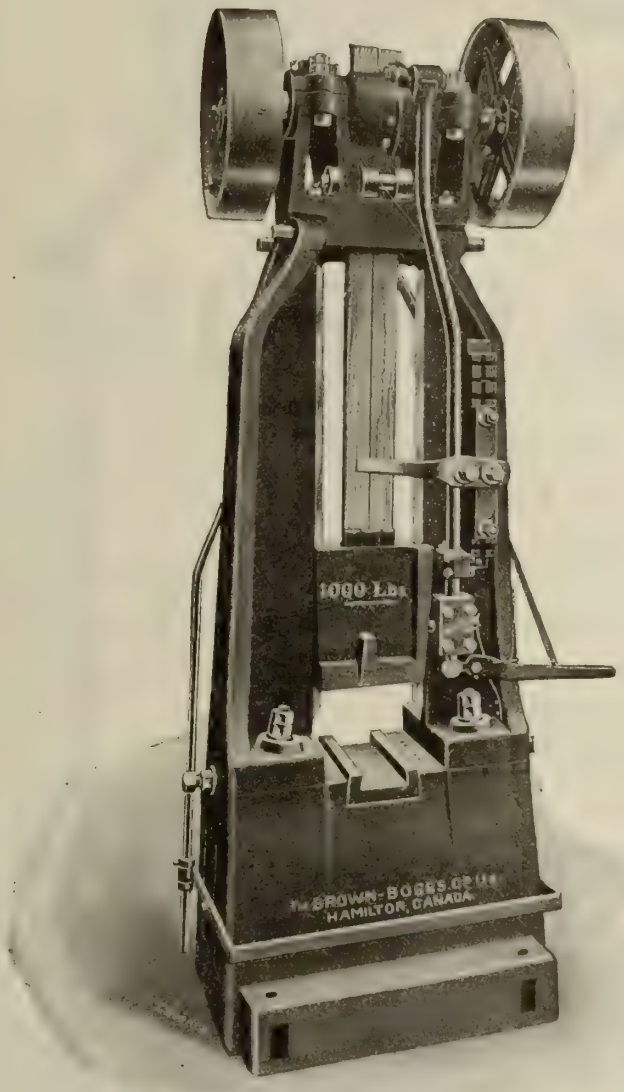
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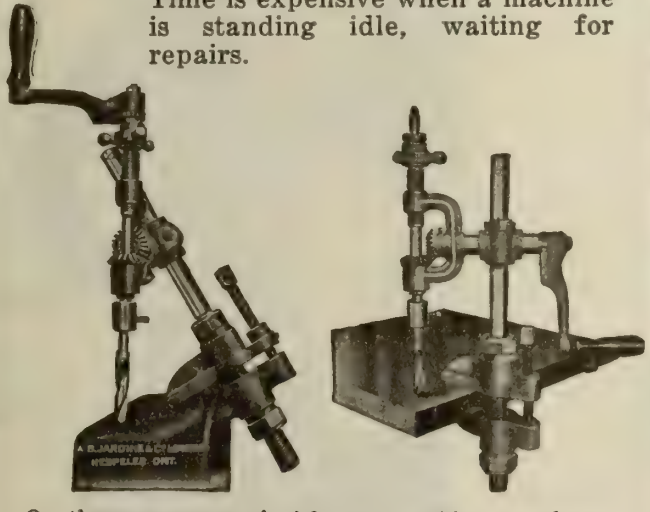
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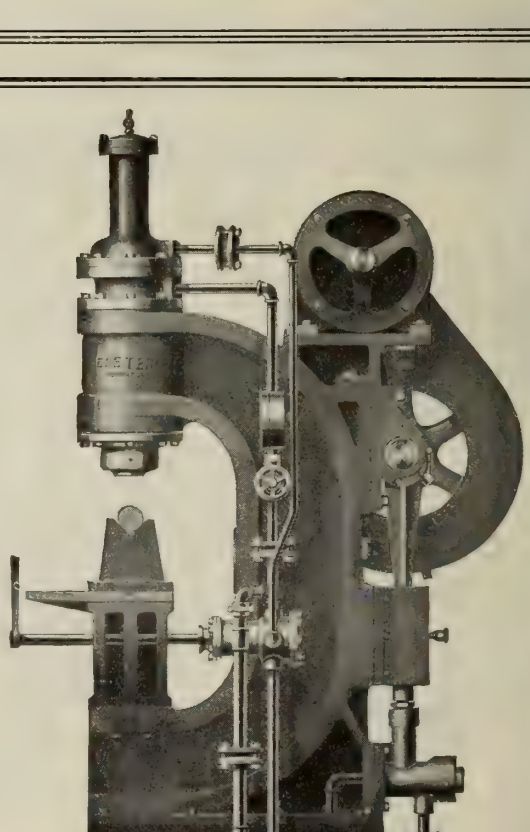
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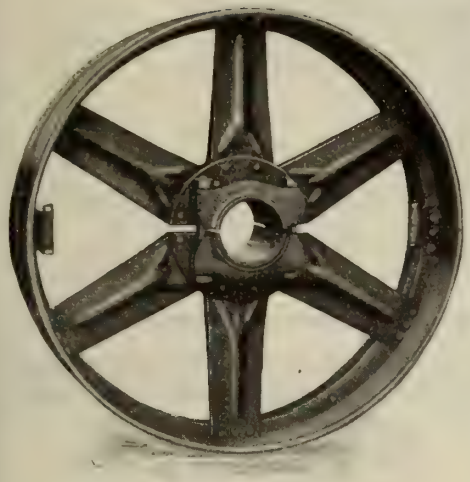
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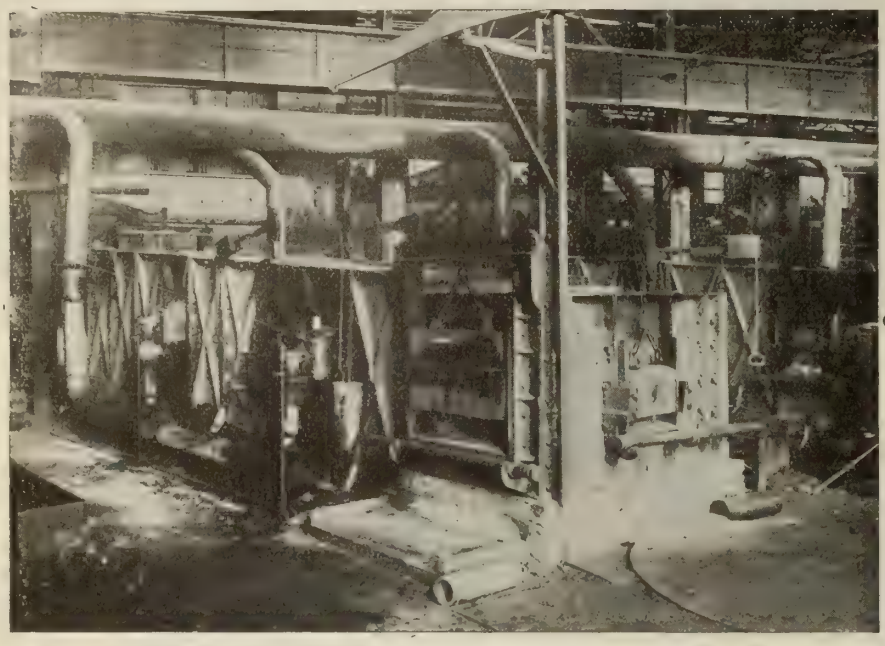
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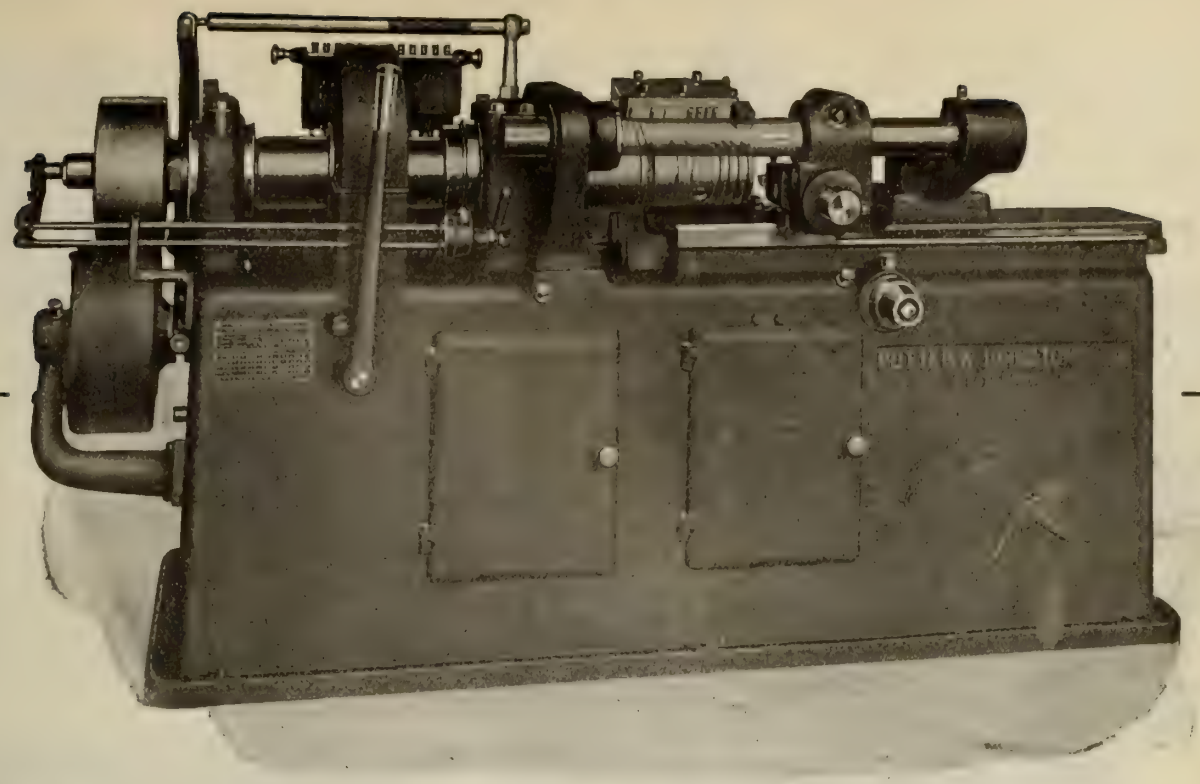
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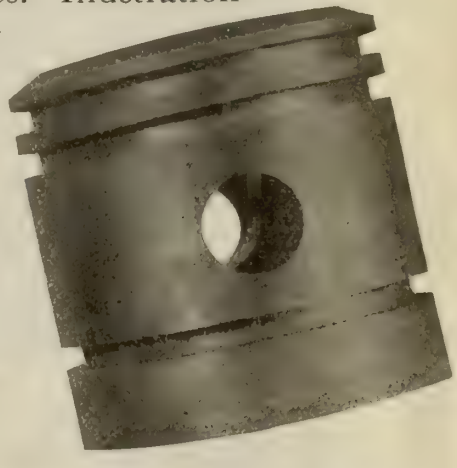


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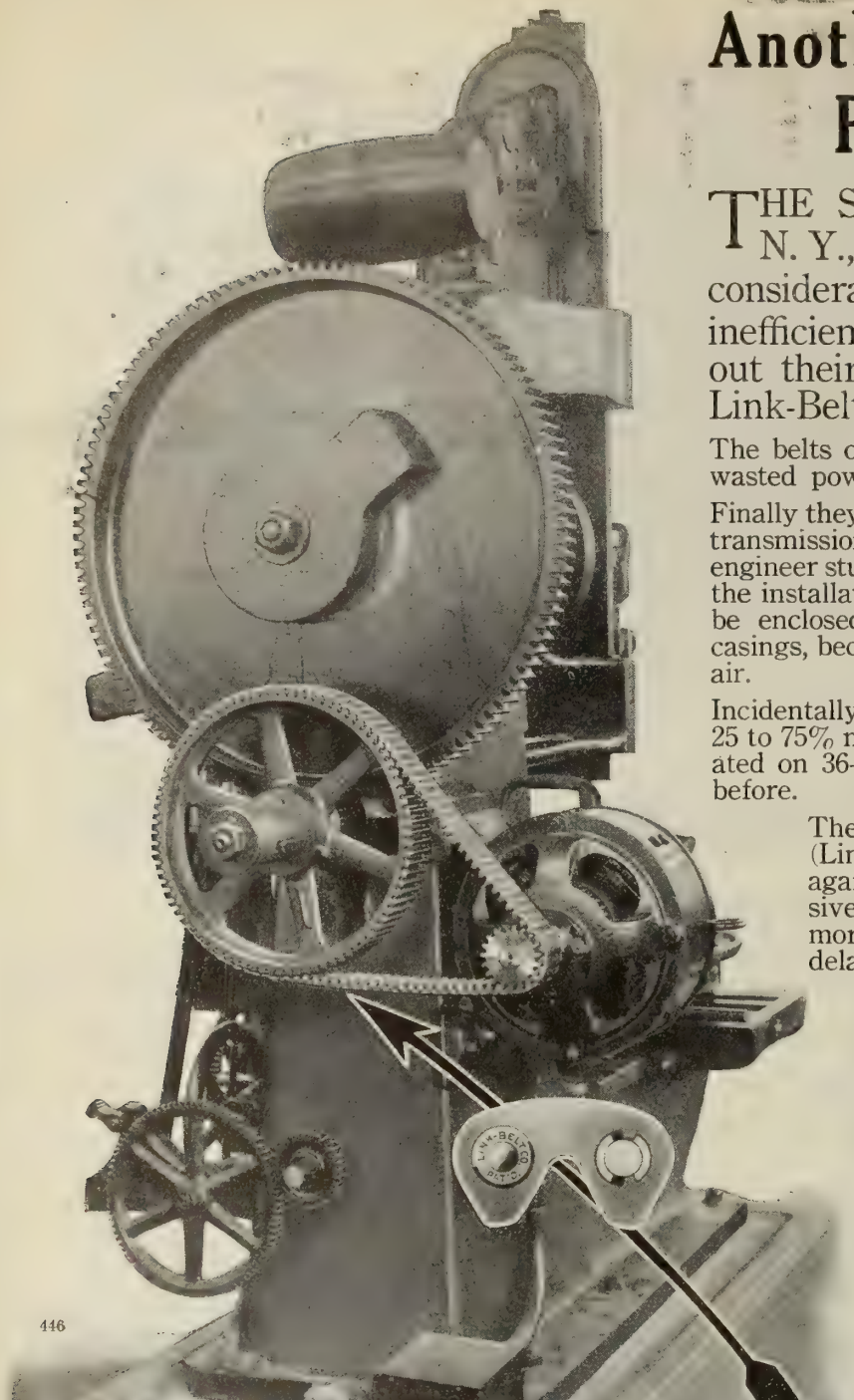
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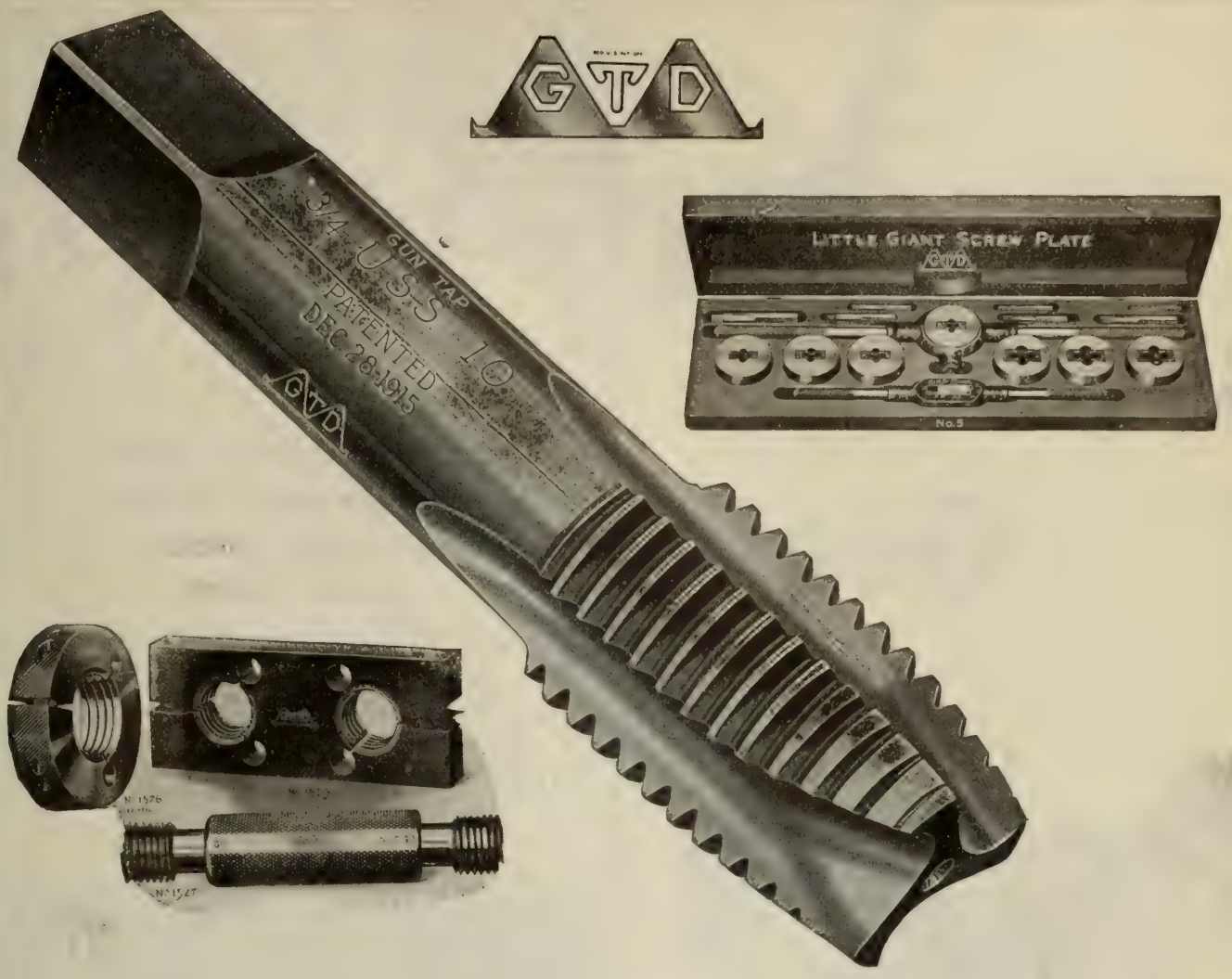
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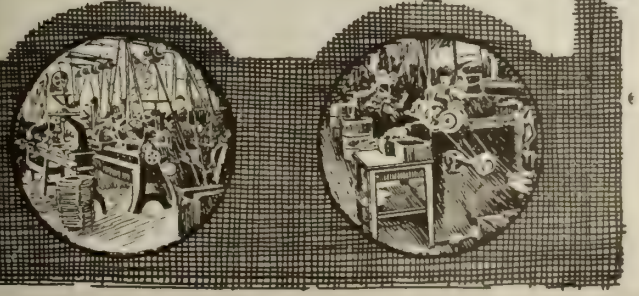
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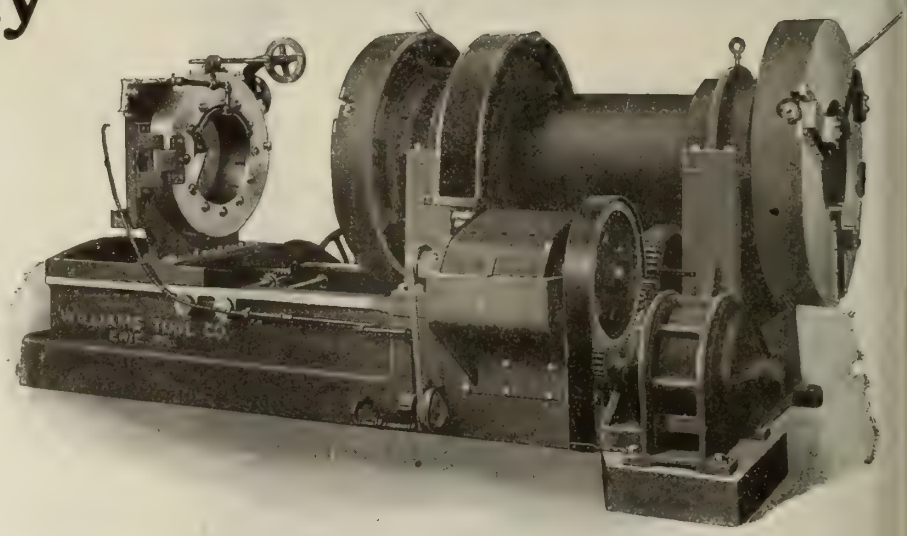
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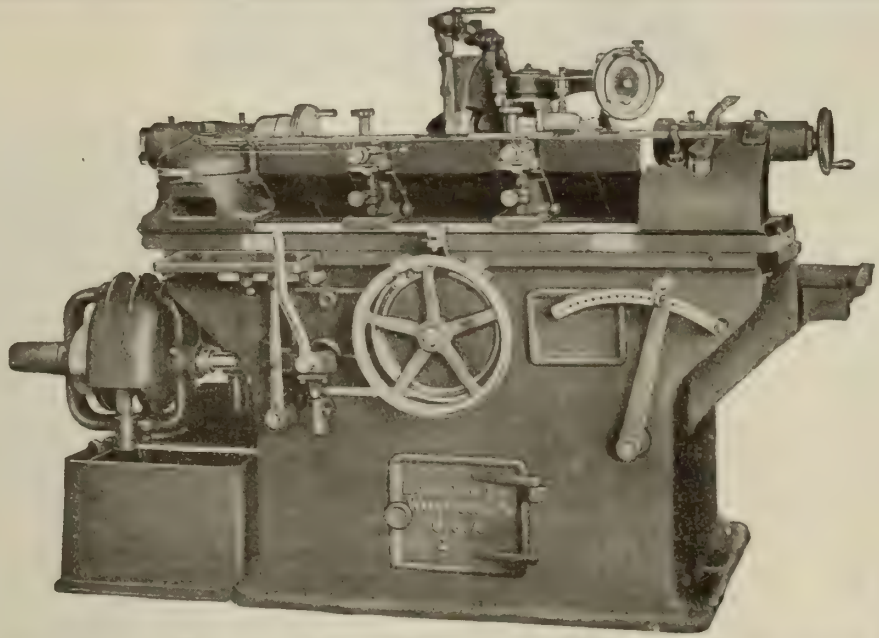
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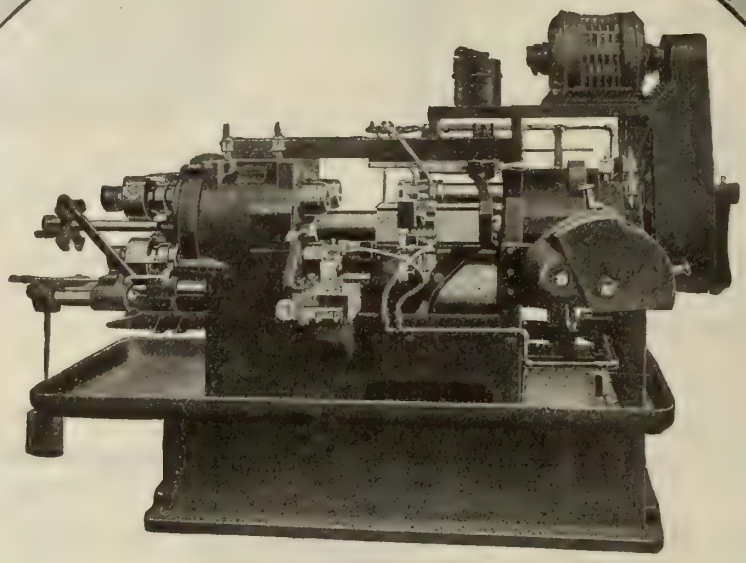
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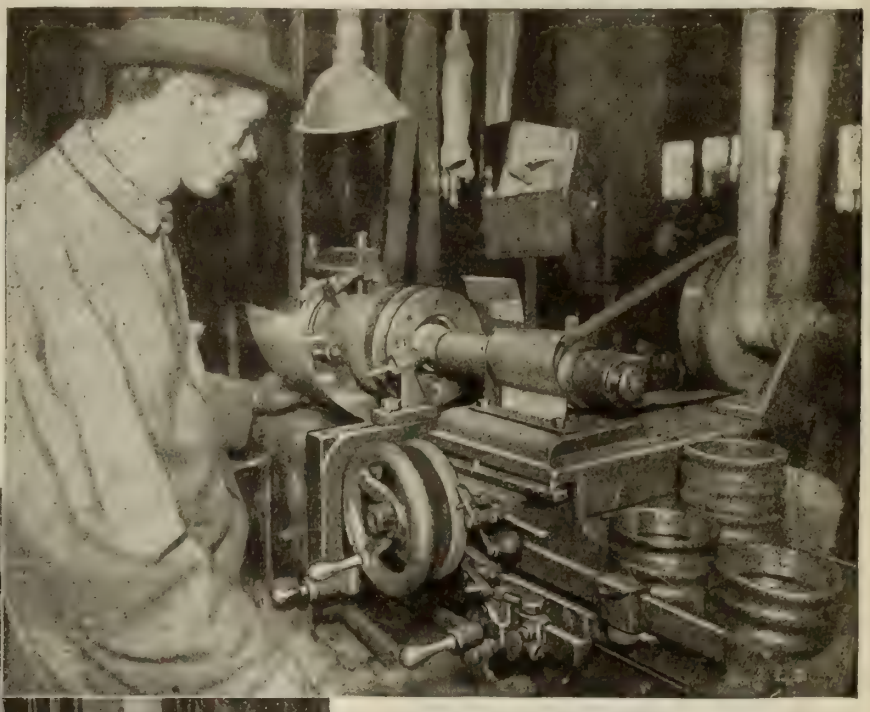
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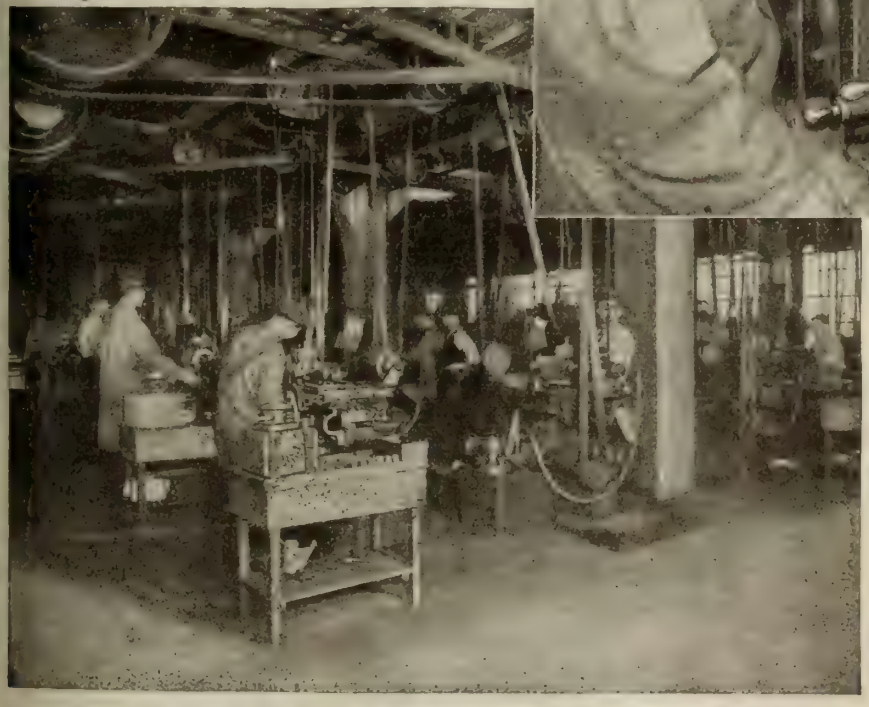
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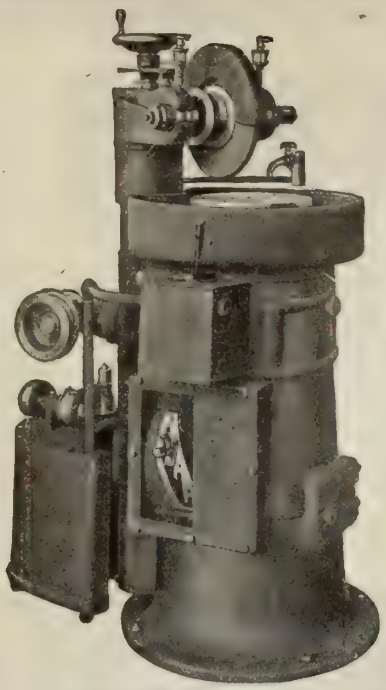
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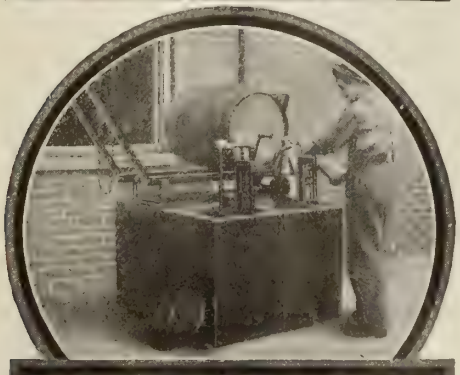
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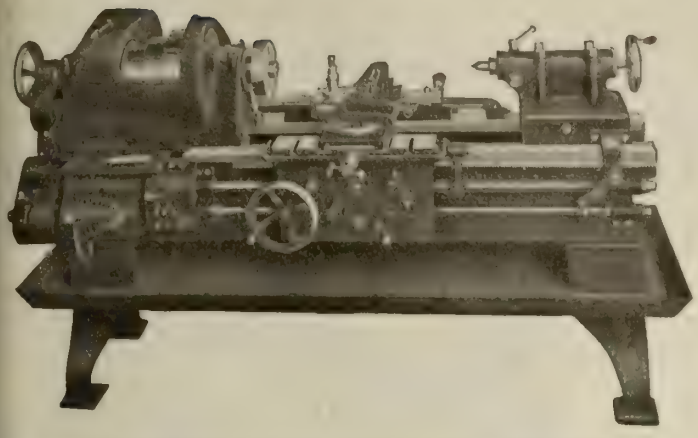
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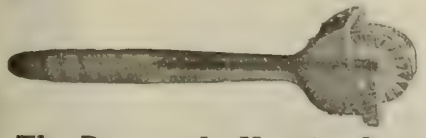


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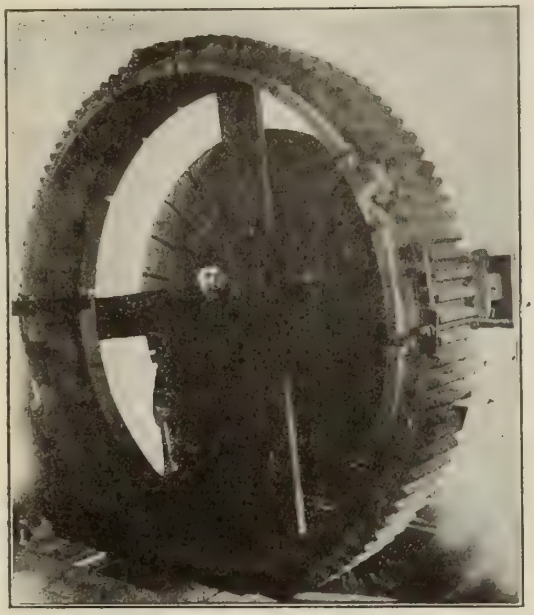
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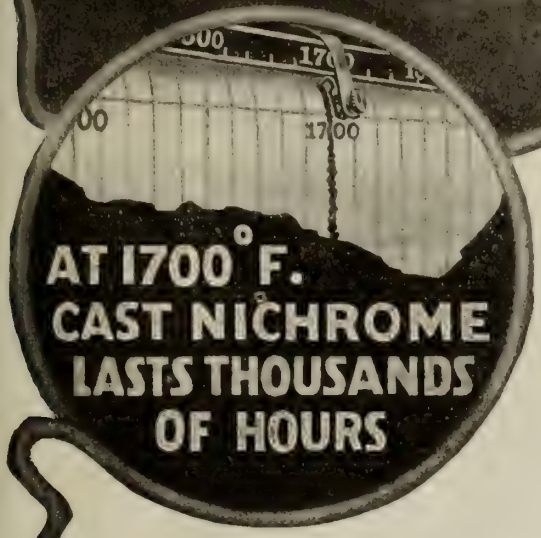
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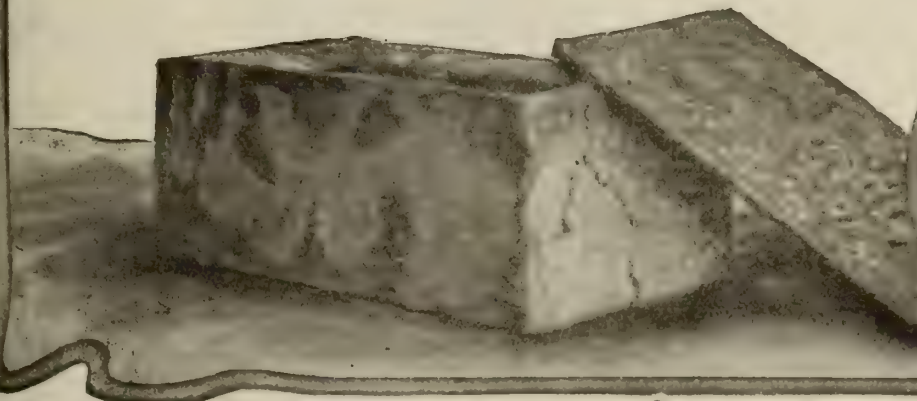
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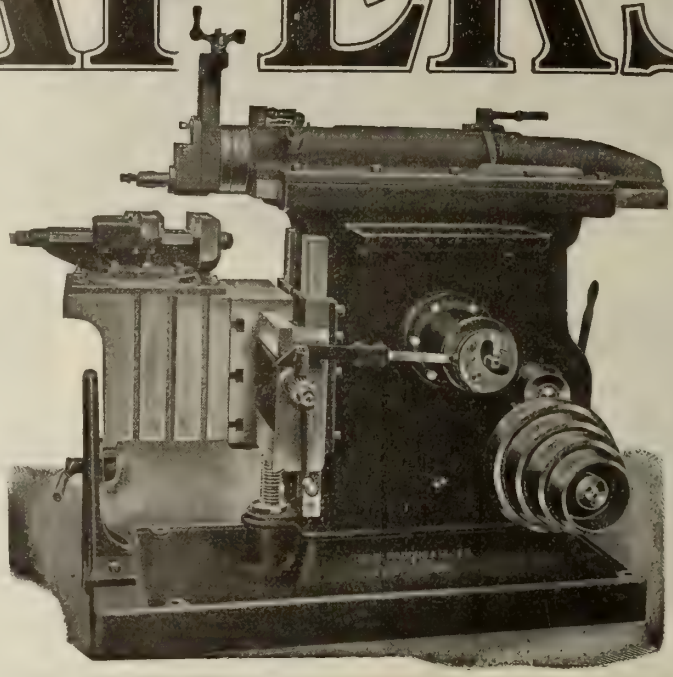
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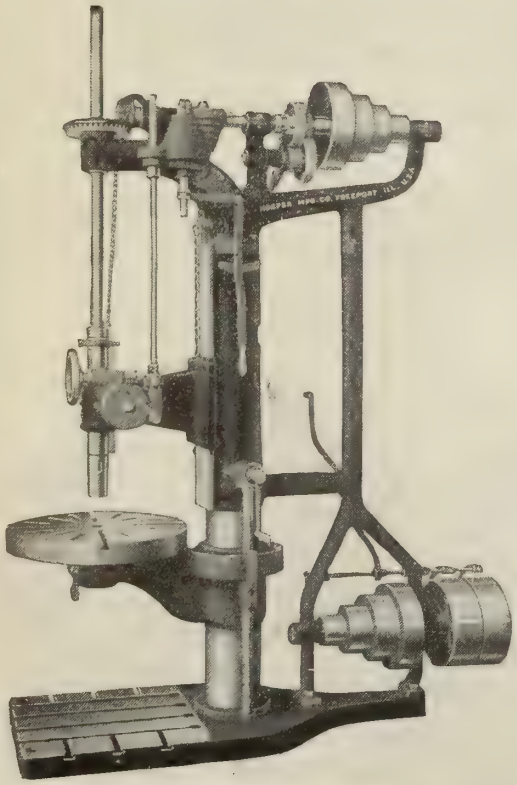
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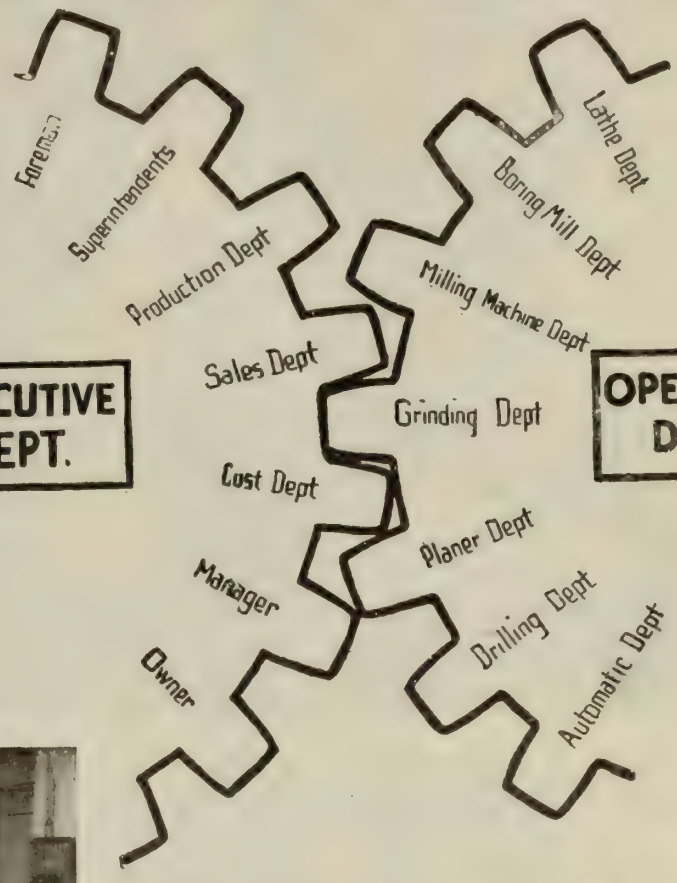
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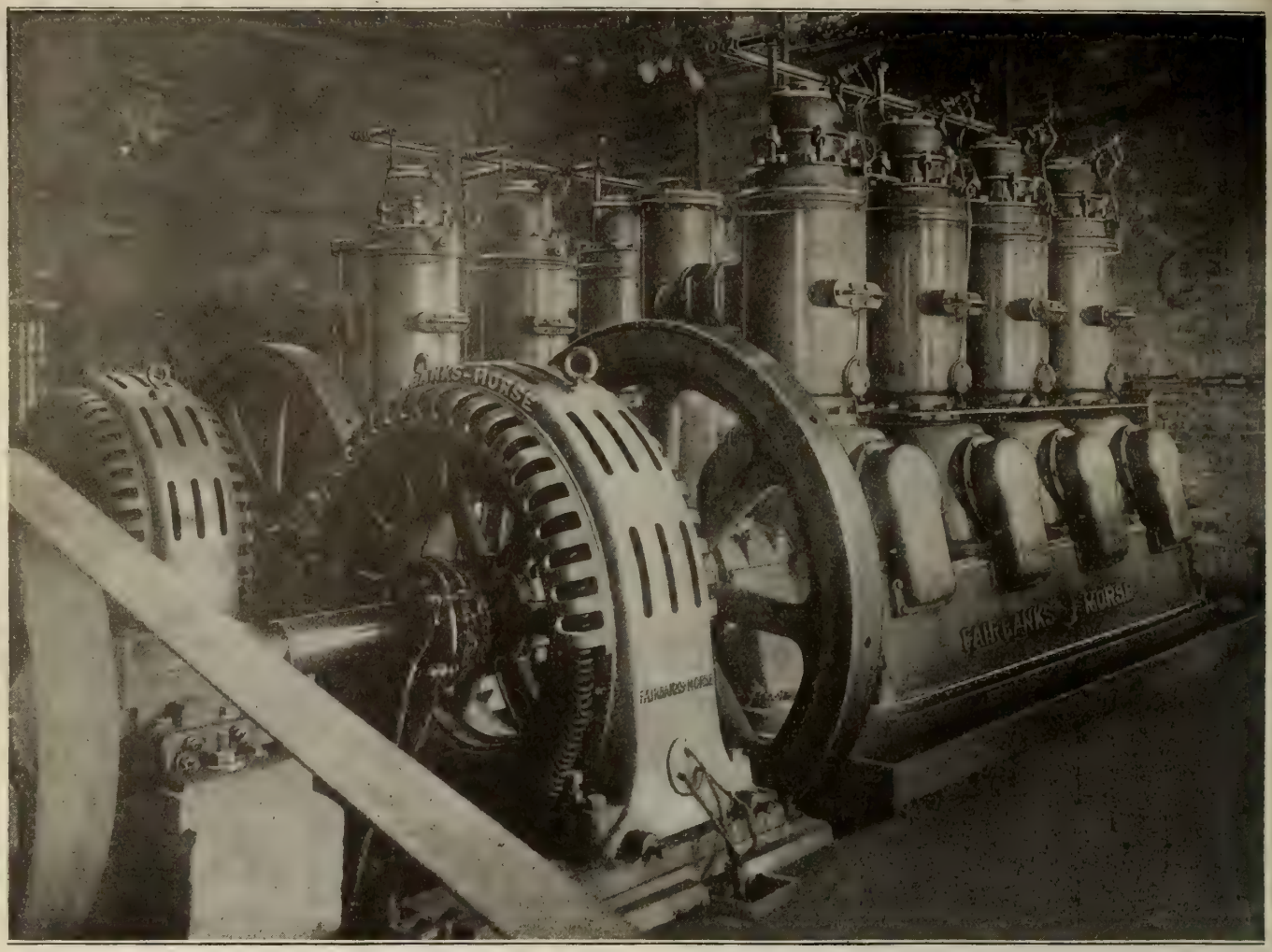
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CANADIAN MACHINERY
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Vol. XXIII., No. 12. March 18, 1920

Die Castings, Their Various Uses and Advantages

The Fisher Motor Co., Orillia, Ont., Who Are Now Producing Die-Castings in Canada, Comment on Several Interesting Points in Connection With This Labor-Saving Industry

By J. H. MOORE.

IT IS a recognized fact that the manufacturing problems of Canada have changed greatly within the last decade. The need of rapid production has built up huge organizations capable of quantity production, where before, manufacturing was limited by the methods employed. Canada is at the present time looking forward to a future that will mean still greater manufacturing achievement, and that will bring to their various manufacturers a keener interest in everything that tends toward increased efficiency.

Among the many methods developed within the past twenty-five years, with a view toward improving large scale production, the process of die casting has been widely accepted as a means of eliminating machining, and as such has gained steadily in favor.

To the uninitiated, we might state that die casting is performed by forcing molten metal into steel moulds under such pressure that, after solidifying, its surfaces conform so minutely to the interior of the steel mould as to yield practically finished results. As a matter of fact, there is absolutely no variation between two die castings out of the same mould or die, while between duplicate pieces machined by one and the same workman, there is always a chance of error.

Die castings have long since ceased to be an unknown quantity. They have taken their recognized place with such parts as stampings, screw machine parts, forgings, etc.

Take for instance such well-known products as automobile accessories, phonograph parts, electrical instruments, adding and billing machines, milking machines, aeroplanes, cream separators, motor boat parts, stationary engine parts, photographic supplies, etc. All these lines lend themselves readily to die-casting production, in fact there are few lines of manufacture which have not found some use for die castings.



A SMALL SECTION OF THE DIE-MAKING DEPARTMENT.

So far the majority of Canada's requirements in the die casting field have been filled by other countries, principally the United States, but now Canada has awakened to its opportunities in this regard and we can look forward to their going after their own home business.

The Fisher Motor Co., Orillia, Ont., realizing the possibilities of this field, have gone into the business in earnest, and have not only reached the production stage but are already shipping their product.

Before going into a description of their plant, however, let us delve into a short history of the advance of the die casting industry. In the year 1900 an exhibition of die castings received recognition at the Paris Exposition, but even as far back as 1892 their advantages had been recognized by various manufacturers. The castings made in those earlier days were mostly small, from low fusing alloys, but with the growth of the automobile industry came a marked advancement in the production of die castings.

It seemed as if at last die castings had established their real worth. Not only were they found ideal for engine bearings but were found invaluable for the framework of magnetos, for lighting systems, oil, water and air pumps, engine governors, and many other accessories.

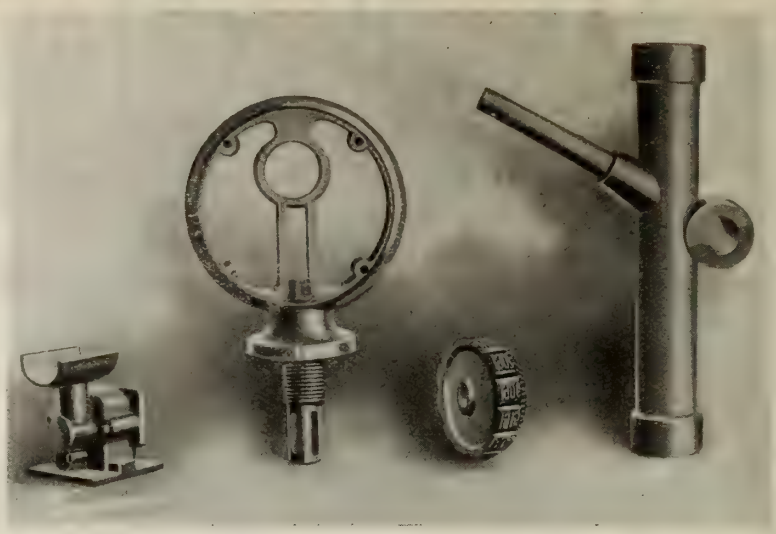
The addition of aluminum to the other alloys previously used made the die casting process especially valuable in the production of small parts for aeroplanes, telescopes, binoculars, gas masks, bombs, and other devices where lightness was required.

The standard die castings, that is those

made from the regular die casting alloys, found their field in such articles as truck governors, bearings for tractors, and so on. We could go on indefinitely, mentioning the various industrial fields which have benefited by the use of die castings, but let us next take up the metals commonly used for this type of casting.

The Metals Used

In the early development of the die-casting business, a great many alloys were experimented with, so that naturally the variety of alloys used at that time was very great. With the advance and development of the industry, however, it was found that a relatively small number of alloys would meet the requirements of the trade.



SOME INTERESTING EXAMPLES OF DIE-CASTINGS.



"We intend to show Canadian manufacturers that we can make first-class die castings in Canada," says Mr. Vollans—and we believe him.

Briefly, the metals used in die casting can be divided into five groups as follows: The white metal, the tin base, the aluminum base, the brass and bronze base, and the lead base.

The white metal group comprises the zinc base alloys. The metals in this group contain a certain percentage of zinc, tin and copper. The zinc base alloys are perhaps more easily handled in the die casting process than any of the other alloys, and are therefore more generally used. They can be employed for all purposes where cast iron or yellow brasses can be used. The tensile strength of such an alloy is less than that of the brasses, so that in this grouping, castings of such alloy should only be used when the tensile strength required does not exceed 17,000 to 20,000 pounds per square inch. This strength, however, is obtainable when the metal is properly treated during the process of alloying of casting

Zinc base castings present about the same wearing surface as cast iron or yellow brass. Castings of this alloy are used to quite an extent on small electric motor frames, magnetos, and on many parts in the automotive and electrical fields. Generally speaking, the characteristics of zinc-base alloy castings are similar to those of cast iron. Some concerns used about 86 per cent. zinc, 7 to 10 per cent. tin, and from 4 to 7 per cent. copper. In some cases, other metals are added to obtain certain results depending on the nature of the casting, and what it is to be used for.

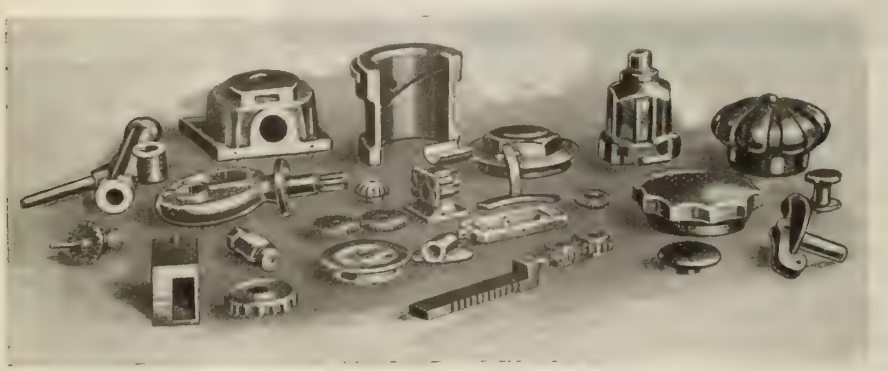
The Tin Base Alloy

The tin base alloys are used principally for bearings, and are, in reality, what is more generally known as babbitt metal. Of course, it is well-known that this class of metal varies considerably in composition, some even containing as high as 85 or 90 per cent. of tin, while the cheaper metals contain a much smaller percentage.

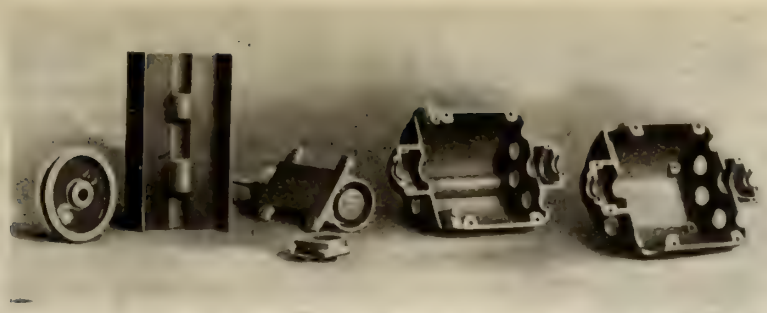
This alloy is also used for parts which must resist acids, such as parts of milking machines, and other parts used in the food industries. Again, the alloy's composition depends upon the requirements. To make the metal extremely acid proof, the tin is kept high in percentage, the antimony next, and the copper last. For example, a favored mixture or composition is made of 90 per cent. tin, 6 per cent. antimony, and 4 per cent. copper. The addition of the antimony and copper increases the hardness of the alloy.

The Aluminum Alloys

While it is possible to die-cast pure aluminum, there is no value in so doing because aluminum in its pure state is too soft for commercial use. For this reason, the standard aluminum alloys contain a high percentage of aluminum alloyed with copper. This is the arrangement generally adopted when a light casting of considerable strength is required. A commonly used mixture is 92 per cent. aluminum and 8 per cent. copper. This alloy, when produced in die casting form, has a tensile strength of approximately 20,000 lbs. per square inch and is employed whenever a light, strong alloy is required. Before die casting, the alloy is really 25 per cent. less efficient than after completion.



A GROUP OF DIE-CASTINGS SHOWING [illegible] OF WORK OBTAINABLE BY DIE-CASTING [illegible]



ILLUSTRATING THE EXTENT TO WHICH DIE CASTINGS CAN BE USED. NOTE THAT EVERY PIECE ON THIS ENGINE [illegible] IS MADE FROM A DIE CASTING.

Another alloy often used on automobile parts contains a high percentage of aluminum as before, but also from 2 to 5 per cent. of magnesium, and from 3 to 7 per cent. copper. This alloy is much stronger than the former mixture given, and by proper treatment in melting and casting it is possible to obtain a tensile strength as high as 35,000 pounds per square inch.

The copper hardens the metal as before, while the magnesium produces a closer grain than can be obtained in the first given alloy. Nickel is sometimes added to produce still greater hardness.

Where gears are not subjected to heavy wear or strain, but merely transmit motion without a great deal of power, die castings can be used to a nicety. Accuracy is easily obtainable, and the saving effected in the elimination of the necessity of teeth cutting is a big factor. Spur and bevel gears are the usual type cast, although spiral and worm gears can be cast if desired.

As white metal castings are cheaper and easier to make, they are therefore used whenever there is no need for an exceptionally strong metal. Aluminum alloy castings are, of course, used when strength and lightness have to be combined.

It might be well to mention at this point that complicated shapes have no terror for the die-casting process. Shapes almost impossible by any other process can be perfectly and accurately formed. The various illustrations accompanying this article will, no doubt, convince the most skeptical.

Brass and Bronze Alloy

The casting of brass and bronze alloys are also possible. Practically the same shapes can be produced in brass as are produced from other alloys with the exception that very small holes cannot be cored and produced directly in the casting as in the other alloys, but must usually be drilled afterward.

The reason for this is that the pins of small diameter which are necessary to produce these holes, show a slight tendency to warp when subjected to the high temperatures necessary when keeping brass or bronze in a molten condition. This small objection is, however, overbalanced by the advantages derived from the die-casting process.

Points to be Remembered

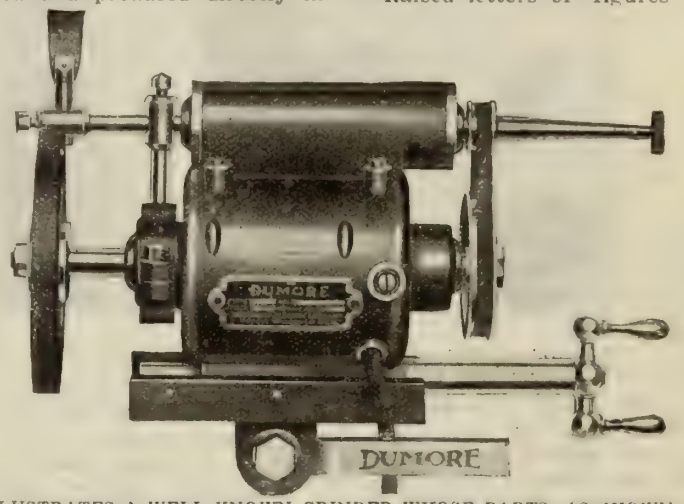
When planning to use die-cast parts, there are certain general points, which, if borne in mind, will increase results in service obtained.

In dealing with steel cores, necessary in a process producing finished parts, undercuts or recesses in the interior wall of the casting should be avoided as much as possible. In many cases, it is possible to use collapsible or sand cores, but this increases the cost of both dies and castings.

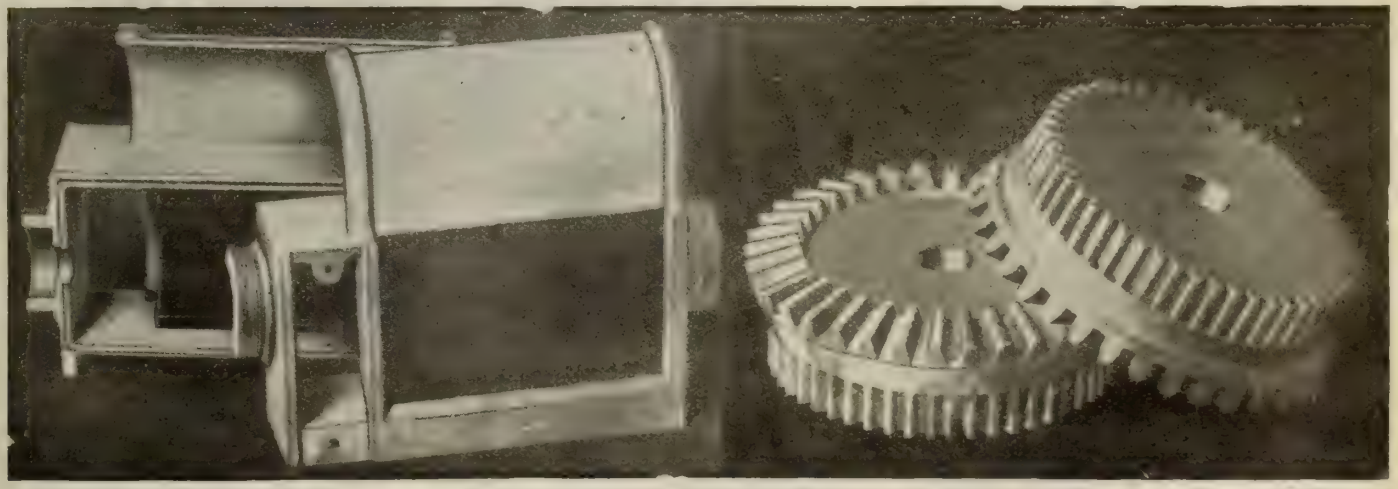
If at all possible a slight draft is desirable, but this is not absolutely necessary. No allowance for shrinkage or machinery need be made in drawings except where excessive accuracy is required, or where a machining operation is actually necessary to true up a piece for assembling purposes.

Raised letters or figures are easier made and cheaper to cast, although both the raised and depressed figures are practical and often used.

If at all possible, allow small fillets at sharp corners, for these add strength to the casting, and increase the rate of production. Where zinc or aluminum base metals are used, the walls of the [illegible] should be at least 1-16 inch to 1-8 inch of an inch thick, according to the size of the part, but when softer



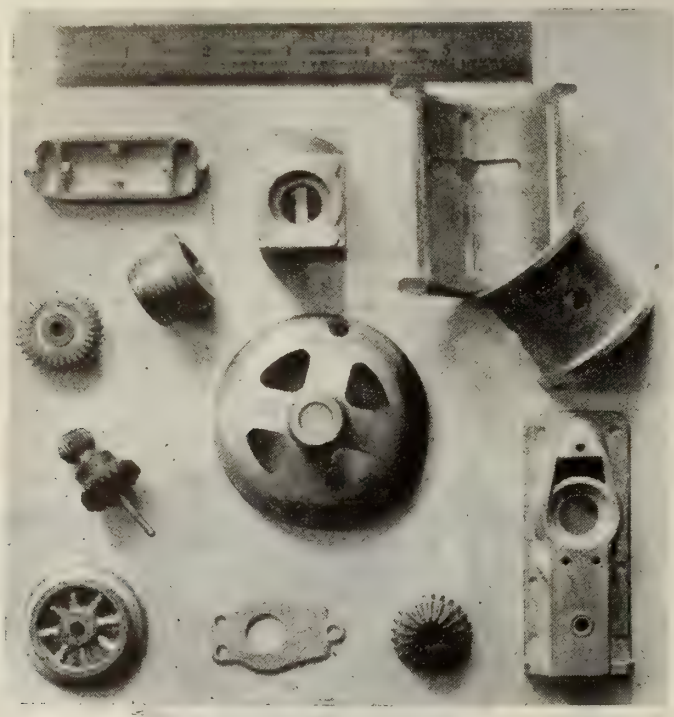
THIS ILLUSTRATES A WELL KNOWN GRINDER WHOSE PARTS, AS SHOWN ABOVE, ARE MADE FROM DIE CASTINGS.



DIE-CASTINGS ARE IDEAL FOR SUCH WORK AS SHOWN IN THIS PHOTOGRAPH.

metals are used these walls can be made still thinner if necessary.

Castings made by the die-cast process can be held to the accuracy of one-thousandth of an inch, which is an advantage not to be overlooked.



ANOTHER GROUP OF INTERESTING DIE-CASTINGS. THE SCALE SHOWN WILL GIVE AN IDEA OF PROPORTION.

The Actual Procedure

Let us suppose we have been producing some certain product in cast-iron, and have come to the decision that from now on the part has to be made a die casting. What is the proper procedure?

First and foremost in the decided change enters the cost of the die. This unfortunately has held back many a concern who cannot, or will not look further than the die cost. To make any change in plans costs money, but if by expanding a certain amount of cash you save money and increase production, you are further ahead in the long run.

Manufacturing conditions in Canada have now reached such a point that luckily the various firms are looking ahead of this first cost. After the die is completed, the rest is easy. Suppose we next consider the plant itself.

The Fisher Motor Co. are well-equipped to handle this die-casting proposition. Mr. Vollans, the president and general manager of the concern, is himself taking an active part in the business. There is hardly an automobile or machine tool plant where Mr. Vollan's accomplishments are not already known, so we need go no further on this point. He has with him experts in both the die-casting and tool-room practice, for as can be understood, the skilled labor employed belongs to these two classes.

We would like to impress readers with the accuracy necessary on the die work, for even if five-thousandths were allowed between these dies, the metal forced up into them would squeeze out, causing an objectionable fin.

When the die is completed it is placed in a special die casting machine of their own design. When everything is in closed, or die casting position, the molten metal is forced up into the die at a pressure varying from 200 to 1,200 lbs., depending upon requirements.

The number of castings die-cast at a time depends entirely on the production required yearly, and the intricacy of the die. It is easily understood that if a concern requires 50,000 pieces yearly, it can well afford to spend money on a multiple die.

After the castings have been die-cast, they go to the first inspection department, where they are carefully looked over for possible flaws, such as blow holes, cracks, etc. Providing they are satisfactory they proceed to the cleaning department, where all fins or gates are removed. They next go through a final inspection before shipping, in order to insure that only perfect castings leave the plant. In this final inspection, the sizes of the castings are also checked.

Analysis of the Metals

The melting of the metals used in die-casting work is a study in itself. Of course, the various metals are bought in their commercial form by the company, and are melted and alloyed to suit the different requirements. The chemical department takes a careful analysis of every alloy made, and reports on its different qualities. All raw materials received are also analyzed in order to make sure that the proper metals are being used.

Although the die-casting art is a comparatively new industry to Canada, we can safely look forward to seeing it grow to large proportions, for die-castings are now a recognized necessity and not merely a novelty.

There is a constant development taking place in this industry, and work formerly thought impractical has been successfully accomplished. This advancement is bound to continue and the next few years will, no doubt, further emphasize the advantage of the die-casting process for certain classes of work. As Mr. Vollans remarked to the writer, "We intend showing the trade that we are out to make die-castings of only first-class quality, and we also hope to educate the different manufacturers as to where die-castings are possible in place of other metals at present used."

With this we will leave the subject, keeping our eyes open for future developments which are sure to occur.



IT IS NOT GENERALLY KNOWN THAT THE MAJORITY OF PHONOGRAPH TONE ARMS AND SMALL PARTS, ARE MADE FROM DIE-CASTINGS. HERE ARE SOME GOOD EXAMPLES.

The Helical Gear, Its Design and Application

The Final Portion of a Treatise Covering the Application of Helical or Twisted Teeth to Gears Operating on Parallel Axis, Together With Data on Design, Application and Production

INVESTIGATIONS made to determine the strength of helical gear teeth have never been conclusive. Of course, this is easy to see when we consider the number of variable factors that enter into the problem. It is therefore impossible to give any rule or formula for calculating the strength of helical gear teeth which can be universally followed. The conditions that arise in each case must be considered separately, and all of these conditions are seldom known, so that any rule or formula must be considered approximate only. In the following an attempt will therefore be made to analyze some of the most important points that must be considered in determining the strength of helical gear teeth.

Comparison of Tooth Action of Spur and Helical Gears

An investigation of the tooth action of the helical gear reveals the fact that a helical tooth must be considerably stronger than a spur tooth of the same pitch, pressure angle, etc., for the reason that there is always a greater number of teeth in action and the tooth action is different. The diagram, Fig. 5, should illustrate this clearly. Another reason is that the greatest load is always taken somewhere in the vicinity of the pitch line.

An analysis of the action of the spur gear tooth shows that there are three distinct phases of engagement; first, as at A, Fig. 8, the point of one tooth engages with the flank of its mate; second, as at B, the teeth are in engagement in the vicinity of the pitch line; and third, as at C, the flank of one tooth is in engagement with the point of its mate.

The greatest load on the spur gear tooth is therefore exerted when the teeth are in engagement in the first and third positions. As the pinion tooth is always weaker than the gear tooth (the same materials being considered), it is therefore evident that with the gears operating in the direction indicated in Fig. 8, the weakest point on the pinion tooth can be determined as indicated at A, according to the Lewis formula.

It is also evident that when the teeth are in engagement at the pitch line, they are more capable of carrying the load, and in this connection it is also interesting to note that the teeth roll on the pitch line, where at all other points of their action they slip upon each other.

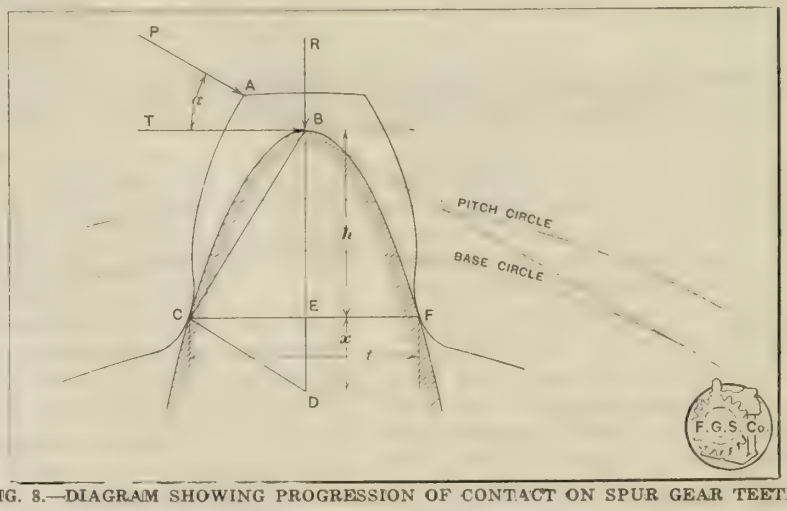


FIG. 8.—DIAGRAM SHOWING PROGRESSION OF CONTACT ON SPUR GEAR TEETH.

Members that are in rolling contact will carry a much heavier load, generally speaking, than those under two loads; viz., pressure and friction. This is especially true of gear teeth.

Method of Determining Location of Weakest Section

The method of determining the location of the weakest section of a helical gear tooth, is found in a slightly different manner from that of a regular spur gear tooth. In a spur gear, for instance, the line of pressure passes through the point of the tooth, as is shown in the diagram, Fig. 9. Owing to the overlapping of the tooth action of the helical gear tooth, the pressure line P crosses the axis of the tooth in the vicinity of the pitch line. In the spur gear the strength of the pinion is not governed by the number of teeth that is in mesh with it, whereas, the strength of the tooth of a helical pinion is governed directly by the number of teeth of the gear in mesh with it.

To determine the location of the point on the axis of the tooth through which the pressure line passes, it is necessary to construct a diagram. With a little experience it is not even necessary to lay out the teeth, but simply draw a series of circles representing the outside, pitch and base circle diameters of the pinion and gear, respectively. The line of action is then drawn tangent to both base circle diameters, and of course, both pitch circles should be tangent to each other. The base circle diameter is found by multiplying the pitch diameter by the cosine of the pressure angle.

We can now determine the strength of a helical gear tooth in the same manner as a spur gear tooth. After an outline of the tooth has been drawn on the normal plane, described later, a line is drawn tangent to the base circle, and passing through the point found in the following manner:

Where the outside diameter circle of the gear cuts the line of action is the point where contact starts on the pinion tooth. The location of the point on the axis through which the pressure line passes will then be one half the distance from this point and the outside diameter of the pinion.

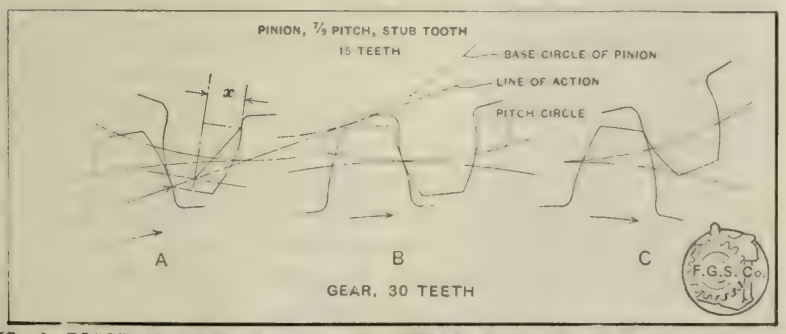


FIG. 9—DIAGRAM ILLUSTRATING GRAPHICAL METHOD OF DERIVATION OF THE LEWIS FORMULA FOR STRENGTH OF GEAR TEETH.

Diagrammatical Method of Determining Weakest Section of Tooth

In order to determine the weakest section of the tooth, it is necessary to construct a parabola passing through the point of application B of the tangential force and tangent to the tooth profile at C which is assumed to be the weakest section. The parabola thus constructed encloses a cantilever beam of uniform strength, the weakest section of which lies in the plane CEF of the base of the parabola. The problem is to find the location of the base of the parabola.

The first step in determining the weakest section of the tooth, assuming that the tooth outline has already been

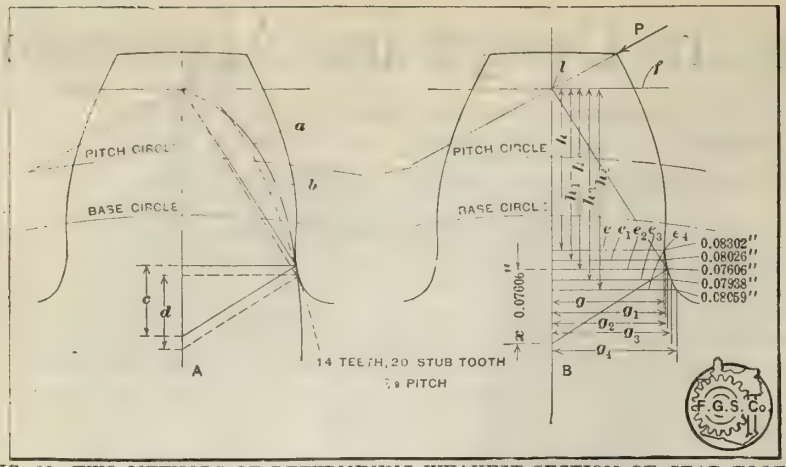


FIG. 10—TWO METHODS OF DETERMINING WEAKEST SECTION OF GEAR TOOTH. A SHOWS METHOD OF CONSTRUCTIONG A PARABOLA BY DRAWING AN IRREGULAR CURVE. B SHOWS METHOD OF CALCULATING WEAKEST SECTION OF TOOTH.

constructed, is to draw a line represented by force P from the extreme point A of the tooth passing through the centre line RD of the latter and tangent to the base circle. The point B where this tangent or pressure line cuts the centre line of the tooth indicates the top of the parabola. Many draftsmen simply use an irregular curve, and by means of their eye, locate what appears to them to be the weakest section of the tooth. Then they draw a curve tangent to the profile of the tooth at this point. That this is an extremely rough and inaccurate method is clearly illustrated at A, Fig. 10. Here two irregular curves a and b have been drawn tangent to what appears to be the weakest section of the tooth, but we find that distance c does not equal the distance d; therefore, the "sight" method is not an accurate one.

Mathematical Method of Determining Weakest Section of Tooth

This method is illustrated diagrammatically at B in Fig. 10. In its primary steps it does not differ from that shown at A, up to the point where the weakest section of the tooth is to be determined. After constructing the tooth section (which should be drawn to an enlarged scale, preferably 10 to 1), draw a series of parallel lines, e, e_1, e_2, etc., 0.100 inch apart, and at right angles to the vertical centre line of the tooth; then draw a parallel line f passing through the intersection point of the pressure line P and the centre line of the tooth. We now, by trial calculations, determine the weakest section of the tooth.

To proceed, we measure the length of the line e, which is the distance g; we then square this distance g and divide it by the distance h, and this gives us the factor as shown in the illustration. For example, g = 0.1188 inch, and h = 0.17. $0.1188^2 \div 0.17 = 0.08302$ inch. We proceed in this manner, starting well above what appears to be the weakest section and continue until the values obtained reduce and then start to increase again. The smallest value indicates the weakest section of the tooth. At B in Fig. 10, the tooth profile appears as five times actual size, but the result of the calculations are given as though the teeth were drawn to the actual size. We see that the distance g_2^2 divided by h_2 gives us 0.07606, which lies in between 0.08026 and 0.07938. In order to prove that 0.07606 indicates the weakest section of the tooth, we thus calculate on each side of the line e_2, taking spaces 0.010 inch apart. In this way we can determine very accurately just where the weakest section of the tooth is. The value obtained by squaring the distance g_2, and dividing it by the distance h_2, gives us the factor which represents the weakest section and is equal to the value x. We therefore find x by calculation instead of directly by measurement.

The helix angle of the helical gear, as will be explained later, affects this strength factor obtained by calculation. As the helix angle is increased, a greater load is imposed on the tooth, so that its relative strength is less.

Determining Proportions of Tooth on Normal Section

The greatest load on a helical tooth is taken in a plane at right angles to the normal section of the tooth, so that in order to determine the strength of the tooth, we must find the proportions of the tooth on the normal plane. Fig. 11 gives us the information that we want in order to determine the shape of the tooth on the normal plane. In order to take a practical example, we will assume the following: To determine the strength of a 15-tooth pinion, 7/9 pitch, 20-degree stub, 23 degrees 25 minutes pressure angle, the proportions of the tooth on the diametral plane are shown on table below:

We see from Fig. 11 that on normal plane, the gear is of elliptical shape, but in order to determine the strength of the tooth we ignore this eclipse and consider the tooth simply as though it were laid out with a larger pitch diameter, greater number of teeth and smaller pressure angle.

How a Steep Helix Angle Affects Gear Tooth Strength

The disadvantages of a steep helix angle for a helical gear are three in number. First, a steep helix angle increases the end thrust; second, it increases the tangential load on the tooth, and, third, it reduces the cross-section of the tooth on the normal plane, mak-

Diametral Plane

Number of Teeth	15
Diametral Pitch	7/9
Pitch Diameter, inches	2.1428
Pressure Angle	20°
Tooth Thickness, inches	0.2244

Normal Plane

Number of Teeth, N_1 $= \dfrac{N}{\cos.^3 a} = \dfrac{15}{0.7727} = 19.4125$

Diametral Pitch, $P_1 = \dfrac{P}{\cos.\ a} = \dfrac{7}{0.91764} = \dfrac{7.6283}{9}$

Pitch Diameter, $D_1 = \dfrac{N_1}{P_1} = \dfrac{19.4125}{7.6283} = 2.5448$ inches

Tooth Thickness, T_1 $= \dfrac{1.5708}{P_1} = 0.2059$ inch

Tan. of Pressure Angle β = tan. 20° × cos. 23° 25′ = 18° 28′

In which:

N = number of teeth on diametral plane
N_1 = number of teeth on normal plane
P_1 = normal diametral pitch
D_1 = normal pitch diameter
T_1 = normal tooth thickness
β = normal pressure angle

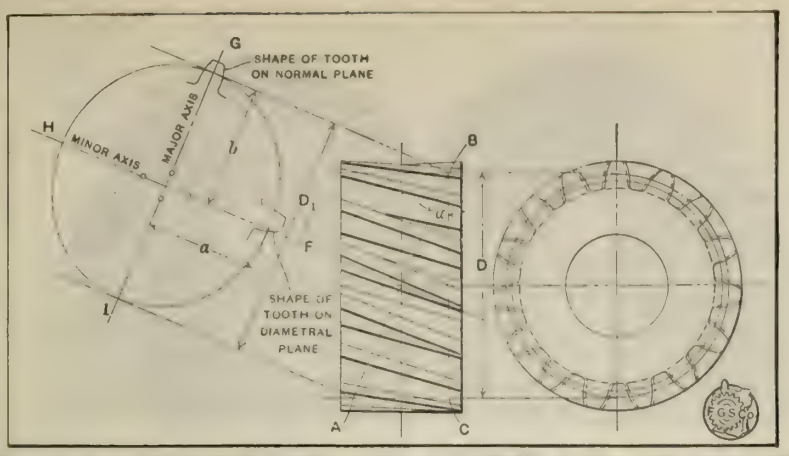


FIG. 11.—DIAGRAM SHOWING DERIVATION OF FORMULAS FOR OBTAINING THE NUMBER OF TEETH ON NORMAL PLANE, AND OTHER NORMAL TOOTH ELEMENTS OF HELICAL GEARS.

ing it less capable of carrying the increased load.

In order to show how a steep helix angle affects the strength of a helical gear tooth, we will take several examples. In the first case, we will compare a 15-tooth spur pinion, 7/9 pitch, with a helical gear of the same pitch and having a helix angle of 15 degrees and 12 minutes. According to the Lewis formula, the strength factor x, for a spur gear of this pitch is 0.0794, and a helical gear of the same pitch and having a helix angle of 15 degrees 12 minutes is 0.1024. A helical gear tooth of 15 degrees 12 minutes helix angle is therefore approximately 29 per cent. greater in strength (ignoring the added strength resulting from the greater face width due to the angularity of a line of contact) than a spur tooth of the same pitch; but we have the factor of increased tangential load to consider. The actual load on the 15-degree 12-minute helical gear is approximately 3½ per cent. greater than that on the spur gear, thus reducing our increased strength factor down to about 25½ per cent. Therefore, we can consider that a helical tooth having 15-degree 12-minute helix angle has approximately 25 per cent. greater effective strength than a spur gear of the same pitch, etc. When we increase the helix angle, however, we find that we weaken the tooth from two standpoints. First, we increase the tangential load on the tooth; and second, we reduce its cross-section on the normal plane. A comparison of a 15-tooth spur pinion with a helical pinion of the same number of teeth and having a helix angle of 23 degrees 25 minutes gives us the following results: From the standpoint of increased tooth strength a helical gear of 23 degrees 25 minutes helix angle is approximately 17 per cent. greater than a spur pinion of the same number of teeth; but when we take the increased load into consideration we find that this increase in the helix angle imposes a tangential load on the tooth which is approximately 8¾ per cent. greater than that imposed on a spur tooth, so that this reduces our effective strength to approximately 8½ per cent. If we carried on our calculations still further, assuming a still greater helix angle, for instance 45 degrees, we would find that our helical gear instead of being stronger than our spur gear was actually about 50 per cent. weaker. This factor would be lowered, however, when we took the angularity of contact factor into consideration.

Substituting Helical for Spur Gears

We are frequently asked by manufacturers for information regarding what we would suggest in the way of a helical gear to take the place of a spur gear where extreme quietness of action is desirable. This frequently comes up, especially in connection with cam-shaft drives for automobile engines. As a general rule, it is necessary for the same centre distance to be retained and also the same ratio between the two or more gears used; so that the problem is one that requires the selection of a set of helical gears having the same centre distance as spur gears and to be of the same tooth ratio.



FIG. 13—HELICAL GUIDE AND CUTTER WITH CUTTER-SLIDE ASSEMBLED; USED ON THE FELLOWS HELICAL GEAR SHAPER.

The Question of Enlarged Pinions

The Involute Curve possesses the advantage of flexibility as regards centre distance and pitch diameter. This flexibility of the involute enables us, therefore, when changing over from spur to helical, to enlarge or reduce the diameters of the gears so as to retain the required centre distance and tooth ratio.

The problem of changing over from spur to helical is sometimes a difficult one, depending largely upon the requirements that have to be met. It is, therefore, impossible for us in this limited space to thoroughly explain all of the points connected with this problem. What we will endeavor to do, however, is to take a simple example which will explain some of the most important points.

We will assume, for example, that we have a pinion of 15 teeth and a gear of 60 teeth, 14½ degree pressure angle, 6 pitch, which is to be replaced by helical gearing. Now, our first consideration is to select an approximate helical angle for our helical gears. Let us assume that these gears are to drive the cam-shaft of an automobile engine, and that the helix angle of 23 degrees will be about right. We will also substitute stub teeth of 20 degrees pressure angle for the 14½-degree full-length teeth.

Calculations for strength show us that 6/8, 7/9 and 8/10 pitch stub-teeth spur gears are all stronger than 6 pitch full-length 14½-degree gears. We therefore have at least 3 pitches to select from.

For the sake of comparison, we will try 8/10 pitch and see what result we get; taking 20 teeth for the pinion and 80 teeth for the gear, we get a tooth ratio of 4 to 1, and a centre distance equal to 6.250 which is exactly what we want. As an 8/10 pitch helical gear having 23-degree helical teeth is stronger than 6 pitch 14½-degree teeth, we can use 8/10 pitch for our gears, should we so desire.

Cutting Helical Gears

The cutting of helical gears does not differ materially from the cutting of ordinary spur gears. There are a few points, however, in connection with the setting of the helical cutter relative to the work which differ from the spur cutter. Before proceeding, however, with a description of some of these points, we will deal briefly with the principle upon which the helical gear shaper operates.

Principle of the Helical Gear Shaper

The principle upon which the helical gear shaper operates has been previously explained. It differs from the principle upon which all other gear-cutting

machines operate, in that the control of the helix angle is positive, and the cutter itself is a helical gear. This cutter works on the moulding-generating process and in its action on the work is similar to that of two gears in mesh.

Control of the Cutter

The helical gear shaper cutter, which is illustrated in Fig. 12, where both right- and left-hand cutters are shown, is simply a helical gear with the top cutting faces of the teeth ground at right angles to the helix angle of the tooth itself. In operation this cutter is held on the cutter-spindle, as illustrated in Fig. 13. The cutter is controlled in its operation on the work by means of helical guides. One of these guides is fastened directly to the cutter-spindle, and the other is retained in the upper worm wheel housing. An adjustable shoe is provided for taking up wear. The bearing surface, however, between these two guides is so great that wear is practically negligible.

This principle, it will be seen, differs from that employed on all other gear-cutting machines in that the change gears have nothing to do with the generating action of the cutter or with its control. All the change gears are for is to preserve the correct relation between the number of teeth in the cutter and the number of teeth in the work. The control of the cutter when in action on the work is positive and is not flexible, consequently the helix angle can be duplicated at any time. Furthermore, the helix angle is beyond the control of the operator, it is impossible for him to make a mistake in setting the machine as far as the helix angle of the gear is concerned.

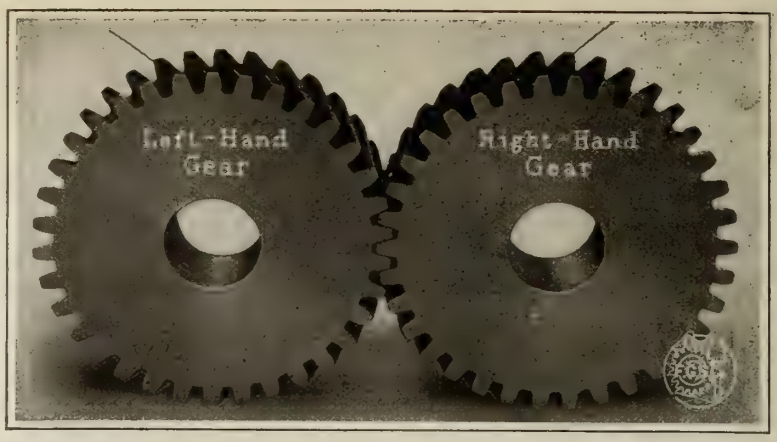


FIG. 14—RIGHT- AND LEFT-HAND HELICAL GEARS SHOWING DIRECTION OF TWIST.

Another very important feature of the helical gear shaper is that the cutter itself is ground all over after hardening, including the involute curves on the teeth, which are generated by a precision grinding process.

Points on Cutting Helical Gears

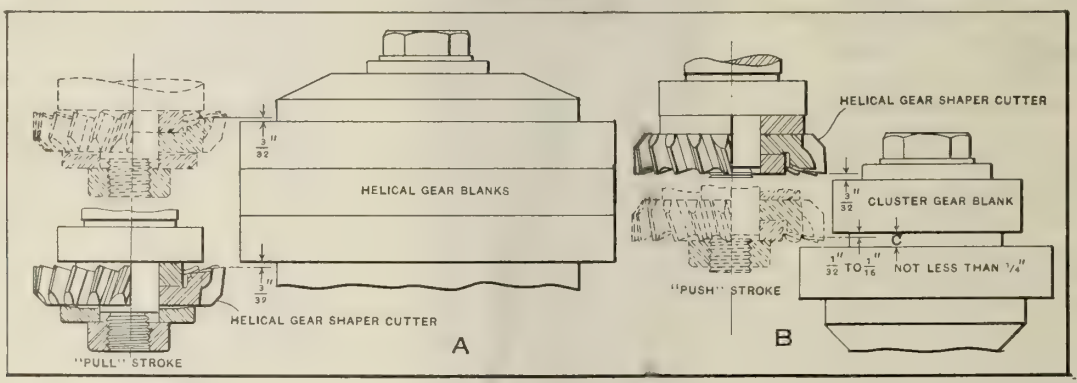
One point in connection with the cutting of helical gears, which will be mentioned, is that the helical cutter requires slightly more overtravel than the spur cutter, because of the relation of the top faces of the cutter teeth to the work. The amount of overtravel for various pitches and helix angles is given in Table III, where a diagram is also given showing the relation of the cutter to the work. The graduations or markings, therefore, on the crank-shaft head, which are used for setting the spur cutter and give an excess over-travel of 3-16th inch, cannot be used directly for the helical cutter; so that it is necessary for the operator to allow additional travel as illustrated in Table III, in order that the top face of the cutter will clear both the lower and upper faces of the work.

In the cutting of shoulder or internal gears in which a recess must be provided for the cutter to run into, it is necessary to have this recess slightly greater in width than that which would be satisfactory for spur cutters. The minimum width of the recess for shoulder or cluster gears is given in Table III for the various pitches and helix angles.

Marking of the Helical Cutter

In order to prevent any possible confusion with regard to the use of the proper cutter for cutting right-hand or left-hand helical gears, the helical gear shaper cutters are plainly marked on

TABLE III.—EXCESS AMOUNT OF OVERTRAVEL NECESSARY WHEN CUTTING HELICAL GEARS, AND MINIMUM WIDTH OF CLEARANCE GROOVE



Pitch	Helix Angle	Plain Helical Gears A	Helical Shoulder and Internal Gears B	
		Excess Amount of Overtravel — Inches	Excess Amount of Overtravel — Inches	Minimum Width of Groove C — Inches
5/7	15°–20′	7/64	5/64	5/16
5/7	23°–35′	5/32	1/8	23/64
6/8	14°–55′	3/32	1/16	19/64
6/8	23°	1/8	3/32	21/64
7/9	15°–12′	5/64	1/16	9/32
7/9	23°–25′	7/64	3/32	5/16
8/10	14°–55′	3/32	1/16	17/64
8/10	23°	3/32	1/16	19/64
9/11	15°– 9′	1/16	1/32	17/64
9/11	23°–20′	5/64	1/16	9/32
10/12	14°–55′	1/16	1/32	1/4
10/12	23°	5/64	1/16	17/64
12/14	14°–55′	3/64	1/64	1/4
12/14	23°	1/16	1/32	17/64

the back face. For instance, the cutter which in reality is a left-hand cutter is marked "right-hand" it is to be used for cutting right-hand gears; and the cutter used for cutting left-hand gears is marked "left-hand," although in reality the twist of the teeth of the cutter is in a right-hand direction. Fig. 14 shows what is meant by right-hand and left-hand gears. A is a left-hand gear and B is a right-hand gear. It will also be noticed that the twist of the teeth on A travels in a left-hand direction, whereas the twist of the teeth on the right-hand gear travels in a right-hand direction.

Setting the Cutter to the Work

The helical cutter can be set with remarked "right-hand" as it is to be used in the same manner as the spur cutter, by using the 0.019-inch feeler gauge. Owing to the twist of the teeth it is necessary to use slightly more care in setting the helical cutter, and the cutter should be rotated by the crank-handle so that one of the teeth used for the setting be brought in an axial position relative to the work. The gauge also should be used at the top edge of the cutter, and it is advisable to rotate the cutter around a few times and make various tests to see that the correct setting has been obtained before starting the machine.

INTERESTING TYPE OF TAPER REAMER

By Robert Mawson

WE recently had the problem of machining the lever shown in Fig. 1, which presented a difficulty which was solved as described.

The lever is made of a malleable iron casting and its general shape and size may be ascertained from the illustration.

The casting was first milled at the fork end and on the bosses A, using a pan of straddle milling cutters spaced to a distance of 5¼ inches on the inside cutting edges.

The next operation is machining the bosses B, and another set of straddle milling cutters is used for this work, the cutters being placed on the machine arbor, with the piece set on the milling machine table, so that the left-hand boss will be 1 inch away from the machined face of the left-hand fork boss, as shown.

The holes in the casting are next drilled and reamed, the holes being tapped in a later operation.

A jig was made for the work of drilling and reaming which was not very complicated, being of an open type.

The piece was located by headless screws placed at an angle of 45 deg., and were used at the fork end.

Screws and clamps being tightened onto the fork casting held it securely for the machining operation.

So far everything seemed to be coming smoothly and standard roughing and finishing taper reamers were tried to machine the large taper hole shown at C.

These reamers were guided through a bushing in the jig, but the results were very unsatisfactory.

The holes were scored and rough in their finish, and we did not seem able to retain the desired size, some holes being larger than would pass inspection even though a fixed stop was used, so that the reamer would enter the piece the same distance for all the forks being machined. It might be added that the hole was machined from the solid.

The problem was solved by using the reamers, shown in Figs. 2 and 3. A ⅞ in. hole was first machined, using a two-lip twist drill guided through a ⅞ in. bushing in the jig. A four-lip drill, 1.010 in. diameter, was then used.

The shank of this tool was 1 inch diameter, and was guided in a bushing of the jig of suitable size for the work. The roughing reamer, Fig. 2, was then used, and this was followed with the reamer, Fig. 3.

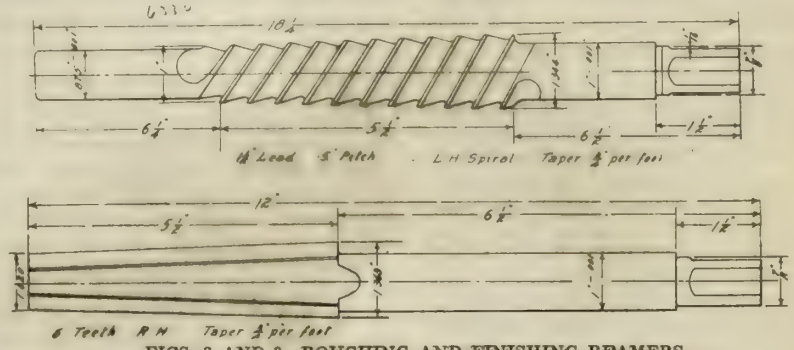
It will be noticed that the reamer, Fig. 2, is of unusual construction. It is made with angular cutting edges with a pitch of .500 in. and triple lead. The spiral is made left hand and the direction of rotation of the tools is right hand.

We tried a reamer with a double lead and this gave so much encouragement in the solution of the problem that the tool, illustrated, was made and very satisfactory.

In action the chips were forced up the reamer along the spiral and a smooth hole absolutely to size was the result. A cutting lubricant was used for the reaming operation.

About 2 to 3 thousandths of an inch was left in the hole for finishing reaming operation and using the tool, Fig. 3, a perfect hole to size and interchangeable in its nature was obtained.

Such a type of reamer should prove useful for cast steel parts or steel forgings as well as malleable iron castings.



FIGS. 2 AND 3—ROUGHING AND FINISHING REAMERS.

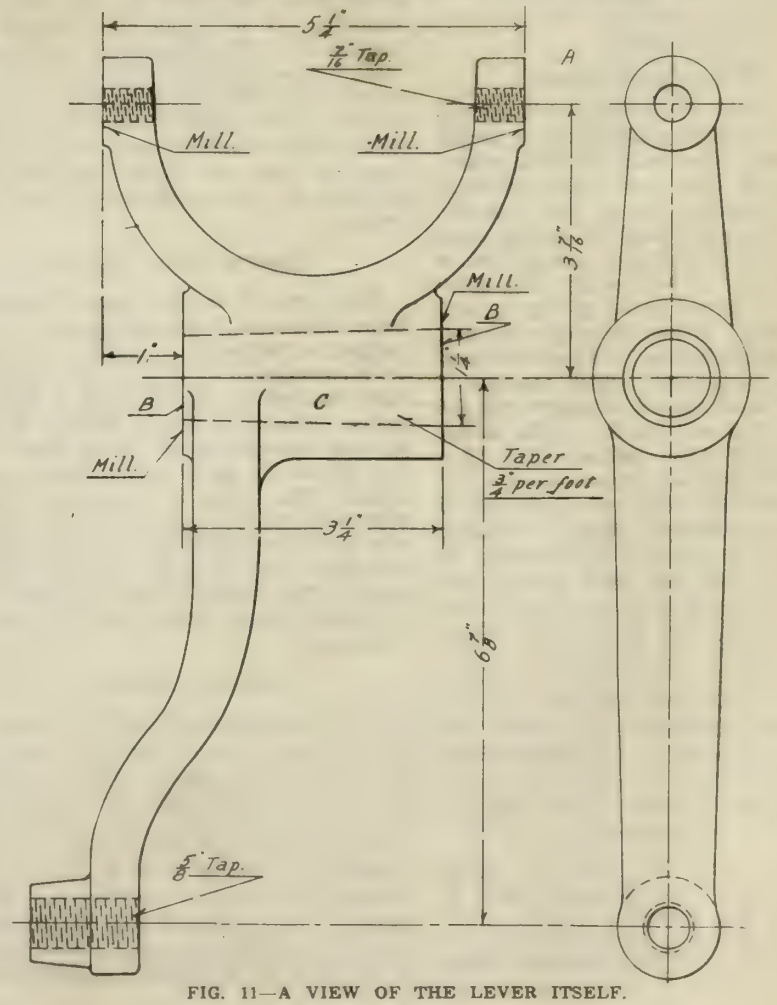


FIG. 11—A VIEW OF THE LEVER ITSELF.

Various Ways of Chucking on Thread Millers

The Chief Points to be Observed in Proper Chucking Are Three in Number. These Are Given, Together With Other Interesting Information Relative to the Art of Properly Chucking Your Work

NO doubt many readers of CANADIAN MACHINERY are interested in thread millers and thread milling in all its phases, so we publish below some matter taken from a bulletin issued by the Smalley General Company, Inc., of Bay City, Mich, relative to the different methods of chucking, and the chucks in use on their type of thread millers.

They commence by remarking that the chief points to be observed in chucking are: 1st. Hold the work so tightly that it cannot slip; 2nd. Hold the work by the parts for which alignment is required; 3rd. Rapidity.

Air-Operated Collet Chucks

The air-operated collet chuck is preferred for most rapid and satisfactory work. It is operated from the operator's position in front of the machine. It is rapid, and furthermore, in chucking rough pieces, if there is a slight slip from a high spot to a low, the air chuck follows it up and tends to grip much tighter. It gives a more powerful bite than can ordinarily be obtained by a hand-operated chuck and therefore holds the article chucked more rigidly. This is of particular advantage when the part to be milled is overhung.

Three-Jawed Chucks

The principle of operation of the three-jawed air-operated collet chuck is simple and familiar. It consists of three collets hinged at the back to a spider which is drawn in and out by an air cylinder. These collets are closed in on the work by an inclined surface sliding on a closing-in ring so that really they operate on an inclined plane giving a very powerful grip. When the piece is small and the article finished it is advisable to use a one-piece collet, which consists of a piece of steel turned outside to fit the closing-in ring and inside a trifle larger than the piece to be chucked. It is then split like an ordinary screw machine collet and given the back and forth motion by the air cylinder. When a tapered thread is to be milled it is necessary in every case that the work occupy the same position with reference to the stop on the bed against which the bottom slide is shoved. In other words, when the milling head is up against the stop which is provided for this work, the position of the hob must be identically the same in each case in reference to the end of the thread to be milled.

Air Collet Chucks Fitted With Stationary Collet

In cases where the work is small enough to permit, a stationary collet is put inside the movable collet. This stationary collet is constructed along the same lines as the screw machine collet but is much larger and is made of cast steel or cast iron. With this device and proper stops on the milling head the work is shoved back into position in the chuck. At the same time the milling head is advanced and shoved into the chuck the proper depth. Then when the air cylinder is operated it does not change its position. If it were not for the stationary collet the piece would be drawn away from the top, an amount equal to the travel of the movable collet, and as diameters of work differ in many cases the amount this movable collet travels inward would decrease with the increase in diameter of the work, thus introducing a variation which of course would be objectionable. Our system of stationary collets has been thoroughly tested and has been found very satisfactory. There are certain points to be observed in the construction of stationary collet chucks. For instance, if the chuck is not properly constructed, concentricity of the work will not be obtained. By our method of construction no variation in the travel of the collets with reference to each other can be introduced. To cite a specific case, we made the largest air collet chuck which we think has ever been constructed. It was used for chucking 16-inch shells. The threads in these shells were not permitted to be out of concentricity over .005 or .006 in regard to the outside of the shell. The Government Arsenal (Watertown), which bought this machine, reported to us that they had not had the least difficulty in this connection.

Tapered Arbor Chucks

This type of chuck is used in certain cases where a large production is required, as for instance automobile hubs. It is sometimes possible to arrange it so that the hob is slipped over a tapered arbor. Then, by simply pulling a ring around outside of the chuck the cams are thrown in which pull it back on the arbor. The piece is driven by a key fitting in the key-way of the hub. When the job is finished the ring is thrown the other way and cams knock it off the arbor. This makes a very desirable sort of chuck in cases where it can be used to advantage.

Adapter Chucking

This is another type of chuck which is used in many cases where the work has to be drawn up against the face plate. The face plate has the proper pilots on it to centre the work. It is operated by a draw-in bar connected with the air cylinder or by a washer forced up against the piece by means of a hand-operated nut. This method of chucking is quite necessary for some work in order to give it the required support when it is so frail or light of section that it would have a tendency to spring.

Difficulties Which Arise and Must be Overcome

This springing brings up another point. In stamping sections made of thin metal or thin castings or in thin tubing, the metal will sometimes spring under the action of the hob, and when the cut is completed be out of true. When this is the case, if accuracy of the thread is required, it is necessary to so chuck the piece that this distortion cannot take place. This is usually taken care of in our collet chucks by chucking the piece on the outside or by expanding mandrels where the piece is held and supported from the inside. In the case of tubing a plug is sometimes driven into the end. Where the piece has a thread on one end and is smaller at that end than at the back end we sometimes put what we call a false collet on the piece. It consists of a spring ring which springs to a slightly larger diameter than the piece on the inside. The outside diameter, which is as large or a little larger than the piece to be chucked, is at the back end. Each time a piece is chucked this piece is placed on the end to be milled and the piece can be shoved back into the collet chuck and is held in place by the false collet which in turn is held in the collet. Sometimes a piece is of such a shape that it is hard to grip it anywhere. Take for instance an old and probably familiar illustration of a shell with a nose thread. The front end of the shell is tapered so that it is impossible to get a hold upon it. If held at the bourillet the overhang of the shell is too much as a slight piece of dirt on the outside of the shell would cause the nose to run out. In this case it was necessary that the thread be concentric with the tapered end, and we made a long chuck something the shape of a cylinder with the sides cut out so that the shell could be dropped in, and at one end of the cylinder was a face plate with a hardened steel bushing in it of such size that it permitted the nose end of the shell to just pass through. A plunger in the back of the cylinder operated by the air cylinder. It shoved the shell into the bushing and at the same time centered it at the back end by means of a conical ring which fitted the base end of the shell. This pressure was sufficient to prevent the shell from turning during the milling operation. This same principle is followed in many ordinary commercial operations.

Milling From the Rough

In many cases the surface to be milled need not be finished before going to the thread miller. If the excess metal is

light the part can sometimes be finished with our turning attachment. If the core sand is all removed from castings so as to give a smooth surface they can be milled from the rough. The cored surface of the casting, however, must be fairly true for roundness. Generally speaking, where a surface adjacent to the thread is required to be in true alignment to the thread so as to have a good or perfect contact with the surface against which it presses, this surface can be turned on a Smalley General thread miller at the same chucking.

Special Chucks

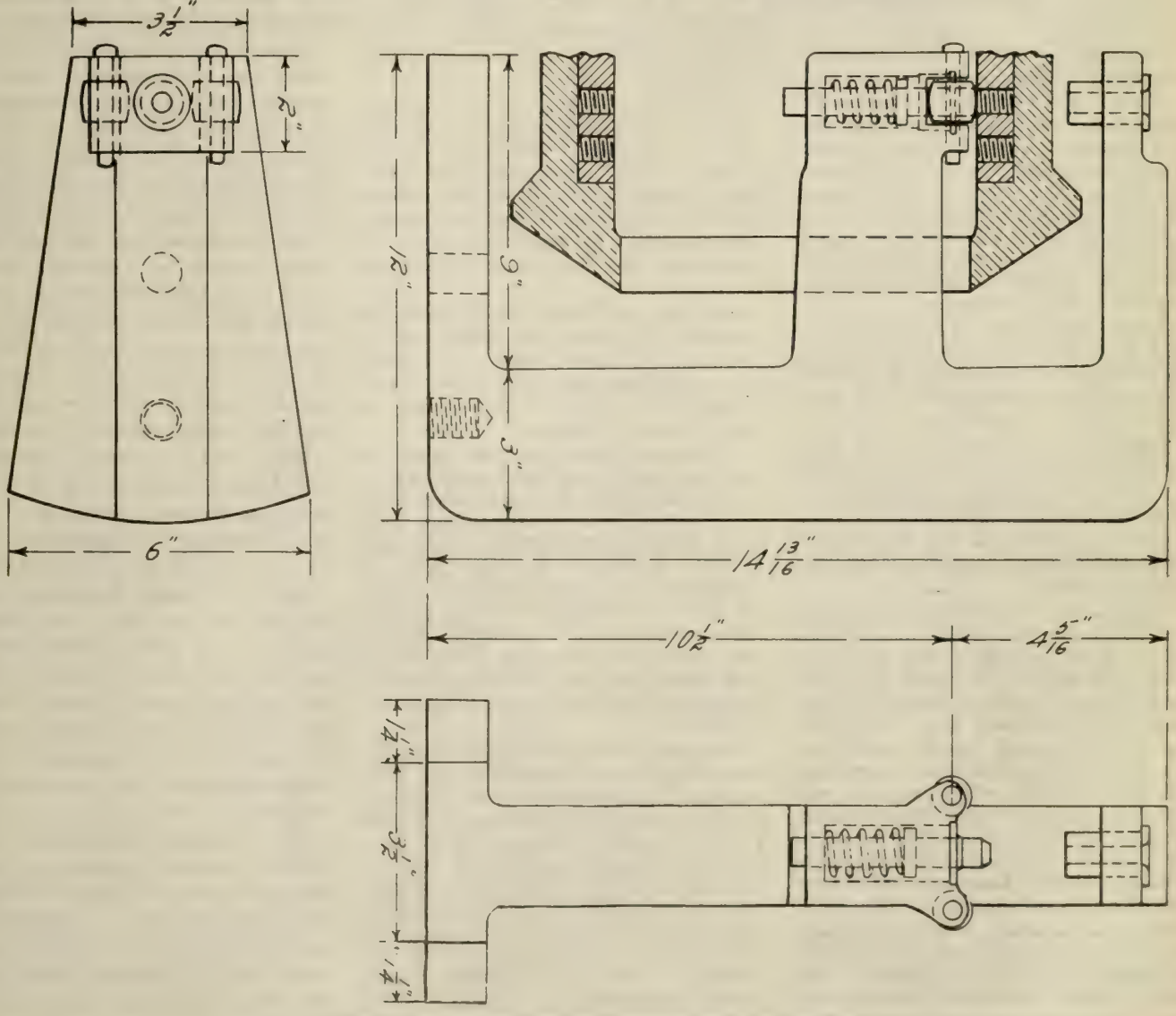
The chucks described above are more or less standard. Where the piece to be milled is unusual in shape, special chucks can be built to insure rapidity in operation and accuracy of the finished part. Attention is called to the fact that in certain cases, as for instance in milling collars or rings, it is possible by the use of a long hob to mill several pieces at one chucking. This materially reduces the net time per piece and the amount of handling. In thread milling the matter of chucking is so vitally important that a word of caution must be spoken. To get proper results with a thread miller the chuck must be mechanically correct and right. It must be remembered that with a thread miller the thread is completed at one revolution of the work by the use of a multiple tooth hob. Hence the stress and strain, the torque and the bite of the hob are greater than in the case of machine tools using a single cutter. Naturally enough it is far from our purpose to suggest fanciful difficulties to those interested in thread milling. But we think it is right and proper to lay stress on the importance of chucking in relation to thread milling, at the same time giving the general assurance that the services of our engineering department are open to any interested person.

DRY PIPE JIG

By C. D. Thorburn and J. Hall

The following sketch illustrates a jig which has proved of considerable value to us in the drilling of new sleeves for old dry pipes.

Frequently we have to renew the sleeve on the end of dry pipe, and the trouble was to get the holes in new sleeve to correspond with holes in the end of old pipe. The old method was as follows: The old sleeve was removed, to transfer and lay out holes some distance up body of pipe. When the new sleeve had been shrunk in position, the holes were again transferred back to it. Very often the man who did the laying off was not accurate, and the result was that when holes were drilled in new sleeve they did not correspond with old holes in end of pipe, frequently causing breakages of drills and taps of holes having to be opened out to a larger size, thereby shortening the life of dry pipe and probably the foreman having to get special oversize plugs made. To overcome above difficulty, the jig, as shown, was designed and made to suit a small sensitive drilling machine, the base of jig being bolted securely to table a the locating pin set central with drill spindle. The dry pipe supported at its middle on a roller trestle and the inside of sleeve end of pipe resting on the rollers in horns of jig. The locating pin, with pressure of spring below, engages in existing holes in old pipe and the bush in top of jig ensures alignment of hole in new sleeve. Result was an accurate job, a big saving of time, and a prolonged life of pipe.



THIS ILLUSTRATES THE JIG FOR DRY PIPES IN DETAIL.



WHAT OUR READERS THINK AND DO



The Functions of a Technical Magazine

By JOHN S. WATTS

THIS article is written for the purpose of suggesting what type of contribution the readers of technical papers wish for.

In a fairly long experience in mechanical work, I have found the technical magazines of inestimable advantage, but still have the conviction that for a variety of reasons they do not fulfil their functions with as high an efficiency as they could.

In the field of mechanical engineering the magazines have, roughly, three main divisions of workers to cater to, these being as follows: Designing, manufacturing, management.

While one reader will be interested in the articles published which fall into that division, in which he is himself placed, the three are so closely interrelated, and the reader himself is probably hoping to be some day in some other division, that it would be a mistake, even if it were possible, for any journal to attempt to confine itself to any one of these divisions.

It may, therefore, be understood at once, that no reader can expect to find every article in every issue to be of interest to him, but we ought to get somewhere near a fair division.

Taking these divisions in their order we have first designing, and I believe this to be the division that needs and uses the technical paper most. I think it could be shown that it is this division which supports the technical paper more than any other.

The reasons I say that the designing end of the business needs the technical papers most is that, in the nature of things, the number of men in the drawing office will be much smaller than the number in the shop, that is, on the manufacturing end, so that while we can, in the shop, subdivide the work so fine that each man will be supplied with that class of work at which he is expert, the man in the drawing office has to be much more versatile and is expected to have a working knowledge of almost everything in the mechanical line.

For this knowledge, he must depend largely upon the technical journals, and as time goes on, and the field of mechanical work extends, he is more and more dependent upon this source. Frequently the designer is engaged in something which is new, at any rate, to his plant, and has generally little to guide him in the way of actual operating experience, with similar machines.

If engineers would publish more information as to the stresses which have proved too high, in machines they have built, and weak points which have developed, we would gain some very valuable information. And under present conditions, when the competition is greater between countries than between companies, the old-time idea of keeping information of this nature secret should be discarded.

The biggest weakness in the organization of most firms to-day is this very lack of operating experience in our draftsmen and designers, and under present conditions can best be remedied by the publication of the weaknesses which develop, by those who have the experience and the remedy that cured it.

On the other hand, the shopman, or operative, is getting his experience, all the time, in actual work, and is more frequently than not working on parts or machines which he has worked on quite frequently before.

In designing new machines, while we have the engineering hand books to give us the basic laws upon which we must build, we get little assistance from these books as to the application of these laws to any particular problem. This is necessarily so, because only the technical journals could hope to keep up with the rapid progress of events in the mechanical world. Therefore, I think there is a great need for articles giving the stresses and proportions used in successful work.

The number of hours spent designing such simple parts, as hand levers, shaft couplings, plain bearings, etc., must be, in the aggregate, enormous. Tables giving the general dimensions of these and similar small parts could well be published in the technical journals, whereas, a handbook being published only every so many years would not care to publish such matter until it had become, in the course of many years, really a standard.

The blame for the scarcity of these really useful articles lies mainly with the designers themselves, because they do not, except in rare cases, send in for publication the tables, charts, etc., that they have got up for themselves. This is partly, no doubt, due to modesty in thinking that what they have themselves done, others can do, or have done, and that the other fellow will probably prefer to get up his own material.

This is not, to my belief, the correct point of view, as I am sure that we are only too glad to avoid the drudgery, and save time where we can by utilizing the work of another.

It should be borne in mind that mechanical engineering, touching as it does almost all the human activities, requires sometimes information on almost every subject under the sun; therefore practically nothing that can be classed as information on any subject whatever, should be rejected, provided it may be reasonably expected to be practical.

The manufacturing or shop end, I think, is much better served by the journals, but I would like to see more attention paid to the time required to perform the operation described. This point is very rarely mentioned in describing a job, but would be valuable for comparison with other methods. The time consumed in doing a certain piece of work is really the final criterion by which to judge the method of doing it.

The third division, management, is, in my opinion, one that would be assisted greatly, if an open discussion could be started and kept up in the paper between the two sides in an amicable and truth-seeking spirit. I believe it would lead to a better understanding between the executives and the men. All embarrassment will be removed and personal animosity if the letters were published under a nom de plume.

It is largely up to readers to make a technical paper of service to them by doing their part in sending in material, both on simple and on obstruse subjects, the one is as likely to be helpful as the other, as we must always remember there is a younger generation coming along.

A SIMPLE MARKING MACHINE

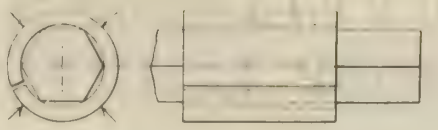
By D. A. HAMPSON

In a recent number of CANADIAN MACHINERY there was described a machine used in making Smith typewriter characters. It brought to mind the device shown above which the writer made up one morning during the rush of war work to mark the round heads shown in the upper corner.

We had slate marking machines and other stamping tools, but there was apt to be congestion on the machine used for these heads. Feeding these small round pieces was slow work at best and so it was decided to try another scheme using the same roll die as the machine.

Some odds and ends were gathered together, a little milling done and some drilling, and the idea of 7 a.m. was the fixture of noon.

In the drawing, one of the screws has been left out for clearness—all four were provided with compression springs to make up for variations in thickness. A tongue allowed the base to be grasped in a vise and with a boy at the end of the handle, five thousand of the pieces could be marked in a day. This kept us ahead of the screw machine and it relieved the marking machine of this job, at the same time doing better and faster work. More than this could not be asked of any device.



HOLDING HEXAGON STOCK IN FOUR-JAW CHUCK.

By F. Horner.

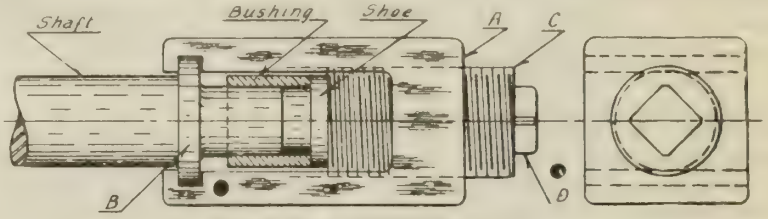
In a case where a lathe happened to be fitted with a nice new 4-jaw self-centering chuck, the following arrangement was adopted to get around the difficulty of holding some hexagon stock, there being no 3-jaw chuck provided. A piece of stout steel tube was taken, of a bore to just slide over the corners of the hexagon, and a saw-cut put through enabled it to centre and grip the bar, the pressure of the jaws coming as indicated by the arrows. The same device might be employed for triangular bar, while, on the other hand, square rod could be chucked when only a three-jaw chuck is available.

FORCING SHORT BUSHINGS ON SHAFT ENDS

By F. SCRIBER

Having had considerable trouble driving the short bronze bushings shown by the accompanying illustration on the shaft owing to their becoming cramped, a tool having the features of construction in Fig. 1 was made for this purpose.

The body of this tool A is cut away at B to hook over the shoulder of the shaft. A screw C having a soft shoe between it and the bushing is contained in this body, thereby causing the bushing to be forced in place by turning the screw with a wrench on the square at D.



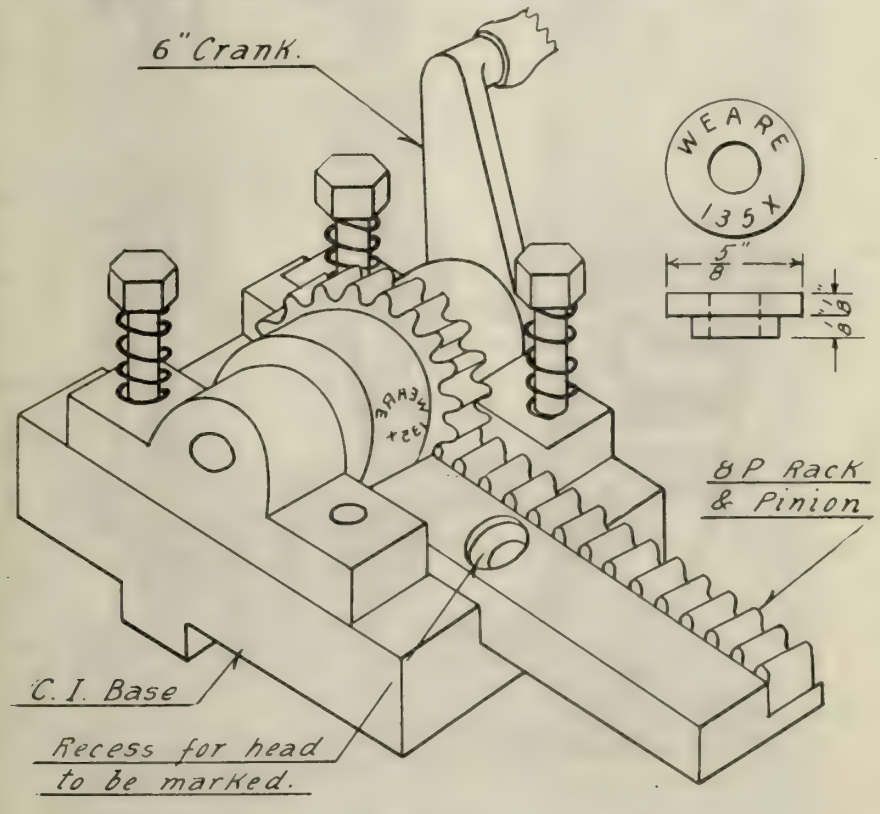
THIS VIEW SHOWS THE IDEA.

"SHORT ENDS"

By J. Gray

In a machine shop doing general repair and construction work, a good many pieces of shaft up to a foot or so in length accumulate. These short ends come in very useful for making collars, bushings, pins, etc., and the following method of sorting and storing is considerable of a time-saver, the mechanic being able to lay his hands on what he wants without going through a miscellaneous pile with calipers and rule.

A row of small bins is placed convenient to the lathe hands, and a piece of plate bent to a right angle is screwed on the front face of each bin. The projecting side of this angle plate has two holes drilled in it, one acting as a "go" gauge and the other as a "not go" gauge. The shaft ends can then be speedily sorted into their respective bins and as speedily checked up by the mechanic when one is needed.



GENERAL VIEW OF THE MARKING MACHINE.

U.S. Has Claim.—A claim has been filed by Sidney S. Underwood, representing the United States, for $376,496 and $100,000 damages, against Motor Trucks, Ltd., Brantford. After adjusting its claims with the Imperial Munition Board, the company were awarded $1,633,203, and after various deductions, the amount owing to the company by the United States was $637,812. This was paid, together with an additional $5,000, by the U.S. Government, on November 10th. The U.S. now claim that the value of the lands and buildings making up the company's plant at Brantford were included in the payment, and that the company now refuses to hand over the property to the United States.

Canada Metal Extends.—The large plant of the Steel and Radiation, Ltd., on Fraser Avenue, Toronto, has been purchased by the Canada Metal Company, the price of the buildings and necessary alterations amounting to $250,000. There are six one-storey reinforced concrete buildings, and these will be used for the manufacture of cement tubs, and increasing the nail and wire output, the general smelting and refining business.



DEVELOPMENTS IN SHOP EQUIPMENT



BARNES GANG DRILL

The Barnes Drill Co., Rockford, Ill., have placed on the market a 26 in. all geared gang drilling machine with sliding heads as shown:

This gang drill is built for heavy ordinary type duty work, having same capacity as regular box column type.

It has the strength and power of the ordinary 36 in. cone belt driven drill, and is more conveniently arranged for quick control.

There are no cone and inherent belts to shift or to slip.

It has eight changes each of geared speeds and of geared feeds on each spindle, all independent of each other and all under instant control of operator.

Each spindle is exceptionally large and double splined. Each sleeve has 14 in. travel and drift hole is below sleeve. Head and spindle are counter-balanced, the weight being suspended by roller bearing sheave wheel. The other sheaves are accessible to oil. Head is gibbed to column face, insuring perfect alignment, and is held at any point within the long travel by two quick-acting clamp screws. The head is raised and lowered easily and quickly by means of a crank pinion operating in a rack. An adjustable stop is supplied to clamp on column face so that sliding head may be instantly brought back to exactly the same place each time head is raised.

This machine will drive a 2 in. high speed twist drill at .041 in. feed per revolution of spindle or at the rate of 6½ in. per minute in cast iron, without the back gears.

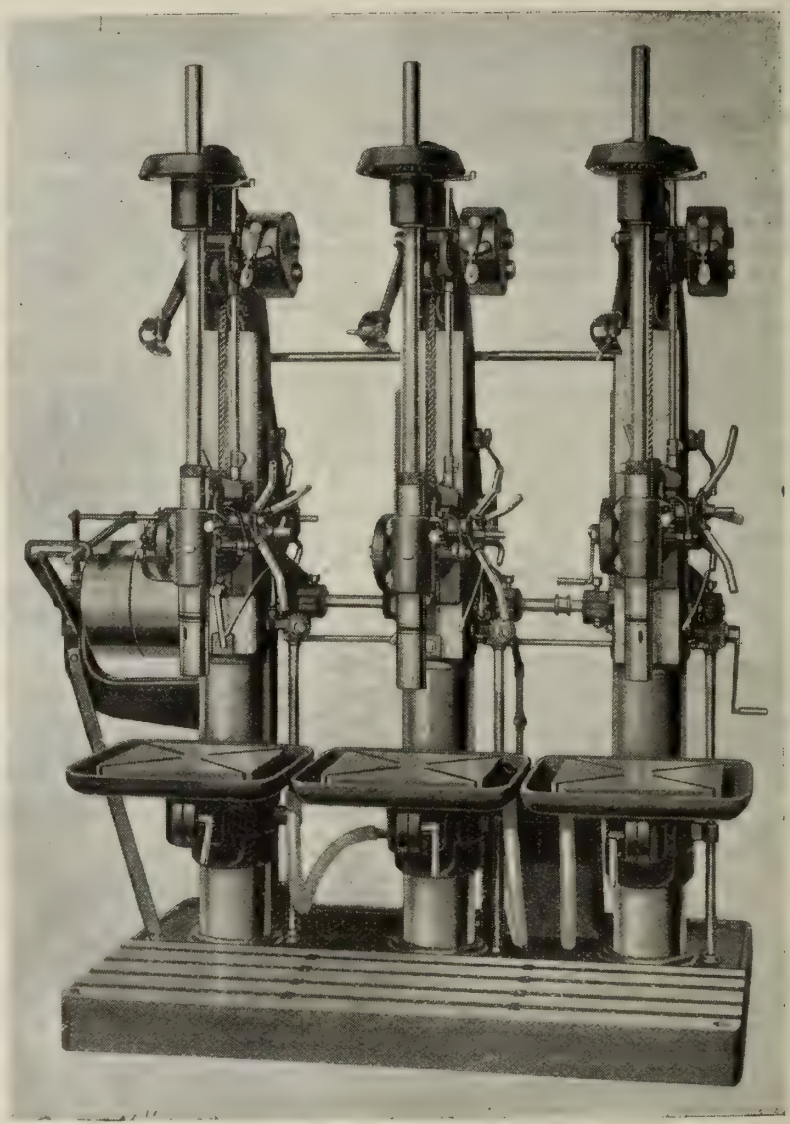
Suitable feeds are available for boring bar work and the machine will bore out an 8 in. hole.

The multiple disc friction clutch gears, giving reverse speed of 1¾ to 1, are on the driving shaft of the machine—not on the spindle—a strong point, as machine is geared down 13 to 1 in front of the clutch gears.

Any or all spindles can be made with ordinary type automatic reversing mechanism. Trip can be set so that the instant tap reaches depth required, spindle will automatically reverse, backing out at increased speed. Shifting lever can also be set so that when tripped automatically (or by hand) it will return to neutral position, thus stopping the spindle instantly instead of reversing same.

Following are the principal specifications:

	Inches
Height of drill	94
Distance from centre to centre or spindles	24
Distance from face of column head to centre of table	12
Distance from turned column to centre of table	13¼
Diameter of spindle nose	3 3/32
Diameter of spindles	1 15/16
Ratio of back gearing	4 to 1
Maximum distance from No. 4 taper spindle to table	40
Minimum distance from No. 4 taper spindle to base	18½
Maximum distance from No. 4 taper spindle to base	53½
Vertical travel of spindle for any position of head	14
Vertical travel of table	20
Vertical travel of sliding head	23
Diameter planed surface square table, exclusive of oil channel	18 x 18
Diameter of round table	23



GENERAL VIEW OF THE DRILL.

PORTABLE OIL BURNER

The Canadian Hauck Burner Co., Ltd., Port Hope, Canada, have placed on the market what is known as their combination Lead Melting Furnace and Portable Oil Burner.

This device is actually two outfits in one. When used as a melting furnace, 200 lbs. of lead or babbitt can be melted in 15 minutes and kept in a molten condition at the cost of a few cents per hour. Additional supply of fresh lead melts instantly.



HAUCK COMBINATION LEAD MELTING FURNACE AND PORTABLE OIL BURNER.

When not used for melting lead in pot, the burner may be detached from the furnace and used for melting babbitt out of bearings, rebabbitting, bending pipes, straightening, preheating in connection with welding, brazing, expanding to make shrink fits, etc.

The device consists of a furnace on three legs, supplied with 200-lb. capacity pot. The 12-gallon oil tank is of heavy steel, equipped with pressure gauge, hand pump and fittings. The burner is of the Hauck Hand Pump Type burning kerosene as fuel. Burner does not consume any air from the tank. The pressure secured by the use of the pump is simply to force the oil to the burner, where it is vaporized. A single pumping will operate the apparatus for three hours.

This device will, no doubt, interest anyone connected with the machine tool industry.

CYLINDRICAL GRINDING MACHINE

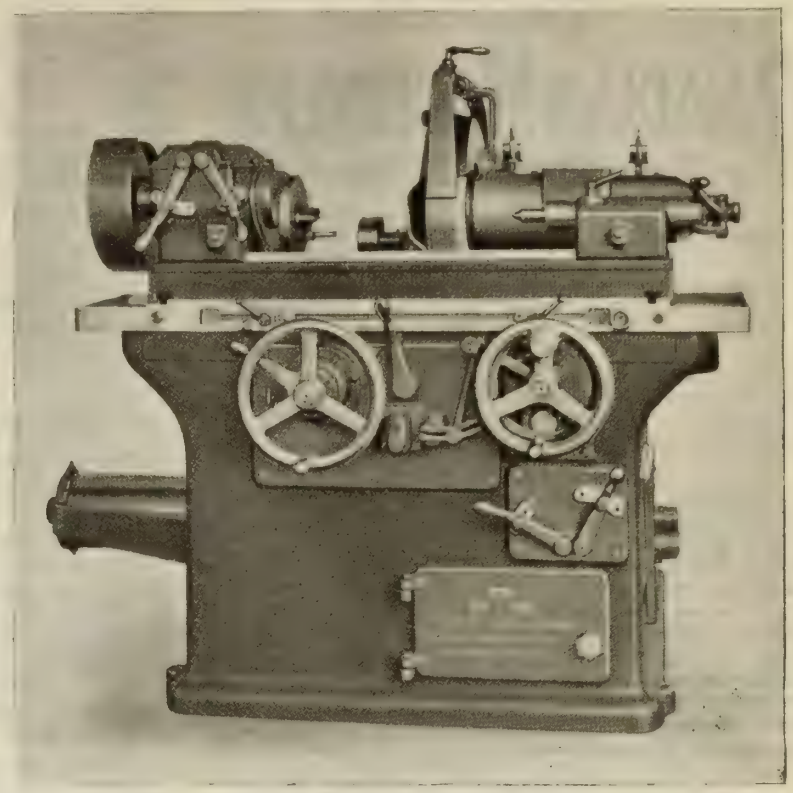
The Fitchburg Grinding Machine Co., Fitchburg, Mass., has placed on the market a line of plain cylindrical grinding machines. The 8 in. by 36 in. size is shown in accompanying illustration.

The wheel spindle is of tool steel, and the spindle boxes of bronze, provided with means of compensation for wear.

The automatic cross feed is operated at each reversal of the table, and is said to be easily and quick set, and is self-releasing when work has been ground to size. The table swivels on a central stud, and can be set to grind various tapers.

The table drive is through spiral gears, rack and pinion. The reversing mechanism is said to be positive and accurate. A coolant tank is cast in the bed and a pump is used of the fan type. The work rest has fine adjustment, and is provided with adjustable set collars for maintaining the size of the work.

The regular equipment includes a wheel trueing device and a centre grinding attachment. The machine is built in six sizes from 4 in. by 36 in. to 12 in. by 54 in. Following are some of the principal specifications of the size shown in photograph:

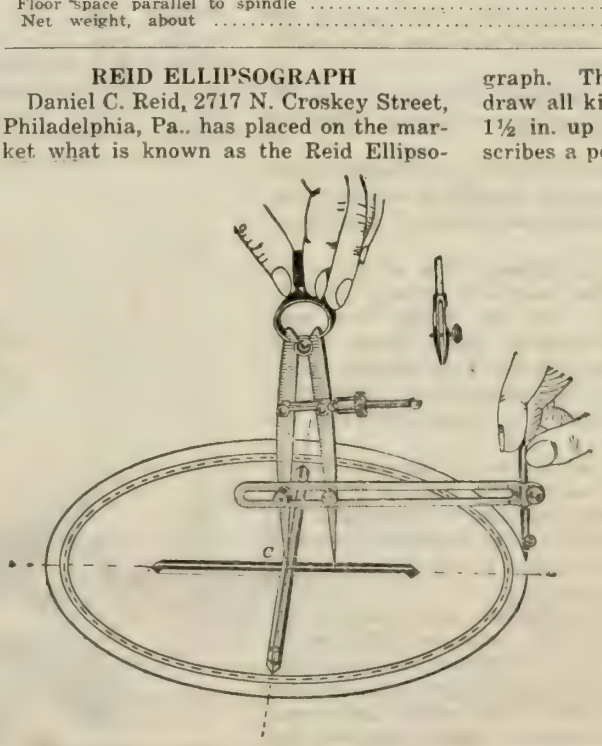


GENERAL VIEW OF THE GRINDER TOGETHER WITH SPECIFICATIONS.

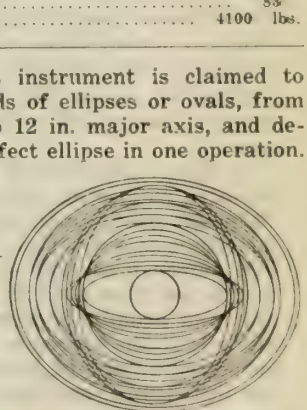
Capacity Head and Footstock centers swing	8" diameter take 20" length
Swivel plate graduated to angle of	10°
Work Centers, No. 4 Morse Taper	1¼" diameter
Grinding Wheel Spindle front bearing	3" diameter 7¾" long
Grinding Wheel Spindle rear bearing	2½" diameter 6½" long
Grinding Wheel Spindle Pulley	6" diameter 4⅜" face
Size of Grinding Wheel	16" diameter 1" to 3" face 5" hole
Number of Grinding Wheel Speeds (2)	1400 to 1640 R.P.M.
Number of Work Speeds (6)	64 to 340 R.P.M.
Number of Table Speeds (6)	28 to 150 per min.
Tight and Loose Pulley on Counter haft	10" diameter 4¼" face
Speed of Ball Bearing Countershaft	700 R.P.M.
Floor space at right angles to spindle	52"
Floor space parallel to spindle	83"
Net weight, about	4100 lbs.

REID ELLIPSOGRAPH

Daniel C. Reid, 2717 N. Croskey Street, Philadelphia, Pa., has placed on the market what is known as the Reid Ellipsograph. This instrument is claimed to draw all kinds of ellipses or ovals, from 1½ in. up to 12 in. major axis, and describes a perfect ellipse in one operation.



THIS VIEW SHOWS THE INSTRUMENT IN USE.



THE WORK ACCOMPLISHED

The instrument is provided with pen and pen parts, and can also be used for drawing circles up to 12 in. diam. It can also be used as an ordinary divider. This announcement will no doubt appeal to draftsmen, designers, illustrators, architects, etc. To illustrate its construction we show the illustrations herewith.

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Another Strike This Year?

ALTHOUGH the first of May is some time distant, there are rumors abroad already that there will be labor disturbances in the metal working industries at that time.

The memory of the trouble of 1919 is still fresh in the recollections of the industries in this district.

That struggle came at a time when it could not help but make the business of after-war manufacturing hard and difficult. No good purpose has been achieved by the strike of 1919. There are mechanics in all lines of the trades — machinists, molders, etc.— who are to-day living in distant cities and towns where they have poorer conditions than they left here.

There are shops that are manned with help not as efficient as that which walked out on the first of May last year.

As far as CANADIAN MACHINERY is informed, there has been no meeting between the confiicting interests yet. There are points to be discussed and settled, if possible, if a strike is to be averted.

A person need take only a cursory view of the situation to see that a strike this year is extremely undesirable and equally dangerous. So far things have gone nicely, but the pressure of keeping things going nicely, under the burden of increased costs of everything entering the factory, and from the pressure of uncertainty in the supply market, is putting on a tension that has not an inexhaustible resistance.

If Canadian industry has not arrived at the stage where the men in the shop and the men in the office, or in charge of the organization, can meet together as reasonable beings, and discuss their problems, then Canadian industry has not arrived at the stage where it can anticipate the future with confidence and certainty.

The editor of *Canadian Foundryman*, who made an unsuccessful attempt to bring about some kind of a settlement, writing in the last issue of that paper on the strike outlook, stated: "While we sympathize with the molder more than with any other man in the world, and would gladly do anything in our power to assist him, we cannot help but think that he is the loser in the long run by not keeping himself better informed. Had the molders taken the trouble to look the situation squarely in the face last spring, and weigh the possibilities of winning out, they could not help but have seen that the odds were against them, as there was hardly a shop on the continent but what was slack. Things are more favorable now, and there is no reason why every molder is not holding down a good job at his trade. What this paper would suggest would be for the foundrymen to offer the molders a wage such as would support life, and then for the molders to go to work and make hay while the sun shines, and when things get down to normal and work shows signs of slacking off it would certainly show a brotherly spirit to reduce the hours of labor rather than allow some of the men to be laid off, but just now it does not seem possible to get the 44-hour week, and inasmuch as the bulk of the foundries in the United States and Canada are working at least 48 hours and made very little effort to have it reduced, there was not much chance for a few Canadians to win out, even though it might be desirable."

WE Pay For All These Things

WHO is putting up all the increases in wages, selling prices, etc.?

We are.

There's something to think about right there. The employer makes a serious statement about it hurting him. So it does—but not for long.

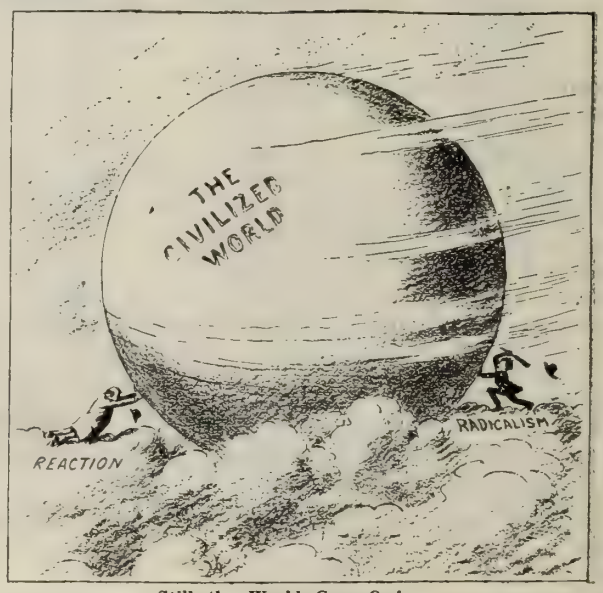
Take a case in the mechanical world. A firm wants a boring mill. A ten per cent. advance is announced. They buy the mill, pay the old price and the ten per cent. as well. It becomes part of the charge against which they must work until depreciation has amounted to sufficient to write it off.

That firm is making a certain article. If they are modern, their cost prices will be kept right up-to-date. That increase in the price of the machine must increase the price of the operation—that is if there is not sufficient increase in production to more than meet it.

If the firm sells to the wholesale trade, a little more is charged. The wholesaler passes that "little more" on to the retailer. The general public—WE—get it last. We have no person to pass it on to, and we pay it.

Every time any section of the community, by favorable conditions or extraordinary circumstances, grabs off a little larger portion of cash or goods, WE pay for it.

WE can take it for granted now that when a city throws up its hands after counting noses, and announces a big increase in population, that it has simply gathered them in from the small centres and the farms. The larger the cities, the less people on the land. And we pay handsomely for this way of doing business.



Still the World Goes On!

New *Industry* Largely the Outcome of an Article in This Paper

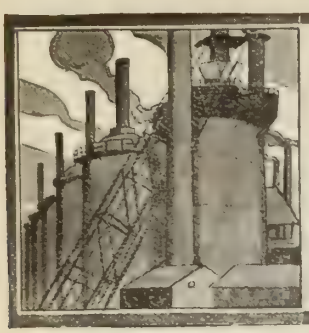
ABOUT a week ago one of our editors visited the plant of the Fisher Motor Co., Orillia, Ont., to prepare an article on their die casting plant and was rather surprised to see on the president's desk, a worn and well-thumbed copy of CANADIAN MACHINERY that was over six months old. He suggested to Mr. Vollans, the president and manager of the concern, that he get rid of the old copy. "Get rid of it," was the reply. "Well I should say not. It was that copy of CANADIAN MACHINERY that started us in the die casting business."

It transpired that one of our staff had written an article on the subject of die casting in that particular issue, which this concern had used as a guide to work from.

Mr. Vollans was also good enough to state that to his mind CANADIAN MACHINERY was a paper to be proud of. He mentioned that he read the magazine every week from cover to cover, always finding something of interest and value to him.

It is encouraging to know that our efforts are being noticed and appreciated by executives such as Mr. Vollans and no doubt others who do not like to thus openly comment on our work.





MARKET DEVELOPMENTS



Steel Turning in Favor of the Consumer Now?

Indications Are That the Peak Has Been Passed and the Runaway Market Has Ceased—New York Reports a Decided Falling Off in the Inquiries for Machine Tools

THE steel market may be turning in favor of the consumer by a trifle, and it may take a little time to notice the change, but it seems to be on the way. The month of February showed a good increase in mill production over the figures of January. The runaway market has done about its worst, and anything that comes now will probably show a tendency to fall from the high-water mark. The New York reports indicate that there has been a falling off in the inquiry for machine tools, and sales are not closed as readily as before. There is some uncertainty regarding future prices and conditions, and this always tends to keep buyers from committing themselves to large investments.

Although the first of May is some distance away, there is talk in this district of labor trouble in the metal trades unions. Many of the strikes that were called last year are still in existence, and it is difficult to see where a second strike can be called. No conferences have been held to try and come to an understanding.

Manufacturers are having a serious time in many cases, being held up for want of material. Sheets, plates, tubes, etc., are very scarce, and a lot of work is being held up for want of boiler tubes. They are so scarce that many of the warehouses cannot even furnish a price on seamless tubes.

Machine tool dealers have a number of good prospects for future business, and the general volume of trade from this field is very good, with no indications of any slackening.

Scrap metal is moving more freely, some of it no doubt being brought about by the higher figures that are offered now. An indication of the scarcity of this class of stuff is furnished by the number of dealers who have been eager to get a chance to bid on the scrap value of an old power plant that was being scrapped north of Toronto.

PRICES TOO HIGH TO PERMIT WAREHOUSES TO PUT MUCH IN STOCK

Special to CANADIAN MACHINERY.

MONTREAL, Que., Mar. 18.—Transportation has again met with a serious setback from the storm of the week-end and temporary inconvenience has been experienced in this district. The St. Lawrence Valley has suffered considerably and Quebec City and vicinity were particularly hard hit by the severity of the ice and snow.

Delivery Shows Improvement

The belief is becoming general that the apex of steel prices has not yet been reached and that the spring demand for building material and reconstruction work on the railroads will tax the capacity of the mills and storehouses throughout the entire summer. As a matter of fact, there is little prospect of warehouse stocks becoming a source of supply for some months to come, as current conditions are not very favorable for accumulation of material. The abnormal prices that govern the trading in steel, while in keeping with present conditions, are nevertheless of such a character as to prevent any heavy buying for future business. The transient movement of material has shown improvement, but rail shipping has been somewhat uncertain during the past week. While firmness marks the current quotations, there is a feeling that prices will be further advanced on some lines.

Good Demand for Tools

The demand for machine tools is still of such a character that it is taxing the best efforts of the dealers to meet the wishes of their customers. While the present requirements are not abnormal, the inability to obtain delivery of tools is a serious handicap to business. The apparent scarcity of standard used equipment is another factor that enters into the present problem of supply and demand. Many dealers have reported a good business in disposing of machinery that has been overhauled and repaired, and in some cases rebuilt. While the prevailing high costs are a deterring buying factor, this circumstance is generally surmounted if early delivery is guaranteed.

There is comparatively little change in the old material situation. The buying of iron and steel scraps continues very active, but there is still great difficulty in meeting the full requirements of the mills and foundries. The insistent demand for machinery scrap has practically depleted every possible source of supply, so that the present market is one of supply rather than one of cost. Little reliance can be placed on quoted prices, as individual sales are invariably made on their own specific conditions. The continued active operations of the mills during the past year has occasioned the absorption of almost all the available heavy melting scrap, and the requirements of the trade at present are apparently taking care of the current supply. The non-ferrous market is quiet, but movement is steady. Prices are unchanged, but nominal, and the general situation is of a stronger tendency.

A New Appointment.—Mr. L. M. Jones, city engineer of Port Arthur, has been appointed engineer on the staff of the Warren Bituminous Paving Co. Mr. Jones will take charge of all the Toronto work of the firm. He has been city engineer of Port Arthur for the past nine years, and was at one time engineer for the Winnipeg Electric Street Railway.

PREMIUM GOODS ARE COMING NOW

Trade Is Good, But Buyers Are Not Anxious to Get Stocked Up Far Ahead

TORONTO.—The arrival of a certain amount of premium material at some of the warehouses is about the only thing that is breaking the monotony of the situation which can best be described as doing business on an empty market.

Dealers who get in premium material are not placing it in stock—not by any means. They are getting it out to the trade just as quickly as their means of distribution will permit, and the trade is not at the state yet where it backs up at the price as long as the actual material is there with it. It is still a case of getting the material and settling the question of the price after.

There is very little improvement in the machine-tool trade, as far as getting shipments through is concerned. Of course, the recognized dealers always have more or less coming through for stock, and in this way are able to often improve on the delivery schedule that might otherwise be adhered to.

A Toronto dealer who has been at several of the American machine tool centres reports an incident that indicates the extent to which new buyers are coming into the market. While he was at the office of a well-known firm of machine tool builders, a representative of the Soviet Government of Russia was also there. His mission was to secure a line of samples from machine tool houses that were to be used for the equipping of machine shops in various centres of Russia. The conditions under which the purchase was to be made were apparently quite satisfactory to the makers. The agent of the Soviet agreed to pay one-third down at the time of the order, and the remainder on shipment. Payments were to be made in gold, so there was no doubt about the financial backing of the Government. It was understood that very large orders were to be placed as soon as it had been decided just what equipment was to be placed in the Russian shops.

Some very nice orders are being placed in the way of equipment, and they are coming from a wide range of territory.

Although there is no tendency on the part of the trade to go slow on taking business, there is a much keener watch kept in many places on the quantity of material that is being passed into stock. Buyers are ordering for two or three months in advance, whereas, in former times, they have bought of certain standard lines enough, when shipped at intervals, to keep them going for a year. One dealer explained the position of his house on this matter: "We would rather lose a little business through not having certain lines than keep on piling in material that we have to secure from a market that is at the peak of high costs." This feeling is having the effect of helping many of them get their house down to a safe margin for anything that turns up. In one way, it is creating a situation that will keep up a demand for some time to come, as stocks by this process will be greatly reduced.

Prospects of labor troubles in this district are not entirely remote, and even at this stage they are spoken of as an influence that may have much to do with the industrial situation and the machine tool market. So far as we can learn, there has been no meeting of the men and their employers to discuss matters, and circulars have been issued at various times calling on the men to get organized in view of trouble that might arise.

An Empty Market

A fairly good indication of the market at present for such material as seamless tubes is furnished by the fact that several of the warehouses in Toronto are not able to correct the price list that is published on another page in this section of the paper. It may be gauged from the other list that goes with it, viz., lap-welded. One firm volunteered the information that a 2-inch tube was worth 32 cents per foot at the present time. There is need for tubes, many of the cases calling for them being bona fide repair jobs that are badly needed.

Canadian mills are doing much better in the matter of supplying the trade here. Bars and shapes are coming in much better than for some time. Shipments of ten gauge sheets are also arriving, but the trade that gets these must recognize that the dealers are paying a good premium for them, and the price is quite well above the regular prices they have been accustomed to pay.

The Scrap Market

Dealers in the scrap metal trade are satisfied to let the prices marked up last week stand for the present. The increasing prices, especially for ferrous metals, is having the tendency of bringing more offerings into the market.

The demand for anything in the line of material grows more keen. For instance, the fact that a power plant north of Toronto was about to be scrapped has brought forth any number of prospective buyers for all the material that was contained in it. There is undoubtedly a shortage of cast scrap and heavy melting steel, while little has come in to help out the stove plate shortage.

Coppers have been weaker during the week. There is no particular explanation for the fact, but it is apt to fluctuate owing to the uncertain conditions in the large copper markets of the world.

New metals stay at last week's prices. Coppers of all kinds are quoted for resale by jobbers around 24 cents. Tin stays at 78 cents. The chances seem to be that it will not go higher, although a short time ago it was freely predicted that it would again touch the dollar mark.

POINTS IN WEEK'S MARKETING NOTES

Production at U. S. steel mills showed an increase of eight to nine per cent. in February over January.

The steel trade seems to consider that the premium mills have gone to their peak, and that hereafter there will be a change for the better from the point of view of the consumer.

The finished rolled steel capacity of United States mills is now placed at over three million tons per month.

The pig iron market seems to be much quieter now, in fact Pittsburgh refers to it as stagnant.

Premium material is arriving in Toronto, and is being sold at premiums with no trouble at all.

Canadian mills are sending out good shipments of bars and shapes.

Scrap metal markets are firm. There is a decided scarcity of cast iron, heavy melting and stove plate.

Buyers are fighting shy of taking on more stock than they can immediately use on account of prices. This tends to keep warehouses bare.

New York reports a falling off in the demand for machine tools. Whether from price or uncertainty is not known, but there are inquiries who are retiring now before placing the orders.

Although the first of May is some distance off, there is talk of a strike in the metal trades industry in Toronto district.

SLUMP NOTICED IN NEW YORK MARKET

Dropping Off in Demand for Machine Tools—Some Foreign Buying Has Been Done

Special to CANADIAN MACHINERY.

NEW YORK, March 18.—As has been noted in recent weeks the volume of inquiry for machine tools has been on the decline. The past week in the New York market was the quietest in some time. Not only have inquiries fallen off, but many prospective buyers show no inclination to close for machines for which they recently inquired. Just how much this condition is due to the uncertainty due to the financial situation and how much to the high prices

and long deliveries is difficult to determine.

The only inquiry of importance now before the trade in this market is from the Otis Elevator Co. for its Yonkers, N.Y., plant and calls for quotations on about 70 machines.

Much of the Government surplus of machine tools will be taken to France by the French commission now in this country making selections. Last week a member of this commission bought a large part of the surplus equipment at the Watervliet Arsenal, Watervliet, N.Y., and other Government plants and warehouses are being visited.

IS THE STEEL SITUATION TO CHANGE IN FAVOR OF CONSUMER?

Special to CANADIAN MACHINERY.

PITTSBURGH, March 18.—While steel is almost, if not quite, as scarce as formerly, there are signs that the situation is changing in favor of the consumer. There are various reports of consumers receiving much heavier deliveries than formerly. One consumer, for instance, received nineteen carloads of steel bars in a week, much beyond the usual amount, and could unload only ten cars. He very cheerfully paid demurrage on the other nine cars. Another point is that on some commodities the top prices paid in the last few days for the earliest deliveries are not altogether up to the top prices of two or three weeks ago. Sheets, for instance, sold up to the basis of 10 cents for common black in the last week of February, but would not bring altogether that price now. Possibly another indication is that some large independents, which only recently covered customers for second quarter, now state that they will probably make prices to customers for third quarter by April 15. If they expected the shortage to increase they would probably hold off as long as possible.

Increased Production

By far the most conclusive evidence, because of its being comprehensive and altogether authoritative, is the report of steel ingot production in February. The American Iron and Steel Institute reports that thirty companies, which in 1918 made 84.03 per cent. of the country's output, produced in February 2,865,124 gross tons of steel ingots. This means that the industry produced in February at the rate of 44,200,000 tons a year, this comparing with a rate of 40,650,000 tons in January, thus showing an increase for one month of between 8 and 9 per cent. The January production was, of course, much greater than the production in the closing months of last year. The monthly ingot report was omitted for the last four months of last year, but it may be estimated that the rate was about 22,500,000 tons on October 1, when the iron and steel strike was at its height, and about 37,500,000 tons on December 31, when the strike was over; but there was still something to be done by way of getting mills in shape for efficient work. For the whole quarter, or, practically speaking, for the period of the strike, production was at the rate of about 29,000,000 tons a year. When January shows a rate of 40,650,000 tons and February a rate of 44,200,000 tons, it is going to make quite a difference in the supply of steel to jobbers and manufacturing consumers. There was almost as much steel made in January and February as in the preceding three months.

March will, undoubtedly, show a large increase in production over February. In the first place, there were transportation difficulties which restricted production in February, and these difficulties have been gradually disappearing, though they are not all out of the way yet. In the second place, bad weather always directly affects tonnage output, and March is always a particularly good month for outputs.

Output and Prices

A large output or a small output does not affect the market, if expected. If unexpected, it does. This large output was not expected. A number of producers last December were predicting that they would be able to operate at only about 75 per cent. during the first quarter of the new year, say, 65 per cent. in January, 75 per cent. in February, and 85 per cent. in March. That would relieve the steel shortage produced by the strike only very slowly. The quarter's output promises to be about 90 per cent. instead of 75 per cent. There is no doubt that many consumers expected a light output for the quarter. It was very largely the consumers who made the rapidly advancing market, by bidding higher and higher prices when they found mills unwilling to sell. If those who made the market acted upon misapprehensions, then the situation created does not rest upon the proper foundation, and will have to align itself to the actual facts.

Railroad Steel

There has been a great deal of loose thinking and talking about the railroads. Clear distinctions should be made between railroad "requirements" or "wants," railroad buying, and deliveries to railroads. The railroads might want a great deal more than they needed, or they might need a great deal more than they could pay for or than their managers would be willing to buy. Thus requiements and buying are different things. Purchases and deliveries are also a different thing. There may be purchases that it would take a long time to complete. The car shops have to build up working organizations again, no easy task by any means, and they will be quite busy for some time to come with repair work. It is possible that the shops could not build more than about 50,000 cars, in addition to export and other orders already booked, up to the end of the year. If so, it would make no difference to the steel supplies, to other consumers of steel, whether the railroads should, at this time, buy 50,000 or 250,000 cars, the car shops would take just the same quantity of steel deliveries this year.

Freight car orders on this movement, a few having been placed already, will probably total between 50,000 and 100,000 cars; but for 50,000 cars only about a million tons of steel would be required, and the industry's capacity, in all finished rolled steel, is over three million gross tons a month. As to rails, nearly all the buying for this year has already been done, and places no great burden on the mills. Locomotives are a smaller item than rails or cars in point of quantity of steel required. As to bridge, buildings, improvement of terminals, block signalling, etc., much work will, no doubt, be done; but there is much engineering work and planning to be done first, also some financing. Steel required along such lines will be needed in 1921 and 1922 rather than this year.

A great many consumers of steel, however, expected the railroads to buy in such manner that there would be heavy drains upon the steel supply this year, beginning, perhaps, as early as March or April. That was a prodigious mistake.

If a large number of steel consumers made two mistakes, by underrating the production of steel in the fore part of this year and by overrating the quantity of steel the railroads would get, then the market they made, or helped to make, proceeding on those theories, requires correction.

In other words, the price runaway in steel is probably over. It has gone as far as it is to go, and it has chiefly affected prices for early deliveries, which are likely to sag. The Steel Corporation's prices, which are on the March 21 or Industrial Board schedule, are not in danger and are, indeed, low by consideration of all circumstances, without taking into account the higher prices secured, on relatively limited tonnages, by independents. The prices lately quoted by large and conservative independents, prices which they probably will not exceed, and may conceivably shade, for third quarter, are not especially immoderate, being about 3 cents for bars, 3.0 cent for shapes, and 3.25 cents for plates, $13 a net ton in the case of bars and shapes, and $12 in the case of plates, above the March 21 schedule.

Pig Iron

The pig iron market has been almost stagnant. If the market is not actually weak, it is not particularly strong, and it certainly shows no advancing tendency. The premiums on prompt foundry

iron have disappeared entirely. The pig iron market is much older than the steel market, and, presumably, it has exhibited all the varieties of which it is capable. One thing has never occurred, and that is for there to be a high market and at the same time for there to be no premium for prompt delivery; yet that is the condition to-day. The market is quotable at $42 for Bessemer and foundry, $43.25 for malleable and $41.50 for basic, at valley furnaces, with $1.40 freight to Pittsburgh.

PIG IRON TRADE

Basic iron is on a firmer footing, the recent irregularities in price having been smoothed out. Foundry iron is holding its price well. Following are reports from U.S. points:

There have been a number of transactions in low phosphorous iron for second quarter at $47 furnace. Further tonnage of Bessemer for export was sold at $45 Eastern Pennsylvania furnace. Foundry iron of 1.75 to 2.25 silicon is at $44 to $45 for first and second half, Eastern Pennsylvania furnace.

CHICAGO.—The market has been quiet here, but there is a certain amount of business being done quietly. Basic iron, spot, is quoted at $45 Chicago furnace. Enquiries for 2,000 tons foundry and 1,000 tons malleable are out.

CLEVELAND.—Foundry iron is firm on a basis of $42 valley furnace. Several thousand tons have been sold during the week at this figure, and some hundreds of tons of malleable at $44.50 furnace. Basic is settled at $43 valley furnace.

PITTSBURGH.—Basic is established at $43 valley furnace, although some sales were made at $41.50. These lots, however, had been contracted for several weeks ago at the lower price. Foundry iron is $42 minimum.

BOSTON.—New England is still suffering from transportation difficulties. A fresh storm came along just as freight was beginning to move and put deliveries back still further, with the result that several furnaces were compelled to close down; $60 furnace is by no means an unusual quotation for pig iron. Iron for delivery in last half is at $45 base grade Buffalo furnace.

NEW YORK.—The demand for pig iron has been small, and prices are about the same; that is, $43 to $44 Eastern Pennsylvania furnace for 1.75 to 2.25 silicon, and $44.25 to $45 for 2.25 to 2.75 silicon. Basic and Bessemer have been sold in small lots for $42 to $42.50 Eastern Pennsylvania furnace.

BUFFALO.—Sales of foundry iron amounted to about 4,000 tons, the prices being $45 for 1.75 to 2.25 silicon, with $46.25 and $48 for the next grades; 7,000 tons basic was sold to a Canadian customer at $43.

ST. LOUIS.—Owing to deliveries on contracts being so far behind, owing to car shortage, there is a good demand for spot iron. Foundry iron, 1.75 to 2.25 silicon, for spot, is quoted at $42 to $43, and $40 for last half delivery.

BIRMINGHAM.—There is a fairly good market, though not so much activity is being shown as has been the case recently. The 1.75 to 2.25 silicon grade is quoted from $38 to $43. A round tonnage was sold for $40, last half delivery.

BUFFALO.—1,000 tons heavy melting steel at $26.50 was the only transaction in this grade during the week. There has been some enquiry for low phosphorous scrap, and 3,000 tons of this grade were sold at $32.50.

CLEVELAND.—Dealers are inclined to hold out for higher prices, heavy melting steel being quoted at $27 to $27.50. There are pretty good-sized stocks in dealers' yards, but it is mostly all sold. The market may be said to be in a strong position

CINCINNATI.—There has been good demand for foundry scrap, and rolling mill scrap has been bought freely. Stocks, both of dealers and those in furnace yards, have been considerably reduced. The market is strong and active.

ST. LOUIS.—Trading has been confined mostly to dealers, and while some slight revisions of prices downwards have occurred, they have been in the nature of adjustments. Relaying rails are at $52 to $55. Cast iron borings and malleable grades are strong.

U.S. SCRAP METAL

While the market is quiet, the decline in prices has been checked. There is weakness in some districts. Following are reports from various U.S. centres:

CHICAGO.—There is a better feeling in the market, and the decline in prices noticeable last week has been checked. On some classes of scraps slight advances have been registered. The car shortage is still in evidence.

PHILADELPHIA.—There has been some activity in steel scrap, the price obtained being $26 delivered. Borings, which are rather scarce, have sold at $25 delivered. A large steel works bought 12,000 tons low phosphorous scrap.

BOSTON.—Some softening of prices is in evidence here, due to lack of demand, caused in turn by shortage of coke. Machine shop turnings are quoted at $16.50 delivered dealers' yards, and borings have declined $1. No. 1 machinery has sold at $46 delivered. Cast scrap is in good demand.

NEW YORK.—The market is weak, though prices remain unchanged. Shipments to New England points are still held up by embargo, but outgoing shipments are moving. Borings and turnings are the only active grades.

PITTSBURGH.—There is little trading, and the transportation situation is still very bad. Heavy melting steel has changed hands between dealers at $27.50, but it is doubtful if consumers could get a lower quotation than $29 delivered.



Donahey in the Cleveland "Plain Dealer."
"Eliza."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	76 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
		Per 100 feet		
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	15
Carriage bolts, 7-16 and up	Net
Coach and lag screws	30
Stove bolts	50
Wrought washers	50
Elevator bolts	5
Machine bolts, 7-16 and over	10
Machine bolts, ⅜" and less	20
Blank bolts	25
Bolt ends	10
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $1.50
Nuts, square, tapped	add 1 75
Nuts, hex., blank	add 1 75
Nuts, hex., tapped	add 2 00
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	40
Sq. and Hex. Head Cap Screws	35
Rd. and Fil. Head Cap Screws	5
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	35
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	25
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	10
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 32
British Manila rope	0 26
New Zealand hemp	0 26
Transmission rope, Manila	0 43
Cotton rope, ¼-in. and up	0 80

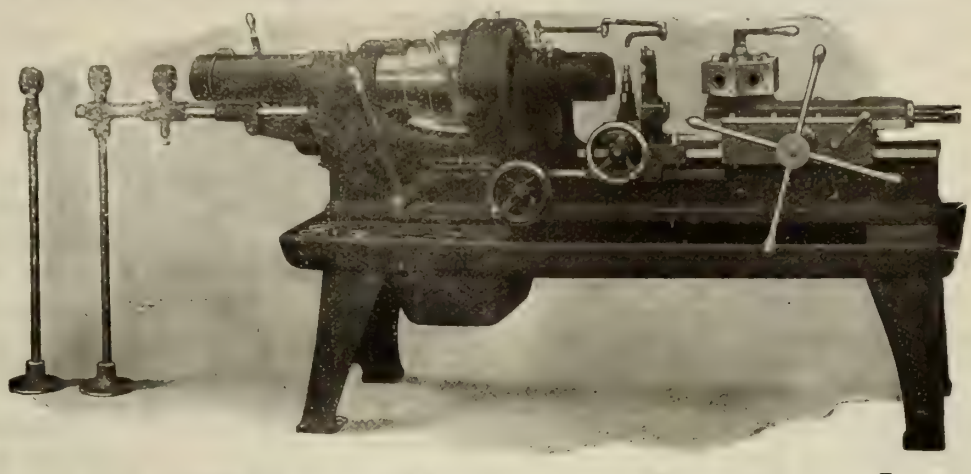
POLISHED DRILL ROD

Discount off list. Montreal and Toronto	net

Warner & Swasey Screw Machine

For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

We can supply you from stock immediately.



The A. R. Williams Machinery Company, Limited

ST. JOHN, N.B.
WINNIPEG, VANCOUVER

"If It's Machinery, Write Williams"

64 Front Street West
TORONTO

Acid Electric STEEL CASTINGS

Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited

Steel Foundry Division, Lachine Canal
Head Office: 187 Delisle St. MONTREAL
Phone Victoria 1462



Keep 'Em Smiling

Your mechanics work better with good tools. It keeps 'em smiling.

A P.H. file can be properly termed "A File With a Smile," because it gives the worker satisfaction, the satisfaction that comes with the use of a fine tool. Imperial files are identical with P.H. as to quality and service.

Both brands are standard in most Canadian and some American shops.

"They Cut Faster and Wear Longer"

BE FILE-WISE

P H

IMPERIAL

Ingersoll File Company Limited
John Morrow Screw & Nut Co., Limited
Sole Distributors
Ingersoll, Ontario

INGERSOLL

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED SHAFTING

At warehouse ..... 6.25 base

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, no. 28	$ 8 50	$ 8 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	9 50
Premier, 10¾ oz.	11 00	9 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.E. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Above prices advanced 5%.

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	40
Black oil, per gal.	15
Cylinder oil, Capital	58
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	.24	Atlas	.20
Peerless	.22½	X Empire	.19½
Grand	.22½	Ideal	.19
Superior	.22½	X Press	.17½
X L C R	.21		

Colored

Lion	.17	Popular	.13
Standard	.15	Keen	.11
No. 1	.15		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.20	Dark colored	.09
Mixed colored	.10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.

Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

GEOMETRIC

Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps.

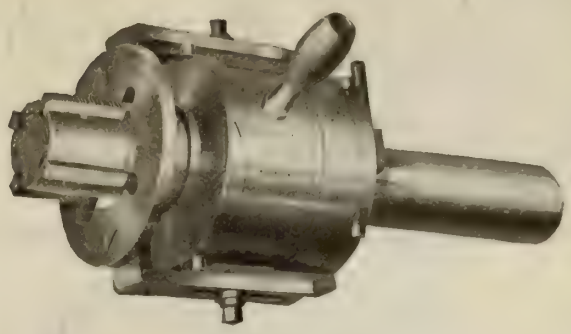
The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

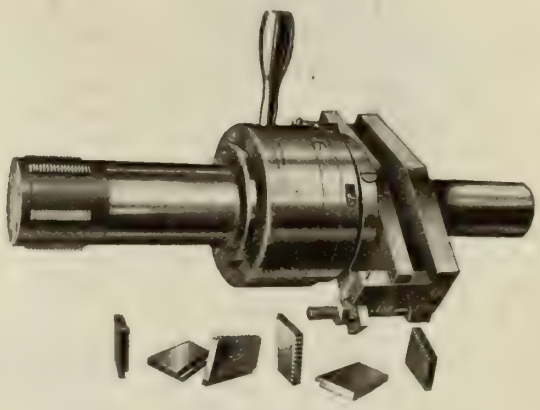
The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

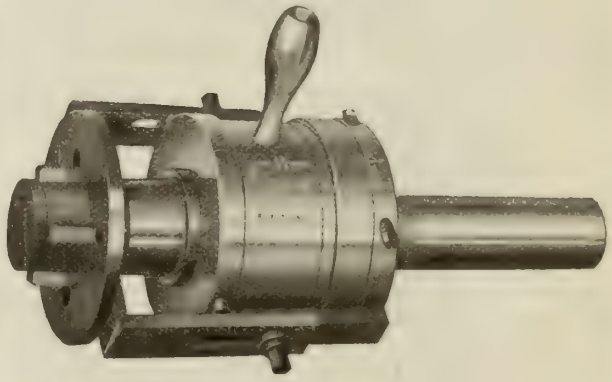
The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

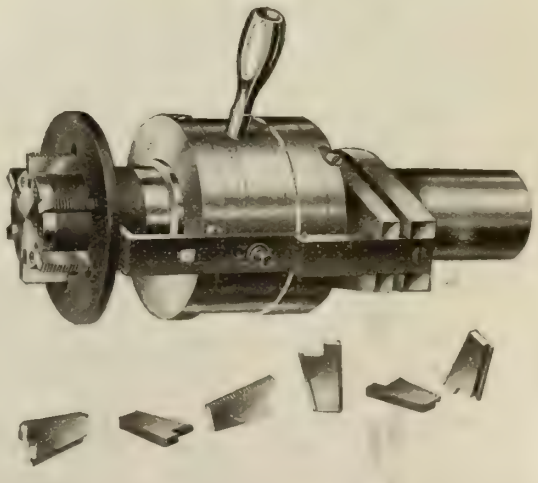
The Originators
and the
Largest and Best Known Manufacturers
of
Automatic Threading Tools

For cutting all classes of screw threads, internal and external, of any diameter and form.









The Geometric Tool Company
New Haven, Conn., U.S.A.

CANADIAN AGENTS:

Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



MOTOR TRUCKS BEING SUED BY U. S. FOR POSSESSION OF BUILDING

SIDNEY S. UNDERWOOD, representing the United States of America, has fyled at Osgoode Hall the particulars of his claim for $376,496 and $100,000 damages against Motor Trucks, Limited, of Brantford, Ontario.

On May 13, 1919, Frederick Andrews, the secretary and accountant of Motor Trucks, Limited, fyled with the Imperial Munitions Board a statement of its claims for compensation, totalling $1,950,804 and including: Lands, $34,062; machinery, $805,654; administrative and supervisory expenses, $405,793. The total compensation that they asked was afterwards increased to $2,005,729. Roy Secord, J. B. Detwiler and F. Andrews were given as the managing director, president and secretary respectively, of the company.

The claim of the company was discussed and on October 7, 1919, it was awarded $1,633,203. The largest "cut" was in administrative expenses, which were reduced from $405,793 to $148,991. from this award was to be deducted $967,000 advanced by the War Credits Board, $62,505 thereon and $15,796 exchange at 2 3-4 per cent. The total sum then found to be owing by the United States to the Motor Trucks, Limited, was $637,812.

On November 6, an agreement was signed between the two parties agreeing on this sum, and on November 10, the United States paid the $637,812 and $5,000 more than that by an oversight was omitted.

The United States now say that by a mutual mistake, specific mention was omitted from the agreement signed on November 6, of the lands valued at $34,062 and buildings at $342,430, making up the company's plant at Brantford. But it is said that these monies were included in the settlement price of $637,812.

They also say that Motor Trucks, Ltd., have refused to hand over the plant to the United States.

It is further claimed that Motor Trucks, Ltd., offered, through John Craig, adjuster of claims of the Imperial Munitions Board on October 29, 1919, to purchase the lands and factory at Brantford at a salvage price of $118,142 for the buildings and $21,037 for the land. On November 11, 1919, it is said that the company offered to heat and guard the plant for $750 a month and arrange about the $1,000,000 insurance, an offer which the United States declined.

The United States now claim the plant and lands valued at $376,496 and $100,000 damages. All these allegations are made by the United States. The defense of Motor Trucks, Ltd., has not been announced.

One of the officials of the company, speaking to CANADIAN MACHINERY about the matter, stated that it was a matter of interpretation of the contract, which was a complicated affair, involving the ownership of the plant. If Motor Trucks retain the plant it is understood that they will use it to house plant of the business of the Bluebird Lines.

Trade Gossip

Damage at Port Hope.—Part of the dam at Siers and Tye's mill and all of the dam at Barrett's mill was carried away when the ice went out of the Ganeraska River recently. The schooner Oliver Mowat had a narrow escape of being destroyed, but the energetic work of a number of boys saved her.

Port Huron.—The tug "Sport" has broken the ice in the Black River, giving full outlet to the water. The steamer H. K. Oakes is now unloading at the Grand Trunk elevator. The steamer "Stadacona" has commenced her outfitting.

Welsh Strike Settled.—A strike that has been seriously interfering with the Welsh steel industry has been settled. The strike was originally started to enforce a demand for a 40 per cent. increase in pay. The men have gone back to work, under an agreement arranged in London, particulars of which are not available. About 70,000 men were affected.

Big Car Order.—The Canadian Pacific Railway are spending $15,000,000 on new equipment, including 2,500 sixty-ton box cars, 500 refrigerators, 500 automobile cars, and 67 ore cars. The Canada Car Company will get a large share of this order, the C.P.R. taking the rest itself.

Coal Prospect Better.—Industries in Hamilton have been put to a great deal of inconvenience during the past two months, due to shortage of coal. The coming of the mild weather is expected to alleviate this considerably, and another week should see the worst of the shortage over.

New Line to Sarnia.—The Chamber of Commerce of Sarnia is anticipating a visit from President Beatty and officials of the C.P.R., who will look over the ground, with a view to putting in a line from London to Sarnia. The City Council state that if the line is put in, at least twenty industries will locate along the bank of the St. Clair River.

Compensation Act Revised.—The Legislature of Manitoba is considering a bill, introduced by Attorney-General Johnson, to alter the bill of 1916 dealing with workmen's compensation. The measure will increase the amount and incorporate the system of state insurance.

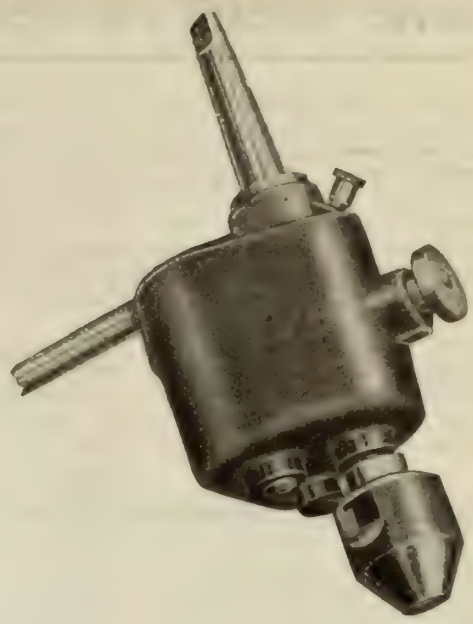
Held Banquet.—The first annual banquet of the men of the electrical department, Steel Company of Canada, at Hamilton, was held with 75 of the day men present. At 8.30 p.m. the men were invited to the banquet table to partake of the good things provided. After every person had satisfied the inner man, the boys were treated to an unique programme supplied by themselves. E. S. Jefferies, electrical engineer, and Mr. Simpson, sales manager, both delivered addresses, which were very much enjoyed by all those present.

Victoria Dock Case Judgment.—The case of Grant Smith & Co. and McDonnel, Ltd., against H.M. the King, in connection with excavation work done on the dock at Victoria, B.C., by the plaintiff, has been settled by Sir Walter Cassells, in the Exchequer Court of Canada. The claims were for $333,812. The amount of excavation work was admitted, but the Department of Public Works claimed that rock prices had been charged for material which should have come under a lower classification. The court found that the resident engineer was in collusion with the contractors, and work certified by him should be set aside. The entire claim was thrown out.

Aikenhead's

Wahlstrom Tapping Attachment

A cure for tap breakage



If the lands are freed from chips the tap won't jam in the hole. Consequently there will be no tap breakage. With the Wahlstrom tapping attachment the chips are freed by the oscillating motion which is a close reproduction of the simple to-and-fro motion of hand tapping. This reduces the tap breakage to a minimum.

The oscillating motion is changeable to a continuous revolution for tapping in soft materials. The spindle reverses when the tap is raised.

The Whalstrom has nothing to get out of order and it fits any drill press. Made in two sizes: No. 1 takes taps of all sizes from 5-40 to ½-inch standard. No. 2 takes taps from ¼-inch to ¾-inch. Sent on 10 days' trial.

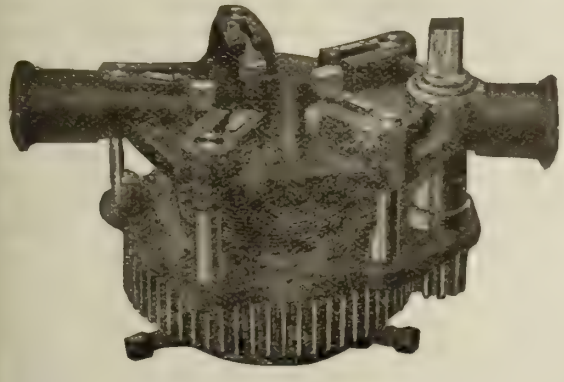
Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

Catalogues sent on request

Aikenhead's

BEAVER, TOLEDO, JARDINE, OSTER PIPE THREADING TOOLS



These tools possess unusual features that result in perfect operation and the greatest economy. The taper thread is not formed by taper dies, but by a receding motion of the cutters from the pipe centres as the die advances. This is a tremendous advantage, since it eliminates friction, and with half the exertion required with a tapered die makes a thread of perfect taper equal to lathe work.

Pipes already in place and in the most awkward positions may be readily threaded by the use of the ratchet motion of these tools.

There are many more valuable and exclusive features. Let us tell you about them.

Complete Lines Carried in Stock

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

If interested tear out this page and place with letters to be answered.

The Week's Events in Montreal Industry

Geo. E. Leighton, vice-president of the Samuel Osborne Co., of Canada, will leave shortly for a two months' business trip to England.

W. Armstrong, of the Armstrong Machinery and Plant Company, of Montreal, has left on a six weeks' business trip to England and the Continent.

The plant and equipment of the Maissonneuve Foundry, at 860 LaSalle St., Montreal, has been sold to Burnett and Crampton, who will continue to operate the plant for general grey iron foundry work.

The Canadian Paper Barrel Co. has secured a property at 227 Wellington St., Montreal, where they will manufacture a line of paper barrels and pails for every purpose. Machinery is now being installed and operations will commence immediately.

E. M. Wright, manager of the marine department of the Northern Electric Company, returned recently from England and the Continent, where he has spent the past six or eight weeks in the study of shipbuilding methods and the electric equipment as adapted to ship service.

At the March meeting of the Canadian Railway Club in Montreal, a paper was read by Mr. F. Williams, mechanical designer of the Canadian National Railways, on "Valve Motion: A Few General Observations." The paper was one of the most interesting and instructive of the season and brought forth much discussion by the members present.

D. W. Fraser, who for the past few years has been managing director of the Montreal Locomotive Works, has recently been appointed vice-president of the American Locomotive Company, with head offices in New York. Mr. Fraser is a native of Nova Scotia and has devoted the greater part of his career to locomotive and mechanical activities, so that he is exceptionally well fitted for his new duties.

L. C. Ord, who, since his return from France about a year ago, has been assistant works manager of the C. P. R. Angus shops, is leaving to take an important position in England. At the recent meeting of the Canadian Railway Club Mr. Ord was presented with the past president's jewel. He was president during the season of 1915-16, but owing to his departure overseas the presentation had to be deferred.

The old Sherbrooke Iron Works, formerly known as the Campbell-Howard Machine Co., Ltd., has been acquired by Geo. L. Dourne and F. A. Schaff, of New York, who will continue to operate the plant under the name of the Sherbrooke Iron Works. New machinery will be installed for the manufacture of locomotives, marine and stationary superheating apparatus, together with other steam specialties. In addition to the new development the plant will continue to carry on a general foundry and machine business.

Following the reorganization of the Davie Shipbuilding Company at Quebec, considerable increased activities are taking place at the plant. Work on the 5,100-ton Canadian Government steamer is progressing rapidly, and as soon as sufficient steel can be obtained to insure uninterrupted operations, the keel for a new 8,300-ton steamer will be laid. The repair work in hand is also of considerable volume, and about 1,200 men are steadily employed at this yard. The Louise Docks are taking on a more active appearance and immediate steps are to be taken to complete the wooden steamers recently built for the French Government.

A practical demonstration of wireless telephony was recently made before a meeting of the Montreal Rotary Club, when A. H. Morse, of the Marconi Company of Canada, gave a short address on this subject and provided the opportunity for the members present to listen to the sounds transmitted from a sending instrument located over a quarter of a mile away and in one of the noisy parts of the city. Mr. Morse pointed out that the wireless telephone has obviously very wide application, but that there was no present indication of its being developed to supplant the ordinary city phone. There was little need for it for such use, but for long distance work, as from city to city and over greater distances than were practicable for wires, it would eventually be of great benefit.

BIG PICKING UP NOTICED IN SCOTIA TRADE AT END OF 1919

Uncertainties of the readjustment period are strongly reflected in the annual report of the Nova Scotia Steel & Coal Company, made public. For a large part of the year the steel industry was in a state of dullness, but a general improvement has recently taken place. Combined profits from operations for the year were $2,193,304, as compared with $3,535,525. The volume of business done was smaller than for several years. The attitude of the directors toward the difficult position is expressed in the following words by President D. H. McDougall:

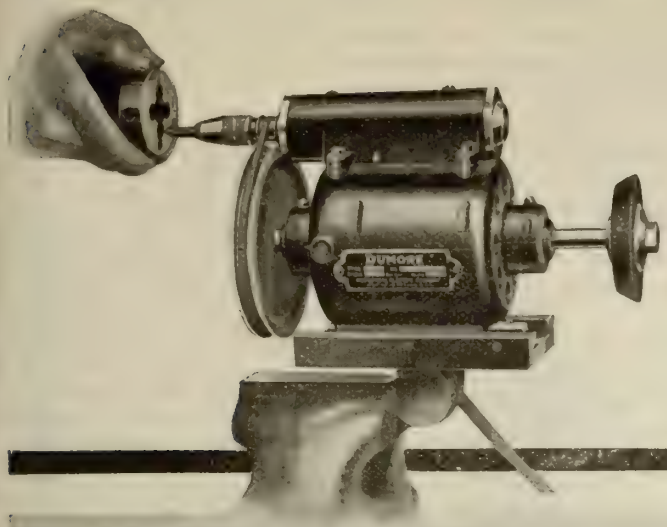
"During the depression it was found necessary to accept a considerable amount of business even below cost in order to furnish employment and hold the organization together, so that the company's profits for the year were affected, not only by the decreased output, but also by the lower prices obtained for its products. The demand for steel, which was very limited for the first ten months of the year improved just at the close, and this improvement has continued until at the present the tonnage of unfilled orders on the company's books is larger than it has been at any time since the signing of the armistice, and the prices at which orders are being booked should show substantial profit."

Coal Trade Recovering

President McDougall, reporting on the various departments of the company's activities, says that the demand for coal, which had been decreased from the armistice until last autumn, was so strong as to permit operation to full capacity for the remainder of the year. Further improvements were made in the deep workings of the Princess Colliery. Legislation at the last session of the Nova Scotia Legislature empowered the Government to make such arrangements of the undersea leases as was considered advisable and already permission has been granted to mine a block of coal on the north side of the Florence Slope. Development work was continued and submarine workings extended as well as the capacity of the iron mines increased at Wabana with a view to "resuming the sale of ore on a large scale as soon as shipping conditions will permit." Mining operations were carried on throughout the whole year and 213,410 tons of ore raised, as compared with 76,767 in 1918. Iron ore to the extent of 51,460 tons was shipped to North Sydney, the quantity being small because of the cessation of steel production at Sydney Mines during about six months of the year. Much progress was made in adapting mechanical loaders to underground operations in the ore mines, and it is now believed that it will be possible to extend the use of mechanical devices in substitution for manual labor. "It is hoped in this way," says Mr. McDougall, "to overcome the inadequate supply of this class of labor, which is generally being experienced in all mining operations."

Variety of Activities

On iron and steel manufacture the blast furnace and open-hearth plants were operated only about five months of the year, and while the rolling mills were totally shut down but for a short time the average monthly production of steel was very much curtailed. Total shipments of finished steel, forgings, etc., from New Glasgow were 44,051 tons, as



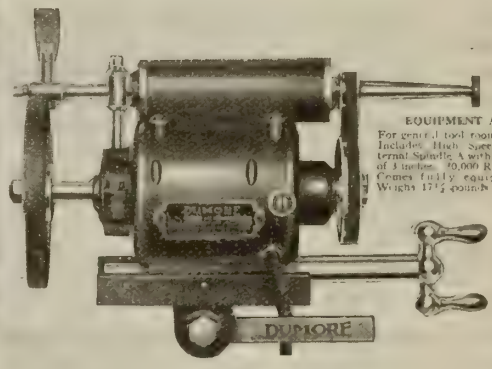
Regrinds Button-Dies in 3 Minutes

A GOOD example of one form of saving made possible through the use of the **DUMORE** grinder is found in the above illustration. Here is the attachment known as Equipment C that regrinds button-dies at the rate of twenty an hour. The special spring chuck holds an emery pencil that travels at the rate of 50,000 R. P. M. which has been found to be the correct cutting speed for work of this nature. Reclaiming these old and seemingly worthless dies, which formerly had to be discarded, means an enormous saving in the course of a few months.

The **DUMORE** grinder is portable and so constructed that the attachments are interchangeable. In other words, Equipment C may be detached and Equipments A or B put on. This gives the tool a very wide range of operation and makes it indispensable to the shop interested in securing the very best results. The **DUMORE** grinder is in perfect running balance and gives even small emery wheels the correct cutting speed. Chatter, taper or bell-mouthed grinding is thereby eliminated.

If your dealer does not carry the **DUMORE** in stock, write us for specifications and prices.

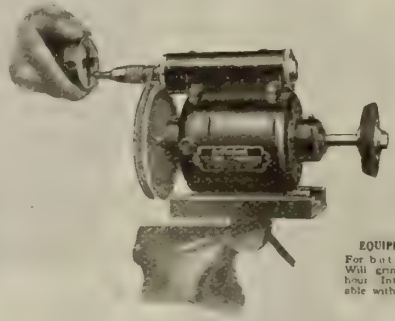
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For general tool room use. Includes High Speed Internal Spindle A with reach of 3 inches. 50,000 R P M. Comes fully equipped. Weight 17½ pounds



EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 50,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button dies Will grind 20 an hour Interchangeable with A and B

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

compared with 93,343 in 1918 and 101,609 in 1917. In shipbuilding the "Canadian Sealer," 2,800 tons, for the Canadian Department of Marine, was completed and delivered, while a sister ship is expected to be ready to launch about the latter part of March. The keel of a third vessel of the same type was laid in January, and contracts for a fourth steamer of the same type has been secured. The Eastern Car Company constructed and delivered 1,800 cars during the year. These orders were completed early in July, and the plant was idle for the remainder of the year, with the exception of the manufacture of some snow ploughs for the Canadian National Railways. Orders have just been received for a substantial number of box and general service cars, which will keep that plant employed for some months. The company has acquired the first preferred stock of the Acadia Coal Company, whose coal holdings are reported to be extensive and valuable. During the year capital expenditures amounting to $839,331 were made.

The Koreans, according to the "Manchester Guardian," were the original inventors of the ironclad warship. It was in 1592, that a Japanese army landed on the shores of Southern Korea and swept northward through the peninsula. The invaders, who carried firearms, which had never been seen before in Korea, penetrated as far as Pyeng-yang, and there awaited further reinforcements before advancing to the conquest of China. The head of the Korean navy, Admiral Yi Sun-sin, determined to destroy the reinforcements before they could land, and for that purpose devised a "kwi-sun," or "tortoise-boat," so called because of its resemblance to that animal. It was covered with a curved deck of iron plates and provided with a ram. In this Admiral Yi attacked the Japanese fleet of 600 boats, ramming them right and left. As he passed on he left the struggling Japanese in the water, to be dispatched by his followers in the ordinary boats of the Korean fleet. A few Japanese boats escaped, but the backbone of the invasion was broken, and for the first time in history the virtues of a protected cruiser were demonstrated.

According to the "Rio Times," the total hydraulic power available in Brazil amounts to nearly 6,728,000 horse-power, or about 5,000,000 kilowatts. Among the principal sources of this potential power are the following falls: Guahyra Fall, 1,058,400 kilowatts; Paulo Affonso Fall, 1,031,940 kilowatts; Umbupunga Fall, 328,545 kilowatts; Santa Maria Fall, 191,100 kilowatts; Itapuca Fall, 41,215 kilowatts; Avanhandava Fall, 45,276 kilowatts; Lavrinhas Fall, 38,005 kilowatts; Salto Grande Fall, 17,785 kilowatts.

An exceptionally large derrick is being employed at the Philadelphia Navy Yard in the erection of a new 350-ton fitting-out crane. The highest part of the crane is 230 ft. above quay level, and yet the derrick, standing on the quay, can lift pieces on to any part of the crane and handle 40-ton loads. The jib of the derrick is 252 ft. long between centres, with an auxiliary 10-ton hoist 13 ft. further out. The mast of the derrick is 102 ft. high. A combination of steam and electric winches is employed and the whole derrick can easily be dismantled and reduced to such dimensions as to facilitate transport to a new site.

Among the prizes proposed by the Paris Academy of Sciences for 1921 are: The Montyon prize—700f.—for the invention or improvement of instruments useful to the progress of the mechanical arts; the Henri de Parville prize—1,500f.—for original work in mechanics; the Pierson-Perrin prize—5,000f.—for a discovery in mechanics; the Plumey prize—4,000f.—for improvement in steam engines or any other invention contributing to the progress of steam navigation; the Gaston Plante prize—3,000f.—for the author of a discovery, invention, or work important in the domain of electricity; the Hebert prize—1,000f.—for a treatise or discovery useful for the popularization or practical use of electricity.

A new German optical glass, described in the "Chemical Trade Journal," is designed for colorless spectacles—instead of the usual colored ones—to give protection against ultra-violet rays. The merit of the glass is due to the discovery that a suitable mixture of rare earths in glass flux absorbs the harmful rays. Such earths as neodymium, erbium, serium, lanthanum and thorium may be used in varying combinations, and the protective glass shows objects in natural colors.



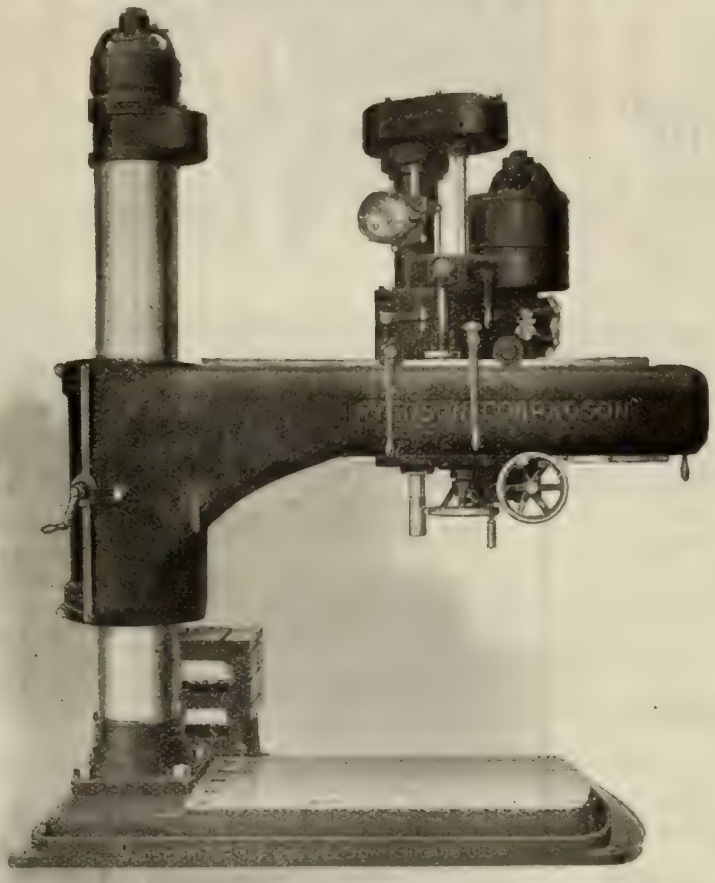
Still, there are Signs of Spring.
Brooklyn "Eagle."



The House Next Door.
Whitelaw in London "Passing Show."

Announcing the New

Ryerson-Conradson Twin Motor Driven High Power Plain Radial Drilling Machine



Special Features in the Design, Construction and Operation

Twin Motor Drive. One motor on head driving spindle and the elevating motor on column.

Drilling, tapping, boring and reaming operations can be performed.

Concentration of all shafts in head. Only four shafts and sixteen gears furnish sixteen spindle speeds.

Elimination of all bevel gears and friction clutches for tapping.

Arm of box section design. No overhanging of head as on other types of radials.

Splash Oiling System.

Exceptional Feed Range. Sixteen feeds from .005″ to .370″.

Only radial drill which can be operated on a true radial line with column.

The long bearing surface and double acting clamping device of the arm on the column reduces all springing and sagging to a minimum.

Power consumption practically 40 per cent less than that of other radial drills.

The new Bulletin 4001-D gives complete information.

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Remarkable in its glass Hardness, Toughness and Cutting Efficiency.

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Don't be contented with half-way goodness or make shift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO (MADE IN CANADA) **SANITARY DRINKING FOUNTAIN**



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments and we'll tell you how much the cost will be.

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Work Progressing.—Developments at the plant of the Dominion Iron and Steel Company at Sydney are steadily progressing from day to day. Up to the present but two of the six blast furnaces have been in operation. A third furnace is now being heated preparatory to relighting and operation. This of course is a section of the works which necessarily always was on double shift, and the prospect of the blowing in of all the remaining furnaces in the immediate future means steady employment for a substantial number of both skilled and unskilled workmen. It is the general hope, and expectation, that the entire plant will, within a comparatively few weeks, be operating to its full capacity, and that when this condition is reached the employees of Dominion Steel will number between 5,000 and 6,000.

Orders From Japan.—A large order for rods and bars has been secured from the Japanese Government by the Dominion Steel Corporation which will keep the rod and bar mill in operation for several years. Such was the information handed out at the mills. The mill has been out of commission for seven or eight months but workmen are now busy making necessary repairs and adjustments to the mill, and it is expected that rolling of the new order will be started early next week. A considerable number of men will be given employment by the operation of the mill.

Big Locomotive Order.—The Canadian National Railways have placed some big orders for locomotives lately. These include 25 Sante Fe engines, weighing 320,000 pounds; 32 Pacific type weighing 261,000 pounds, and 10 Pacific type weighing 271,000 pounds.

The Department of Public Works is calling for tenders, up to March 12, for the construction of a breakwater protection for Toronto Island. Plans and specifications can be obtained at the office of the Department, Ottawa; the office of the District Engineers, Equity Building, Toronto; and the Shaughnessy Building, Montreal.

Freight Payments to U.S.—There will be a hearing on March 16th, at Ottawa, before the Railway Board, re the payment of freights on goods originating in Canada and intended for U.S. points. The railways have ordered their agents not to accept prepayment on this class of goods, claiming that, owing to the exchange rate, they lose money on the American portion of the run.

Shipbuilding Company Reorganized.—The Davie Shipbuilding Company of Lauzon, Que., has just undergone a reorganization and will now proceed on the completion of the contracts in hand. These include the balance of the wooden steamers for the French Government. The new president is Mr. J. W. Norcross, of the Canada Steamship Lines, Major General Sir David Watson, vice-president, and Mr. George Davie as general manager.

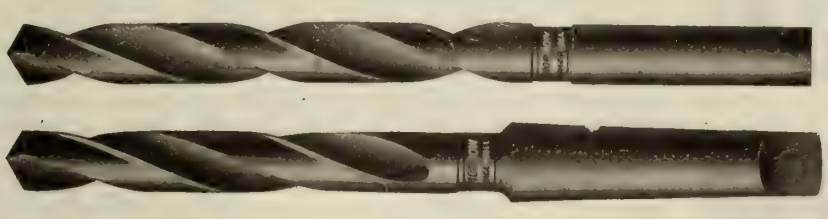
Nova Scotia Industries. — The total production of the Province of Nova Scotia including industries, commerce, agriculture and fisheries had a value for the year 1919 of $198,000,000, which is nearly $300 per capita. The production of lumber showed an increase of 100 per cent. over last year, and was valued at $10,000,000. The total crop of apples amounted to 1,000,000, of which 300,000 were exported to Great Britain and the United States.

Not Selling Out.—The Dominion Foundries & Steel Co., of Hamilton, held its annual meeting. The directors and officers were all re-elected. C. W. Sherman is president and A. G. Wright secretary. Mr. Wright stated that the business was purely routine and no mention was made of any dividends. Mr. Wright denied that the company was contemplating turning over the plant to the American Foundries, Ltd. Earnings of $634,000 were reported.

Canadian Firm Opens in States.—The Pressed Metal Company have nearly completed their factory at Marysville, just south of Port Huron, Mich. The equipment will be moved in April and production start about May. The company will manufacture bushings for the Ford Motor Co., and their output will be 100,000 bushings a day. The Wills Lee Company have bought land on both the Canadian and American side of the St. Clair River, and industrial expansion on the Canadian side is expected to follow closely that on the American.

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Mean Greater Production for You!



If your purchasing agent buys inferior drills just because they are lower in price he forfeits the respect of your Master Mechanics and loses profit for you.

"Morrow" Drills and Reamers should be insisted on because—even if they are higher in price—the Morrow Tools are better value because they do *"more holes with less re-grinding."*

Every tool is fully warranted. "Morrow" motto is—"The customer must be satisfied or we don't want his money."

If Morrow Drills and Reamers do what this advertisement says, you want them as standard in your plant; don't you? Then the least you can do is to send an order to-day and try Morrow Forged Drills.

More holes made more quickly

JOHN MORROW SCREW & NUT CO.
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This is the simplest, lightest, best selling device of its kind. A twelve months' test of selling direct has netted 25% of sales from all inquiries.
500 LITTLE TWISTERS in daily use giving testified satisfaction. Entire patent rights are for sale. Thorough investigation invited from responsible manufacturers.
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DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
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PERSONALS

Directors of The Whitman & Barnes Manufacturing Company, following the annual meeting at the general office in Akron, Ohio, March 3rd, elected Mr. W. J. Elliott, manager of the St. Catharines, Ont., factory, a vice-president. Mr. Elliott will be in entire charge of the Canadian division of the company's business—selling and manufacturing. Twenty-seven years ago he entered the employment of Whitman & Barnes, in a minor position. Advancement from one position of importance and responsibility followed rapidly, when in January, 1908, he was made manager. His promotion to the official circle of the company is merited recognition of his excellent services and the confidence in which he is held by the corporation.

The death occurred at his home, 20 Thorold street, of Mr. Orange Jull, the inventor of the only two mechanical snow plows now in actual use on railroads. Mr. Jull was a native of Trafalgar, Ont., where he was born 75 years ago. His first plow, the "Rotary," was made by the Polson Iron Works; the later invention, known as the "Jull Centrifugal," being built by the Rogers Locomotive Works, New Jersey. Mr. Jull leaves a widow and three daughters.

MARINE

Sault Ste. Marie.—Navigation at the Soo will open about the usual date, that is April 24th. Ice conditions are about the normal, as compared with the same date for the last twelve years. There are about 24 inches of ice at White Fish Bay, and the same at the Soo, while there are no figures available for Mud Lake.

Collingwood.—Through the efforts of Capt. W. Inkster, Government examiner of masters and mates on the Great Lakes, a number of steamship operators had a meeting with representatives of the Canadian Merchant Service Guild, and expressed a desire to co-operate with the Guild. With reference to the pay of steamship officers, the Guild promised to submit a schedule at the conference to be held next January. It was decided that two conferences should be held annually between the Guild and the operators.

Paris Engineering Works.—The Geo. W. McFarlane Engineering Works, at Paris Station, is expected to be shortly in operation, and will soon be employing upwards of 100 skilled mechanics. The Town Council have taken up the request of Mr. McFarlane, and will undertake to erect suitable housing accommodation for the workmen. The financing will be done under the Enabling Act of the Province, whereby the local Government guarantes the amount.

Navigation Some Time Off.—Although last year the first steamer crossed the lake on March 6th, this year at the present date the harbor is ice-bound, and it will be about three weeks before navigation opens. The Canada Steamship Lines are actively getting their vessels ready for the opening, and have an army of painters at work on them. This year the hulls will all be painted white instead of the dark color of former years. The new vessel projected for the line will be put on the lake as soon as she can be procured, but the company are not saying much about this at present.

Ottawa.—According to a statement by Mr. Hanna, head of the National Railways, ships built in Canada are only the same price as those built in Great Britain, and cheaper than those built in the United States. The latest Government contracts were placed in Canada at $163 per ton. If the exchange handicap could be adjusted, Canadian shipyards should be able to secure foreign orders.

BROCKVILLE.—The American barge "Arthur," recently purchased by the Webster Steamship Co., of Quebec, from John O'Hagan, of North Tonawanda, has been transferred to the Sincennes McNaughton Co., in exchange for the barge "Valencia." The Sincennes McNaughton Co. have also purchased the barge "Nellie Reddington" from the Canada Steamships Lines.

CHANGES IN PERSONNEL AT SQUARE D COMPANY

Several additions and changes in the sales and advertising departments of the Square D Company of Detroit, Michigan, became effective February first. E. A. Printz, formerly district sales manager of the Chicago territory, was made sales manager; A. MacLachlan continuing in the capacity of secretary and director of distribution. D. M. Stone formerly district sales manager of the Pittsburgh territory, was made district sales manager of the Detroit territory. J. A. Jaques, formerly in charge of the New York territory as district sales manager, was given the district sales managership of the Pittsburgh territory; and H. W. Spahn, district sales manager of the Buffalo territory, was placed in charge of New York. D. H. Colcord, formerly of the Department of Publicity of the Westinghouse Air Brake Company, of Pittsburgh, was appointed director of research engineering. The annual sales conference of the Square D Company will be held at the Hotel Statler, Detroit, February 16, 17 and 18.

ANNOUNCEMENT

The Gardner-Bryan Company, Cleveland, Ohio, have been appointed special representatives for the Precision and Thread Grinder Manufacturing Co. in Ohio, Indiana and Western Pennsylvania. The Precision and Thread Grinder Manufacturing Company are the manufacturers of the multi-graduated precision grinder.

A seam of good quality coal is said to have been discovered near Cape Horna, in New Guinea. The coal contains from 2.7 to 4 per cent. of ash and has a calorific value of from 7,550 to 7,875 B.t.u.

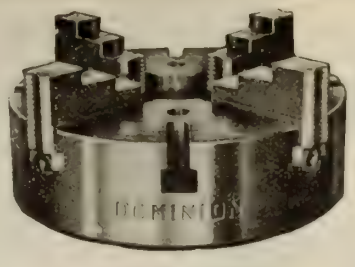
Those whose interests lie in greater production from their machine shops will be interested in the collection of loose leaf notes on broaching machines and broaching practice, which has been collated by the J. N. LaPointe Co., of New London, Conn., who are glad to send free copies on request.

Because of the extensive use of broaching machines in the shops of Detroit and the surrounding territory, this company has opened a branch office at 11 Harper Avenue, Detroit, in connection with which a stock room and repair shop is maintained, as well as a warehouse, in which is carried a stock of J. N. LaPointe Company broaching machines, to save the time and serve the convenience of their customers in Michigan, Ohio and Indiana. This Detroit branch is in charge of Mr. Wm. L. Nicholls, who will be pleased to discuss the advantages of broaching, or assist in the maintenance of existing batteries of machines with the least possible delay.

During the military operations on the Salonika front it was necessary to construct a bridge across the Selimb River. The work required the driving of forty-eight piles about 40 ft. long and 12 in. square to a depth of 24 ft. in gravel, clay, and quicksand. A pile driver with 30 ft. leads and a 1,200 lb. tup was employed and a 4-ton motor lorry used to raise the weight. The lorry was set up on the bank, the left-hand rear wheel was jacked up and blocked 10 in. from the ground, and the other three wheels were snubbed and staked to the ground. The lead rope was given a turn on the brake drum inside the wheel, one man operating the loose end. The distribution of labor was as follows: One motor driver, one signalman, one on the lead rope, three on the pile driver, and two sharpening and putting on pile rings. Work was continuous in three eight-hour shifts, and the bridge was completed for traffic in twelve days.

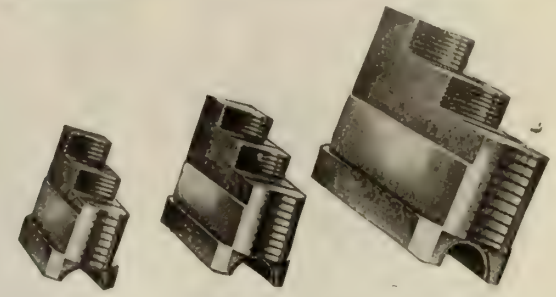
A new form conveyor is being used with considerable success in the Denaby Main Colliery. From a description in the "Iron and Coal Trades Review" it appears that the conveyor troughs are suspended by chains from cross bearers fixed between the pit props. Another cross bar is arranged below the bearer in such a manner that the chain may swing through an arc of a circle with a radius of the full length of the chain on one side of the vertical, while the curvature of the arc on the opposite side of the vertical is much more pronounced. The troughs are reciprocated by a compressed air motor and the coal is propelled in the direction of the short arc. A conveyor of this type 300 yards long by 22 in. wide can deliver a ton of coal every minute.

The amount of pig iron produced in the United States in 1919 reached a total of 30,582,878 gross tons, as compared with 38,506,249 tons in 1918.



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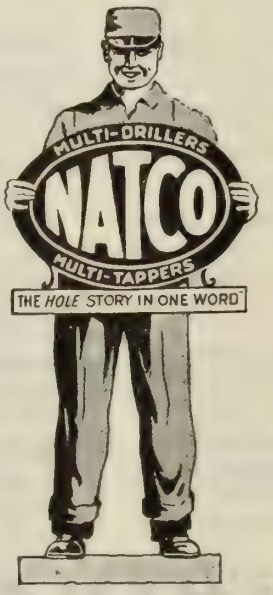


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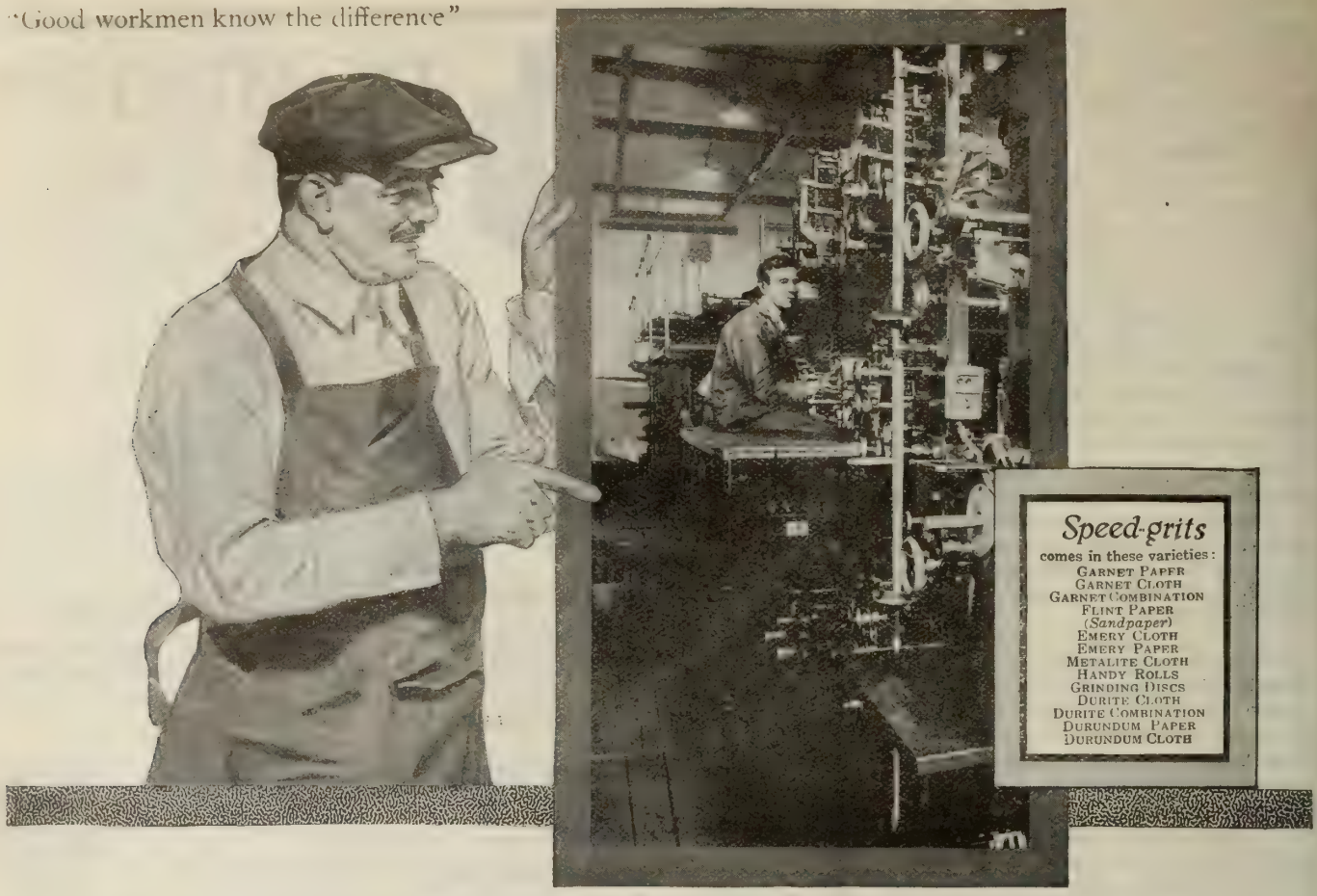
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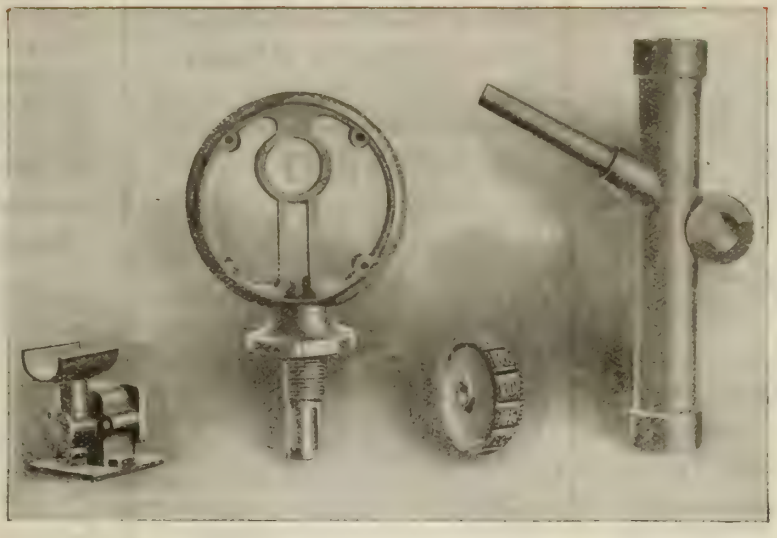
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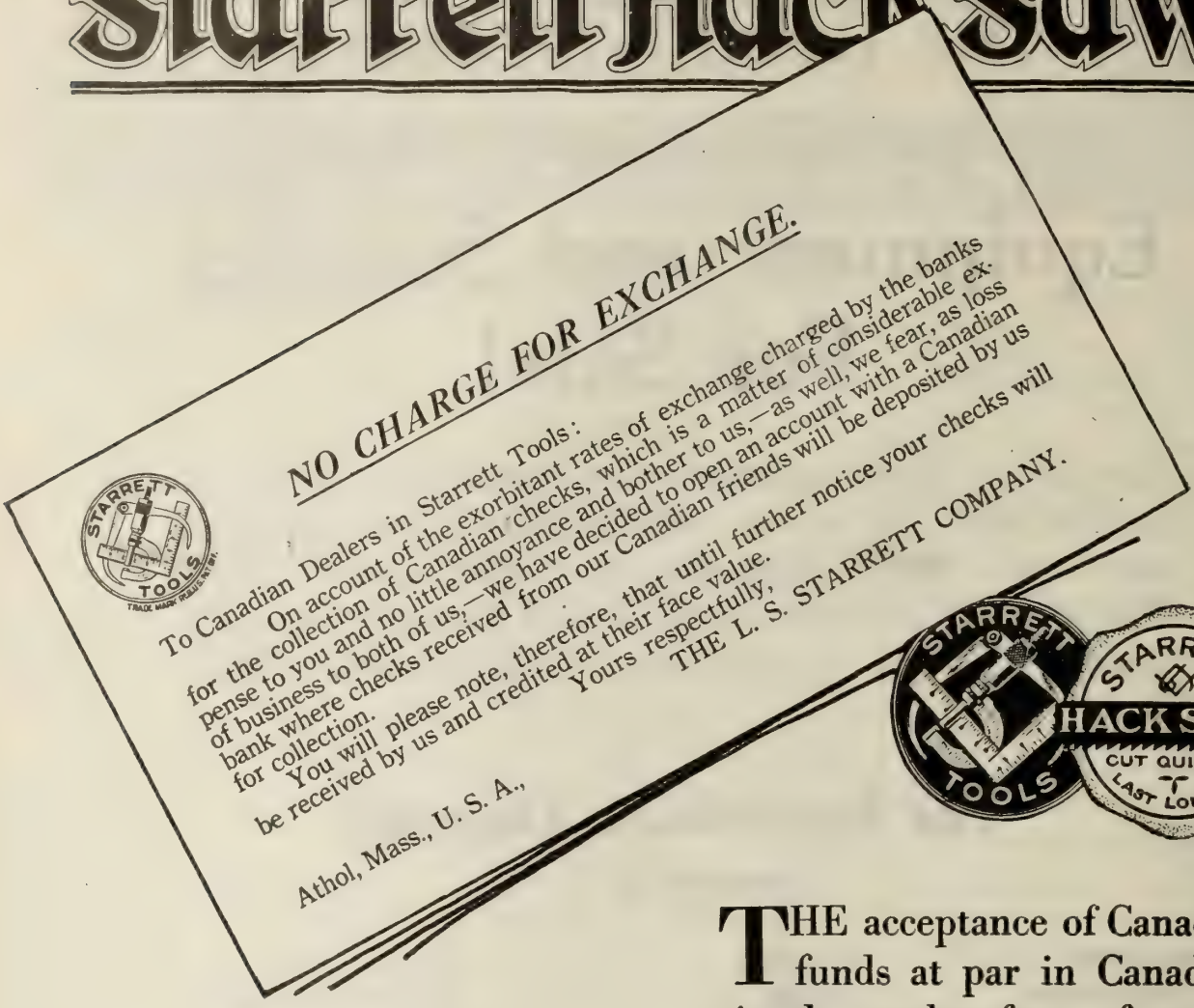
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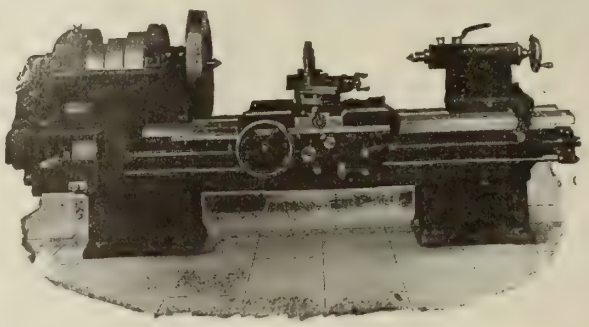
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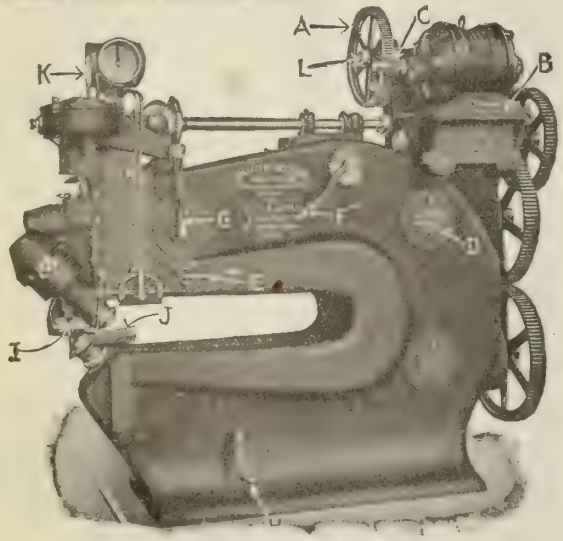
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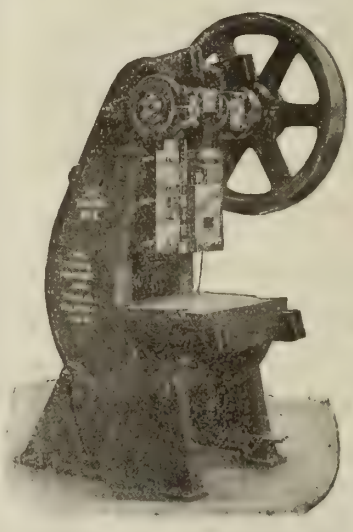
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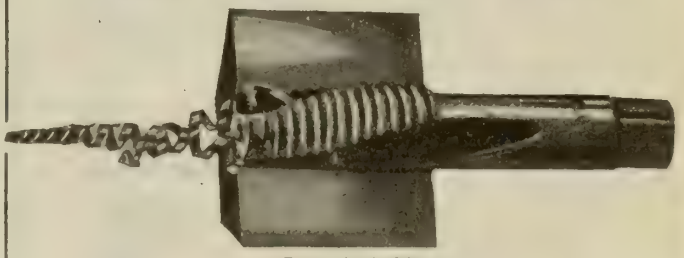
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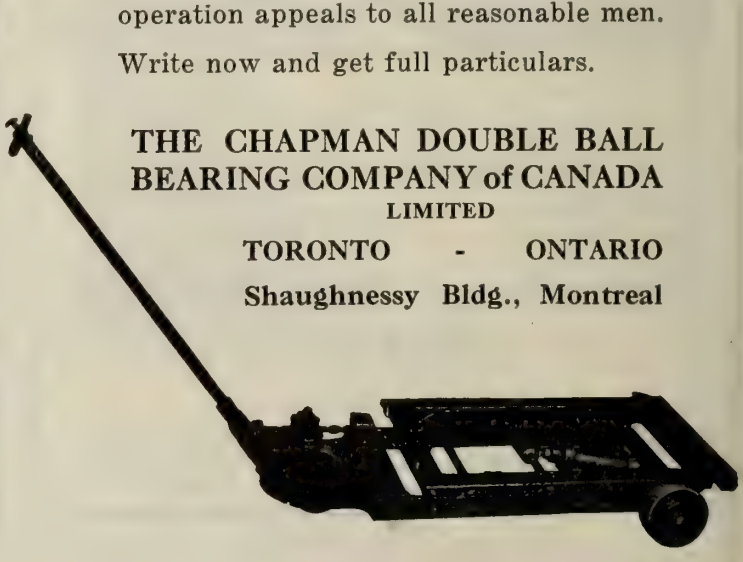
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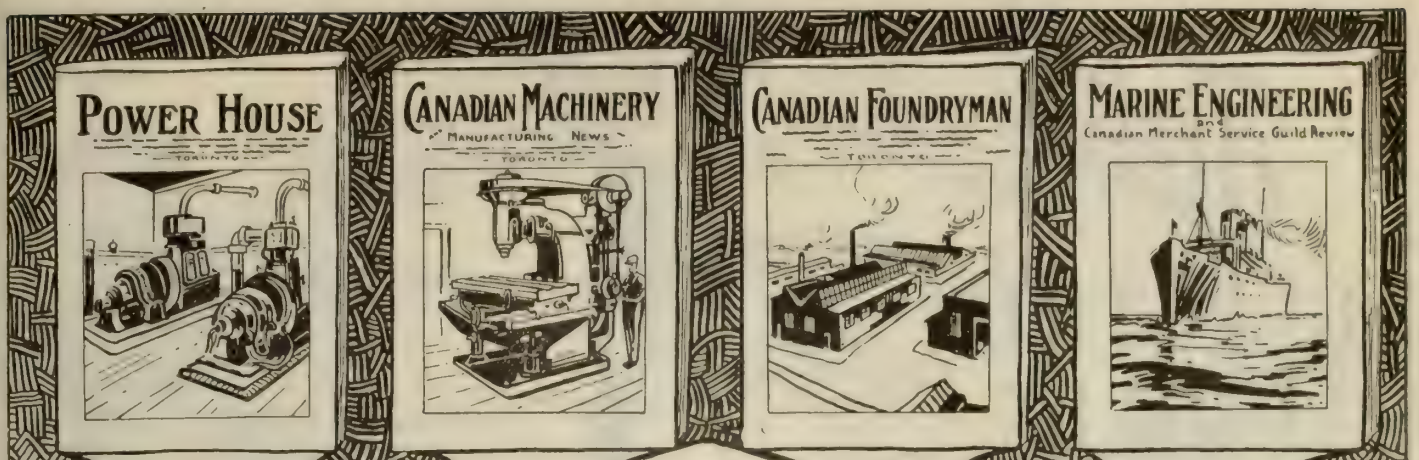
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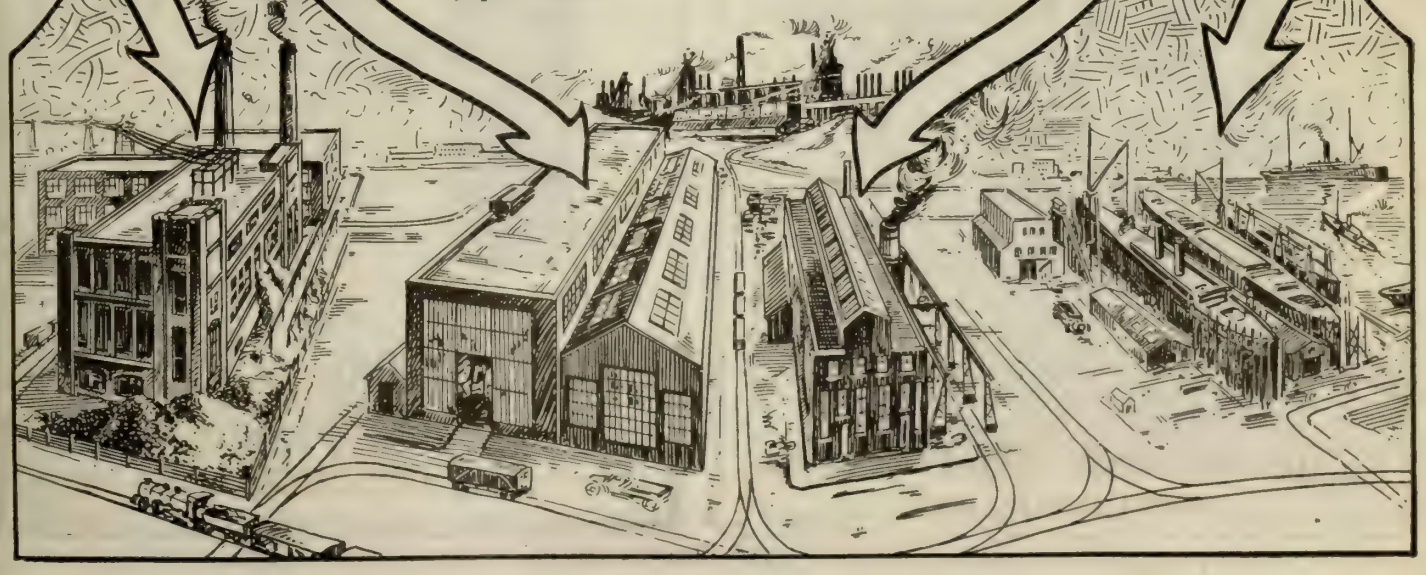
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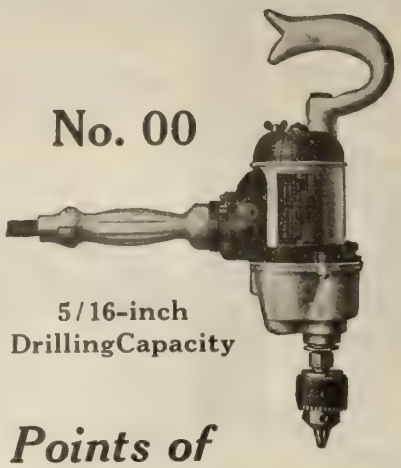


Thor

ELECTRIC DRILLS

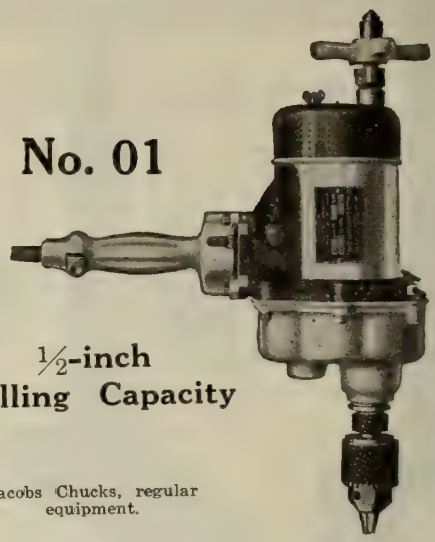
Universal motor for direct or alternating current, 110-220 volts. (Licensed under Buche Universal Motor Patent.)

No. 00



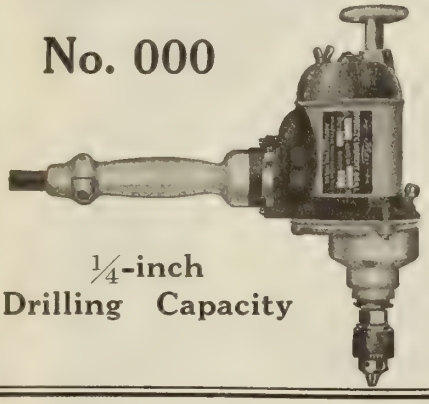
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No. 01



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Points of Superiority:

Jacobs Chucks, regular equipment.

Light weight—The internal gear driver permits the use of smaller gears and gear case—3 teeth in contact instead of one.
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Most Powerful—The method of winding the field and armature, and the use of ball and roller bearings result in greater power.
Extreme Durability — Interlocking commutator bars; fully tapped and insulated coils; large brushes; and perfect automatic brush holders ensure long life.
Highest Efficiency — Results from the unique motor construction and elimination of all friction.
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These features are used in Thor Electric Tools exclusively, and will not be found in any other make. Their compact construction, neat design, and high grade finish is unsurpassed.

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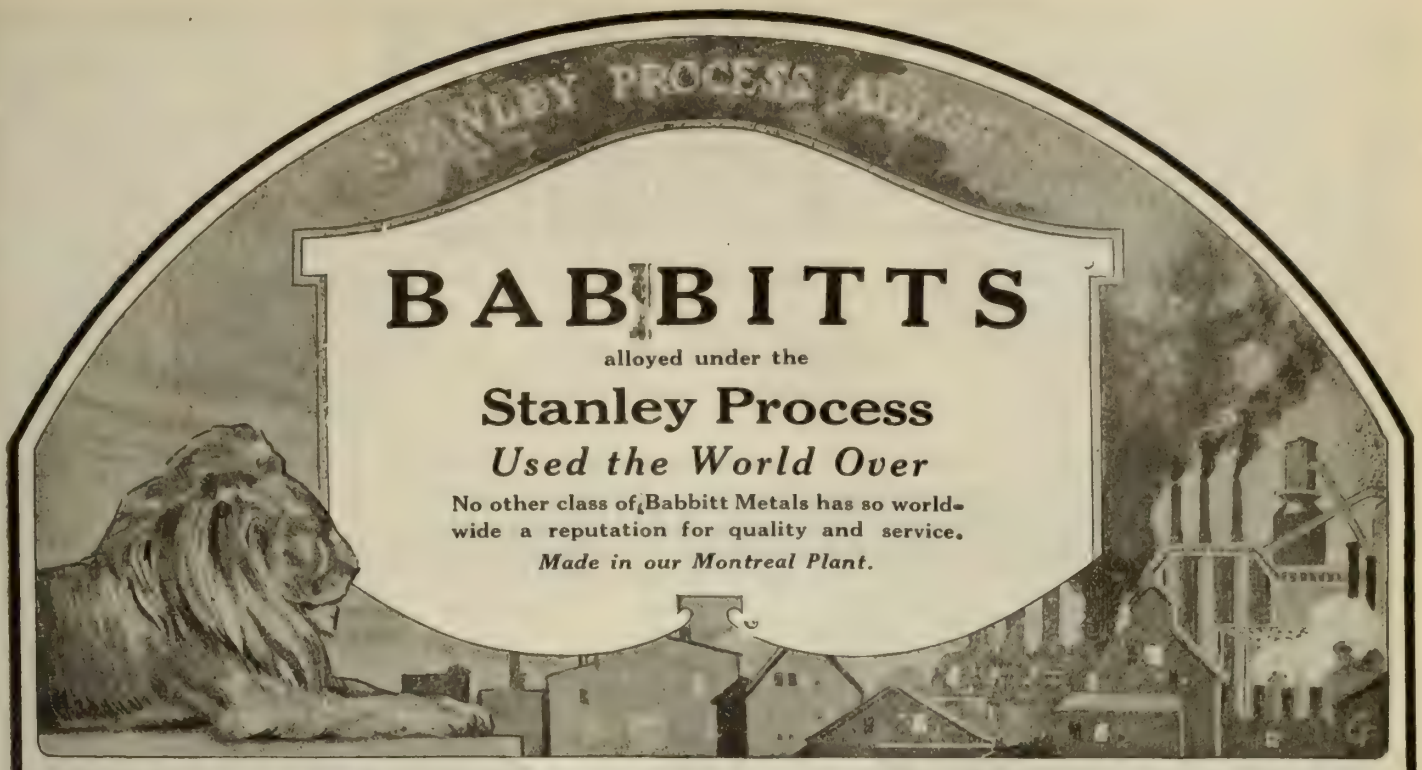


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The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to 5/16".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

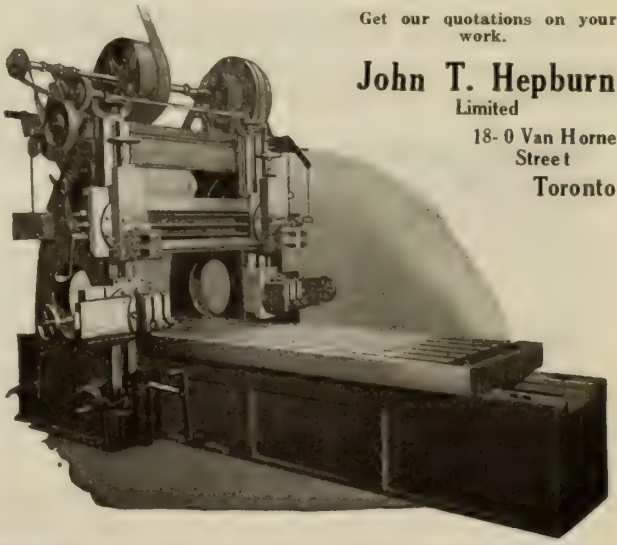
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Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
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Automatic Furnaces, by heating and cooling each piece to the same temperature, for the same length of time and in the same manner, **insure uniformity of finished product.**

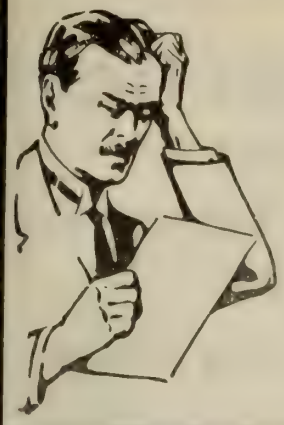
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We have a variety in type and size of Automatic Furnaces, for different heat-treating requirements. Let us work with you in deciding which of these is best suited to your conditions.

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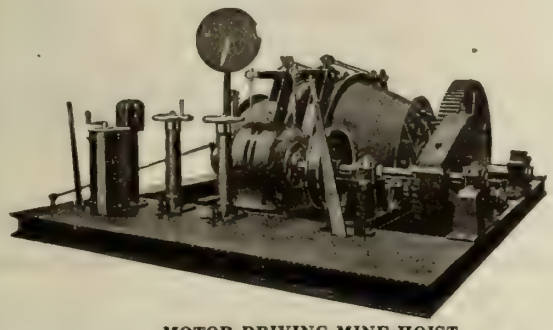
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Write for our booklet on "Inside Transportation." It explains how the Holyoke system permits you to install a more economical trucking system AT LOWER INITIAL COST.

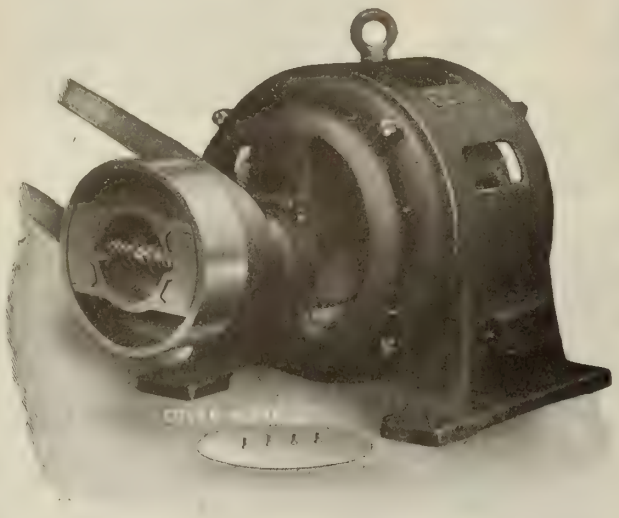
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Entirely Dispenses With all Starting Difficulties

The Clutch also Effects a Great Saving in Current Consumption and Reduces the Initial Cost of Motor and Switchgear.

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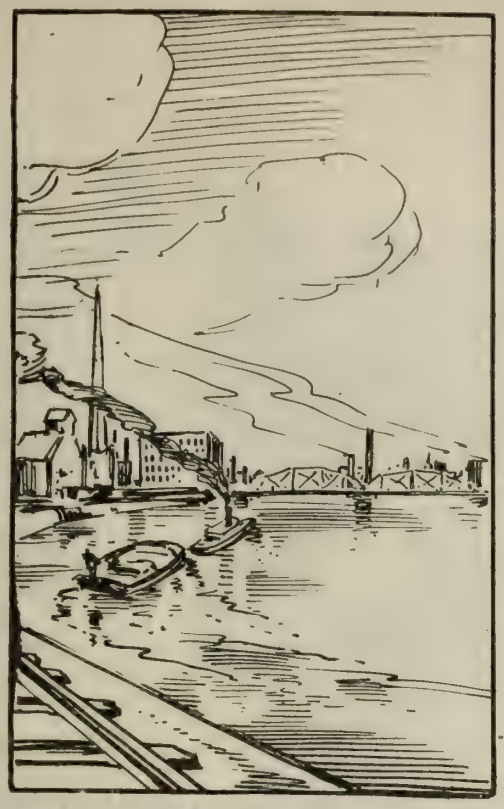
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INVESTIGATE
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before you decide upon the location for that new plant.

St. Johns possesses unusual economic advantages, such as its commanding geographical location, unequalled transportation facilities, adequate fuel and power and a solution for the vexed labor problem.

Already a busy industrial centre, St. Johns is rapidly expanding and now offers unparalleled inducements to encourage the establishment of new industries.

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St. Johns is directly connected by rail with the Montreal docks, 27 miles distant, affording first-class facilities for foreign trade. Excellent canals connect with St. Lawrence and also with New York and the Eastern States.

Electric power is cheap and plentiful and the excellent railway connections assure a satisfactory coal supply.

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In addition to the obvious advantages of St. Johns as an industrial site, the generous assistance offered by the municipality greatly reduces the initial expense and difficulties of organization and make the city an unusual industrial opportunity.

For more specific information, write

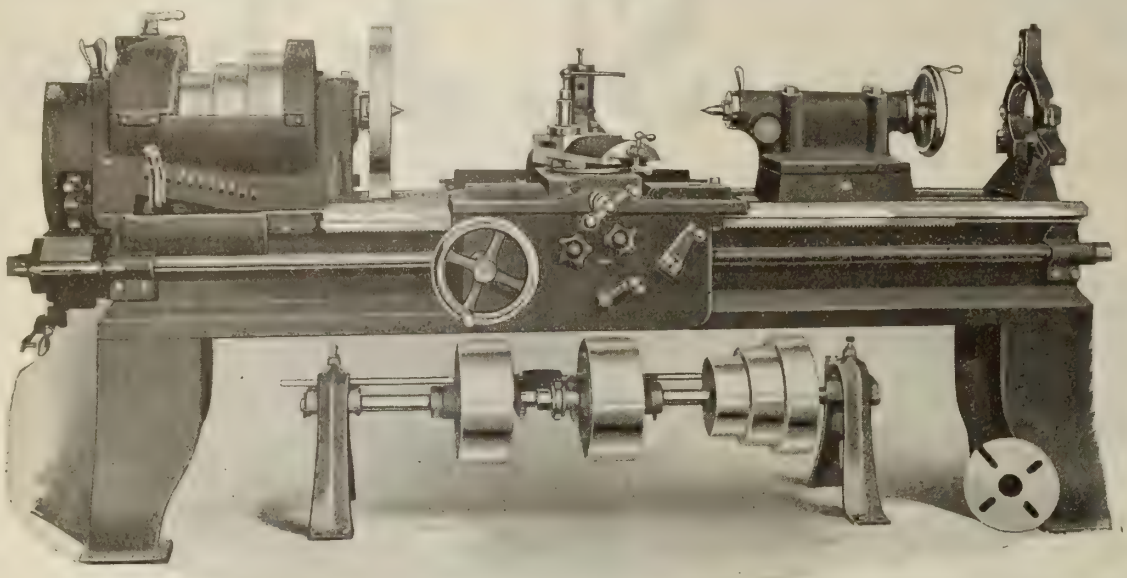
The Secretary of the City Council
St. Johns, Quebec, Canada

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A Lathe That Is Honestly Built

You know what that means. Heavily webbed and ribbed sections of ample dimensions — surfaces and bearings machined and finished with the highest accuracy—steel gears and parts wherever necessary.



You take no chances when you purchase the Rae. It is a tool that does the hard work easily. Its rigidity means accuracy under the heaviest cuts.

We shall be glad to give you detailed information of this machine or of our other lines.

Rae Machine Tool Works, Limited, HAMILTON CANADA

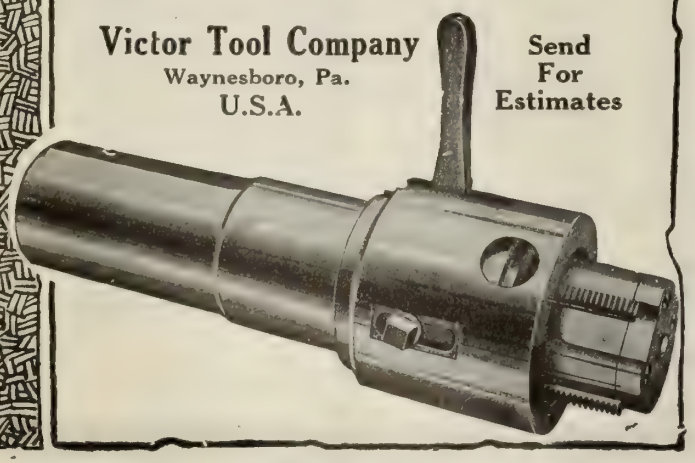
We wanted something original— this is what we got

"BOTH of these operations and half another — I'll show you later—completed in the time our old taps took to do one; that, I guess, is why we continue to use your Victor Collapsible Taps."

It was the often-heard story of time saved, of costs lowered, of all threads clean and smooth. And it was pleasant to hear.

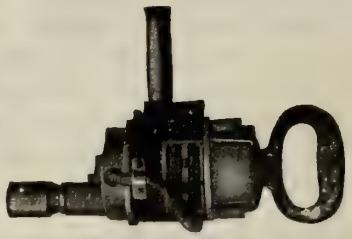
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U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

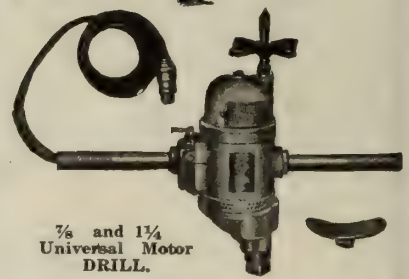
For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

3 SIZES
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All motors wound for 110 or 220 volts.

Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



⅜ and 1¼ Universal Motor DRILL.

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THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

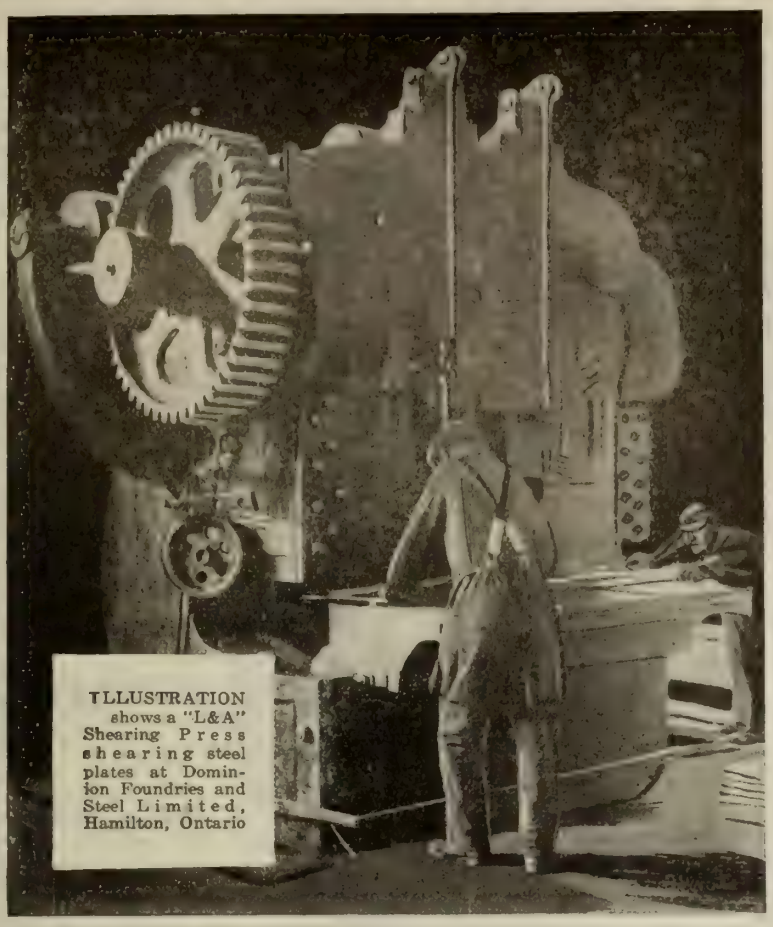


ILLUSTRATION shows a "L&A" Shearing Press shearing steel plates at Dominion Foundries and Steel Limited, Hamilton, Ontario

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We manufacture "The Quality Line" machinery equipment for Rolling Mills, Bridge and Structural Works, Steel Car Plants and Shipyards. All machines are built of the same high grade workmanship and material that have given the "L & A" product a recognized standard of quality of over 50 years.

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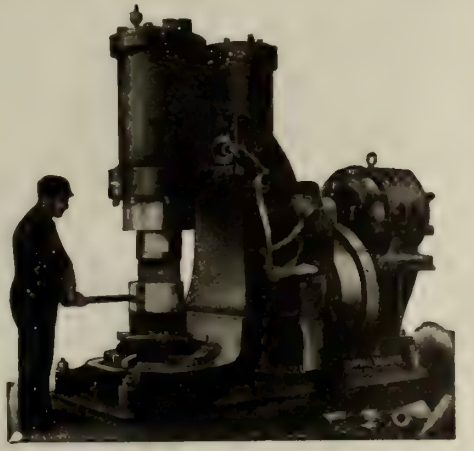
American Punch & Shear Works
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(A Self-Contained Unit)

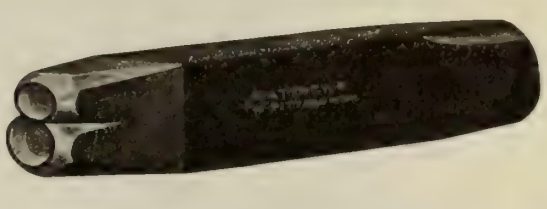
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Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

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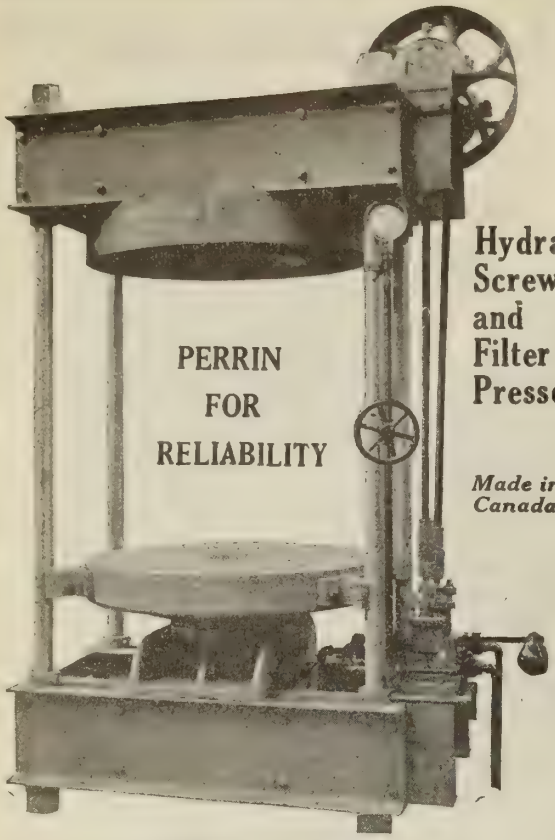
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Made in Canada

Hydraulic Truck Tire Press

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Tool Steel for Every Purpose
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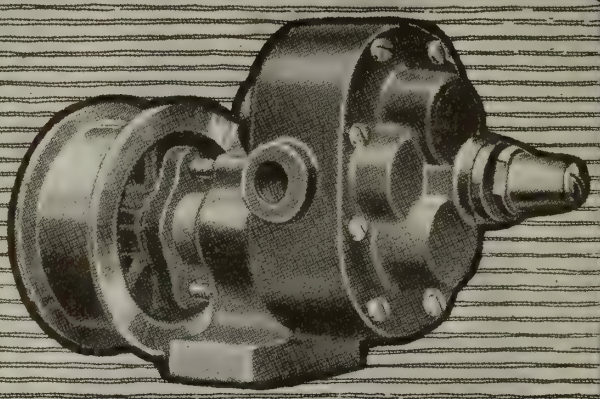
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2

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Lubricating Pumps

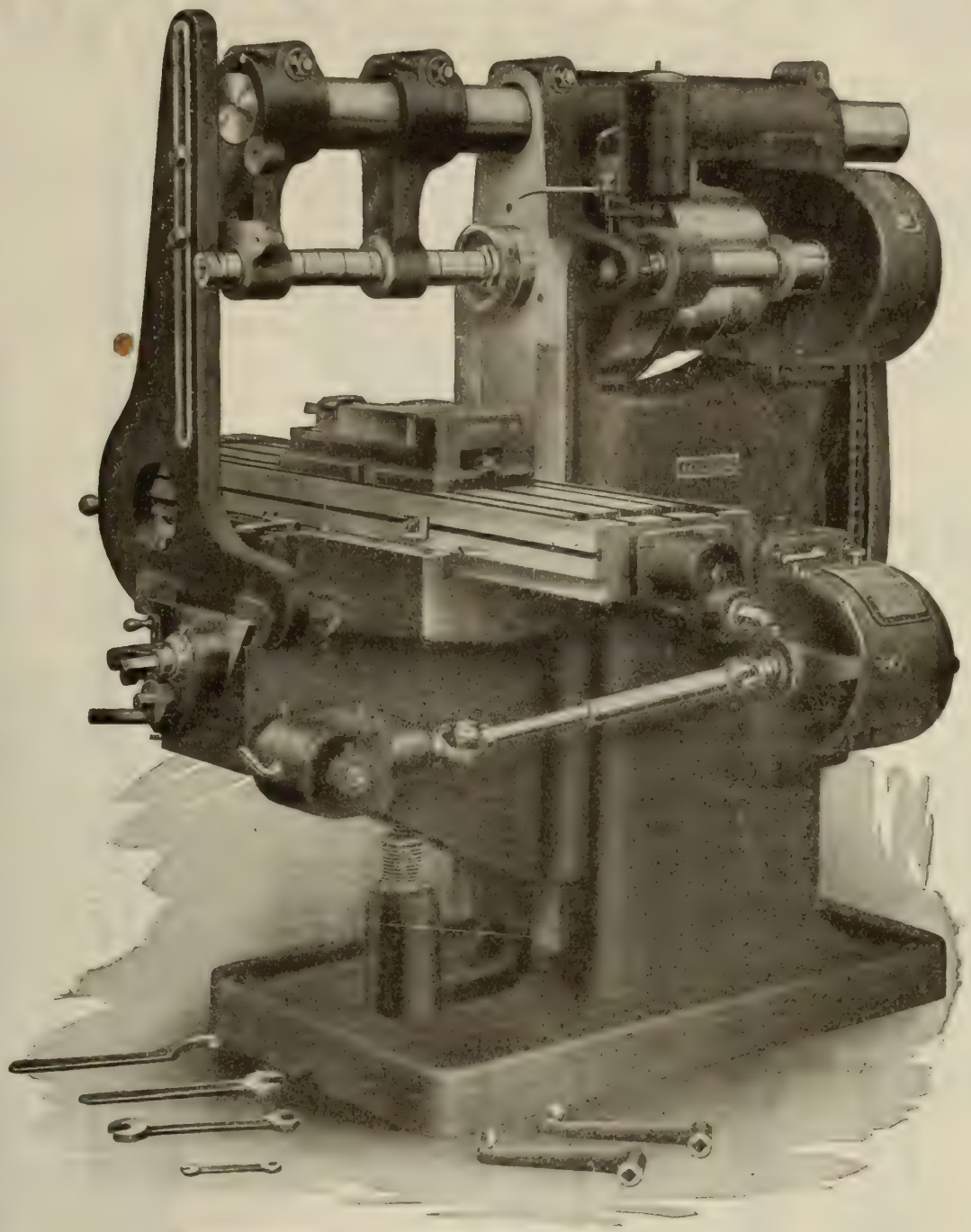


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Trahern Pumps specialize in delivering a continuous, forceful, non-pulsating stream of oil, against 100 lbs. pressure if necessary. If installed properly will not lose prime, operate at low speed, long life.

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KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared.

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy to-day.

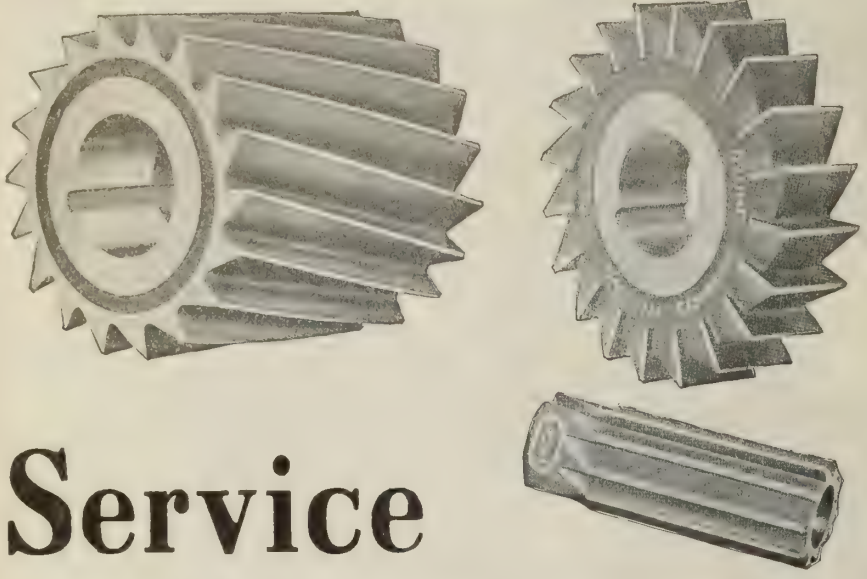
THE KEMPSMITH MANUFACTURING CO.

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"IMCO" Tools





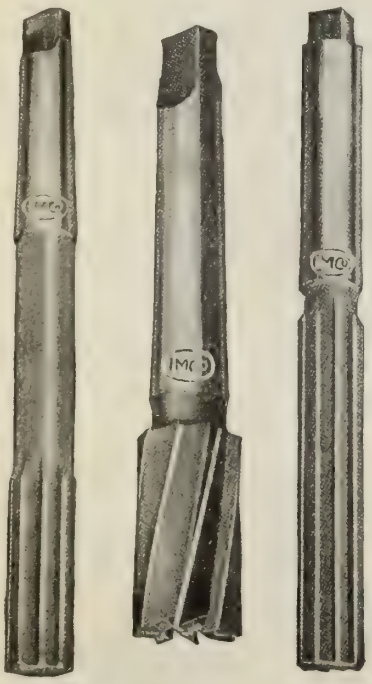
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—*is proof of merit*

Not careful workmanship alone, nor perfect finish, nor even a great many years' manufacturing experience. Service is the *only* proof—the acid test of the small tool.

In service, as in any other particular, Imco tools may be favorably compared with any on the market.

Imco tools have rapidly established a splendid reputation for endurance, for reliability, for the faculty of cutting keenly and accurately after hard use — in short, for economy.

For the real economy that is measured in dollars and cents by the reduction in factory costs.



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DETROIT, Michigan

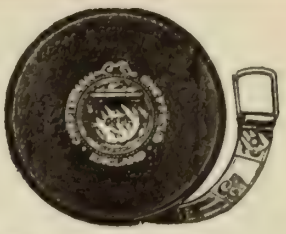
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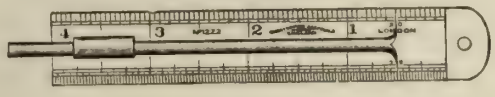
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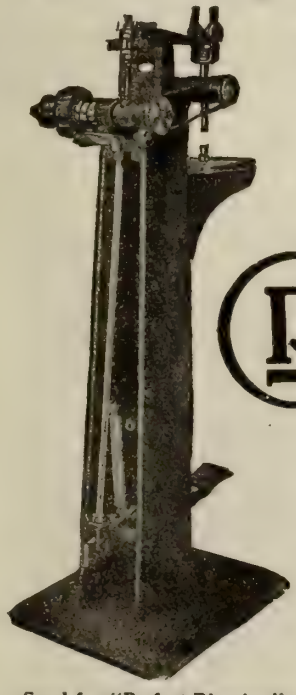
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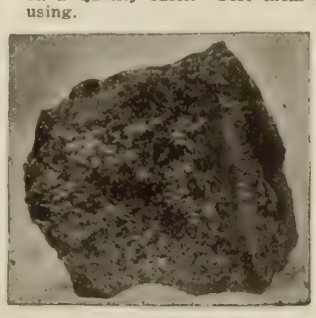


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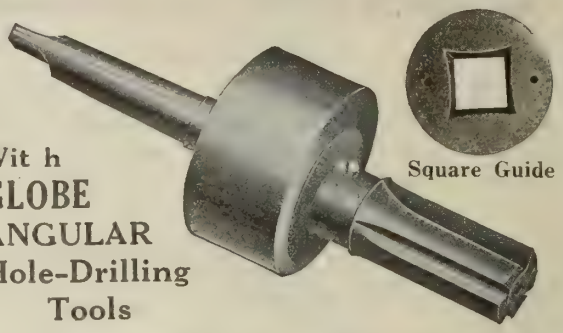
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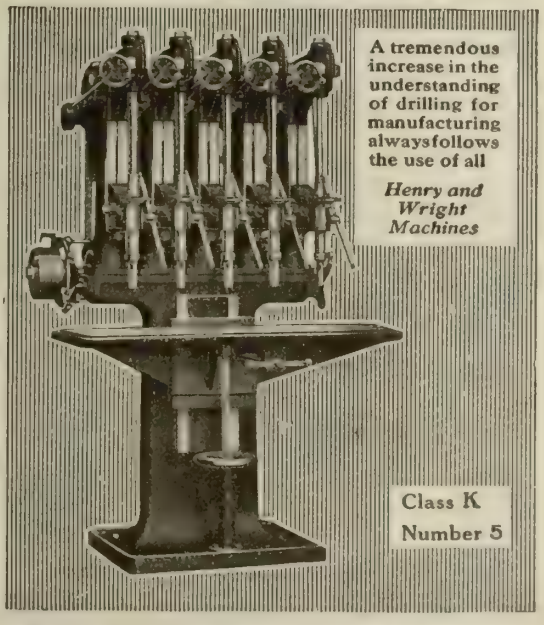
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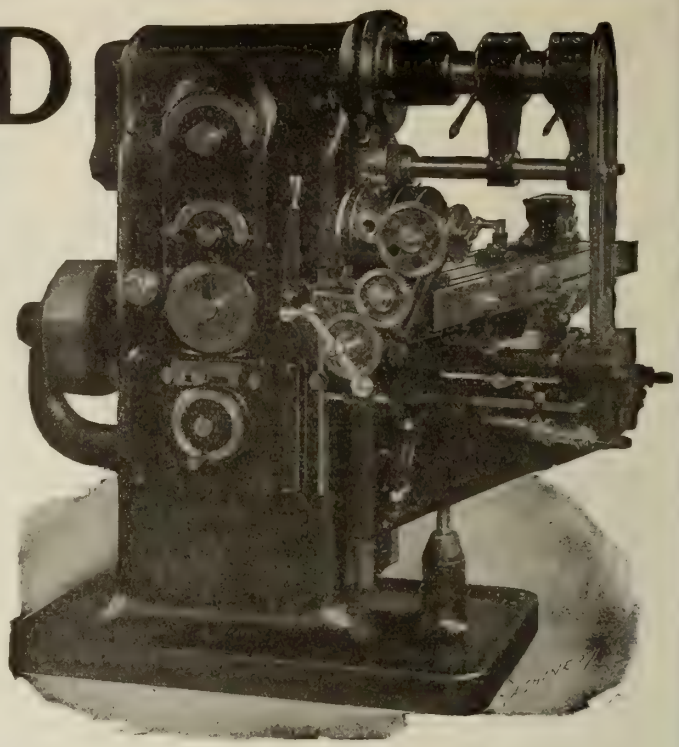
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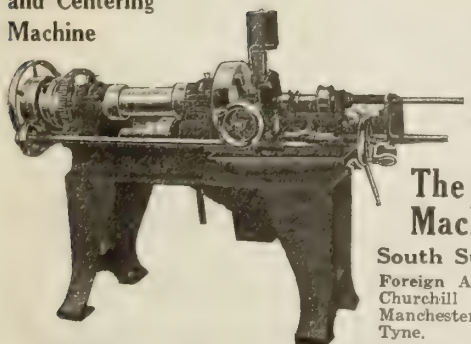
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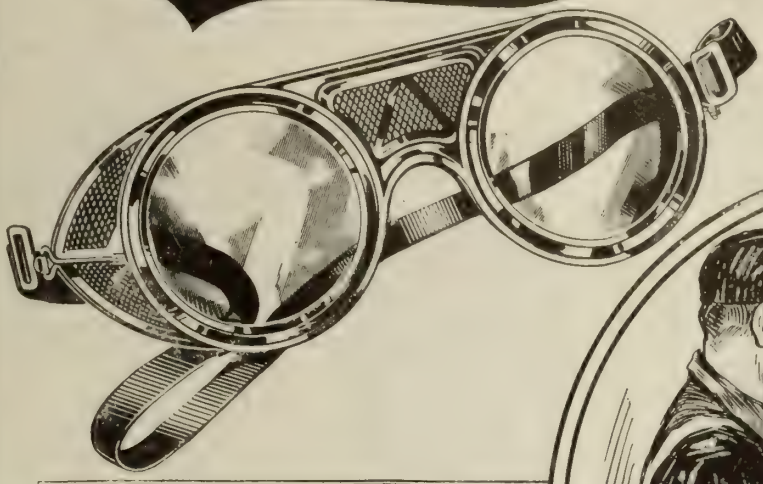
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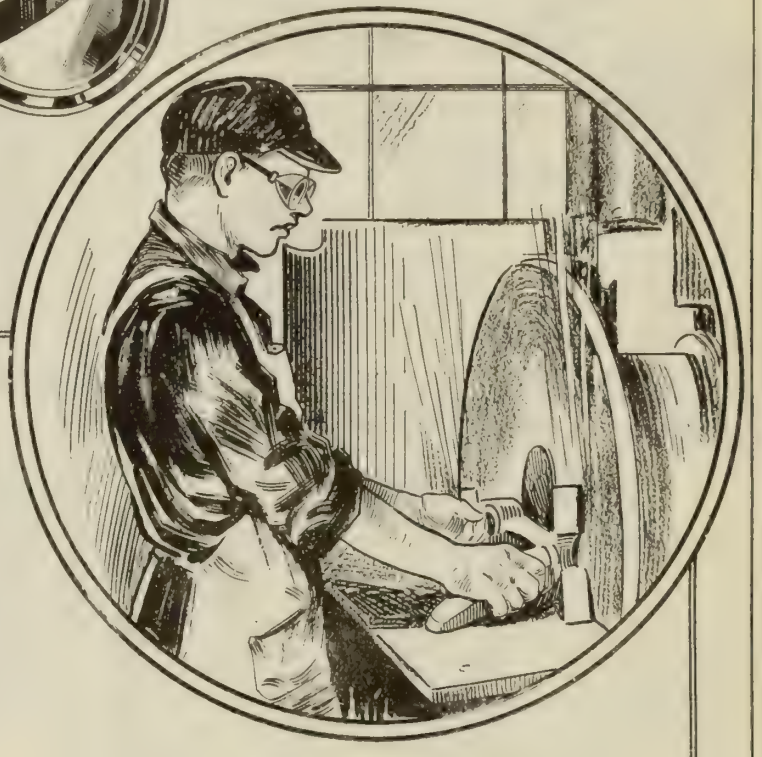
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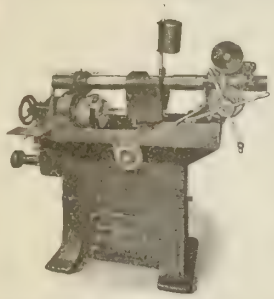
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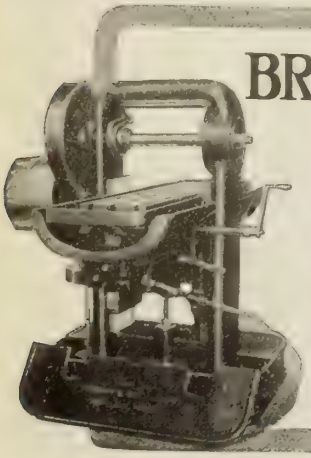
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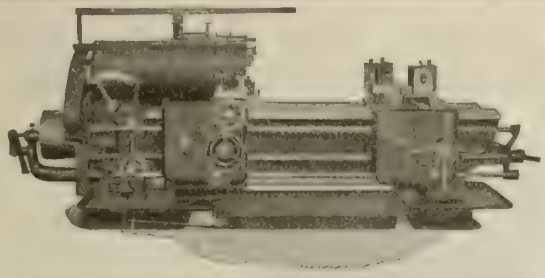
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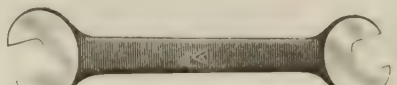
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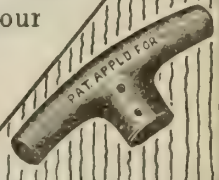
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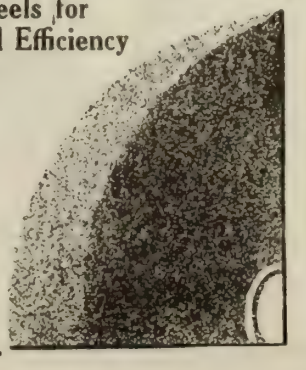
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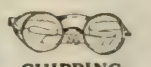
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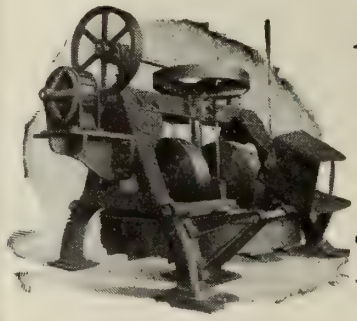
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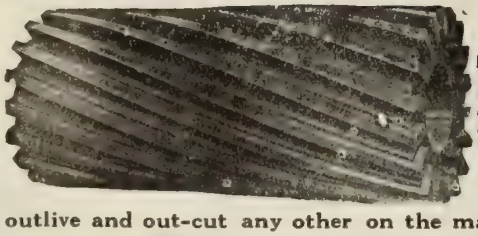


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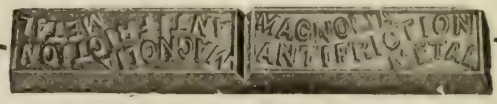
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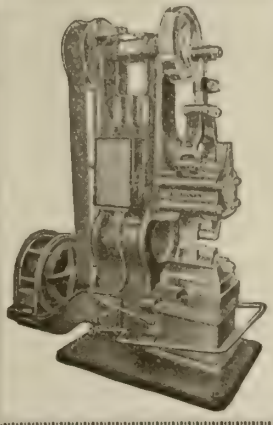
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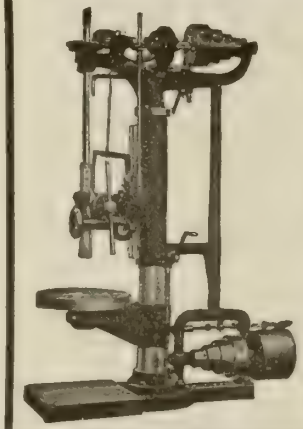
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Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Rockefoson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Hoggson & Pettis Mfg. Co., New Haven Conn.

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Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
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Williams & Co., J. H., Brooklyn, N.Y.

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Can. Blower & Forge Co., Kitchener
Sturtevant Co., B. F., Galt, Ont.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.

COMPOSITION INGOT
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

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Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock-Walker Machy. Co., Toronto.
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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MacGovern & Co., Montreal, Que.
Smalley-General Co., Inc., Bay City, Mich.

CONDUITS
Northern Electric Co., Ltd., Montreal Que

CONNECTING RODS
Canada Found's & Forgings, Ltd., Welland, Ont.

CONTRACTORS' HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

CONTRACT WORK
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Ford-Smith Machine Co., Hamilton, Ont.
Globe Engineering Co., Hamilton, Ont.
Horner & Wilson, Hamilton, Ont.
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St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.

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Volta Mfg. Co., Welland, Ont.

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Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal.

CONVEYORS—McCASLIN GRAVITY BUCKET
Canadian Mead-Morrison Co., Limited, Montreal, Que.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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Bertram & Sons Co., John, Dundas, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
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Brown's Copper and Brass Rolling Mills, New Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

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Aikenhead Hardware Co., Toronto, Ont.
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Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.

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Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

COUPLINGS, RAPID HOSE
Ist. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

CORE AND COAL
Hanna & Co., M. A., Cleveland, O

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Cleveland Pneumatic Tool Co., of Canada, Toronto.
Gardner, Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville.

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont.

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Petrie, Ltd., H. W., Toronto.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Oliver Engineering Co., Montreal.

CRANK SHAFTS
Canada Found's & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

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Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
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CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Ingersoll Mache. Co., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
Wilt Twist Drill Co., Walkerville, Ont.

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Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Atkins & Co., E. C., Hamilton, Ont.
Bertram & Sons Co., John, Dundas.
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Foss Mchy & S'ply Co., Geo. F., Montreal
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass
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Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Lyman Tube & Supply Co., Montreal, Que.
Niles-Bement-Pond Co., New York, N.Y.
Prest-O-Lite Co., Inc., Toronto, Ont.
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Cataract Refining Co., Ltd., Toronto.
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CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
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DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DERRICK HOISTS
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DIAMOND (BORTZ)
Furniss, Clarke & Co., Montreal, Que.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Furniss, Clarke & Co., Montreal, Que.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Petrie, Ltd., H. W., Toronto.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
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Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
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Wells Bros. of Can., Galt, Ont.
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Matthews, Jas. H., & Co., Pittsburgh, Pa

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A. B. Jardine & Co., Ltd., Hespeler, Ont.
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DIES AND DIE STOCKS
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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
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National Acme Co., Cleveland, Ohio.
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Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
U. S. Ordnance, Toronto, Ont.
Wells Brothers of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Elliott & Whitehall, Galt, Ont.

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Crescent Mche. Co., Ltd., Montreal, P.Q.
Landis Machine Co., Waynesboro, Pa.

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Crescent Machine Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

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Garvin Machine Co., New York.
Jackson Machine Tool Co, Jackson, Mich.
Pratt & Whitney Co., Dundas, Ont.
Walcott Lathe Co., Jackson, Mich

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Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.

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Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
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Brown, Boggs & Co., Hamilton, Canada
Globe Engineering Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

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Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros., Co., of Can., Galt, Ont

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal

DIRECT CONNECTED UNITS
MacGovern & Co., Montreal, Que.

DRAFT, MECHANICAL
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sturtevant Co., B. F., Galt, Ont.

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Crane, Ltd., Montreal, Que.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

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Hughes, Owens Co., Ltd., Montreal, Que.

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Petrie, Ltd., H. W., Toronto.
Wheel Trueing Tool Co., Windsor, Ont.

DRILL PRESSES
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Barber Mchy. Co., Ltd., Toronto, Ont.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto

DRILL RODS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Kayser-Ellison & Co., Ltd., Montreal.
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Marshall, Son & Bunney, Toronto.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Silver Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE AND MULTIPLE SPINDLE
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg., Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
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Butterfield

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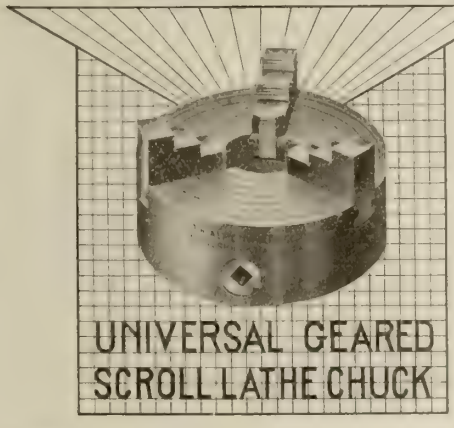
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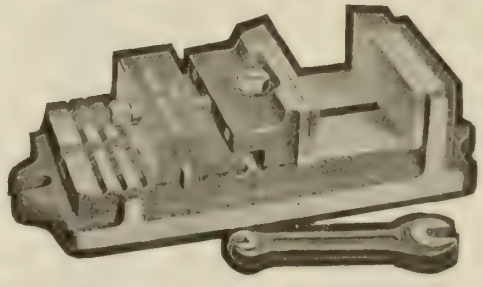
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GEARS, COMPENSATING
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Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
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Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
Victoria Foundry Co., Ottawa.

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Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
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GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

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St Lawrence Welding Co, Ltd., Montreal

GENERATORS AND CONVERTORS
Northern Elec. Co., Ltd., Montreal, P.Q.

GENERATORS, MOTOR
MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
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U. S. Ordnance, Toronto, Ont.

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Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

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Rice Lewis & Son, Toronto.

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Consolidated Optical Co., Toronto.
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

GRAB BUCKETS—CLAMSHELL and ORANGE PEEL
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Jones & Glassco, Montreal.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

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Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

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Foss Mchry. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
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Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

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Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Ford-Smith Mach. Co., Hamilton, Ont.
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Grant Mfg. & Mach. Co., Bridgeport, Con
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
Wisconsin Electric Co., Inc., Racine, Wis.
Williams Mchy Co., A. R., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

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Universal Grinding Mach. Co., Fitchburg, Mass.

GRINDERS, HOLE, HOLE AND AND DEEP HOLE
Barber Mchy. Co., Ltd., Toronto, Ont.
Bryant Chucking Grinder Co., Springfield, Vermont.
Heald Machine Co., Worcester, Mass.

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Barber Mchy. Co., Ltd., Toronto, Ont.
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Cleveland Pneumatic Tool Co., Toronto.
Garlock-Walker Machinery Co., Toronto.
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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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W. F. & John Barnes Co., Rockford, Ill.
Blount & Co., J. G., Everet, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield.
National-Acme Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
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Manhattan Machine & Tool Co., Grand Rapids, Mich.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Williams Mchy Co, Ltd., A. R., Montreal

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Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Williams Mchy Co., A. R., Toronto, Ont.

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Gardner & Son, Robt., Montreal.
Garvin Machine Co., New York.
Garlock-Walker Machy. Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Haskins & Co., R. C., Chicago, Ill.
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Niles-Bement-Pond Co., New York, N.Y.
Norton Co., Worcester, Mass.
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Wisconsin Electric Co., Racine, Wis.
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Ford-Smith Machine Co., Hamilton, Ont.
Foss Mchy. & S'ply Co. G. F., Montreal.
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Canada Machinery Corp., Galt, Ont.
Canada Wire & Iron Goods Co., Hamilton
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B. Greening Wire Co., Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.
St Lawrence Welding Co, Ltd., Montreal
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Ford-Smith Machine Co., Hamilton, Ont.
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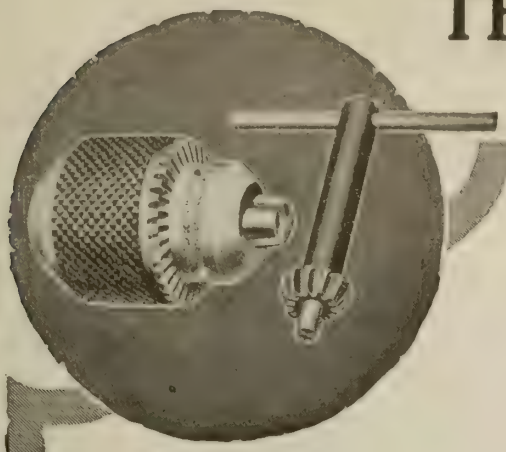
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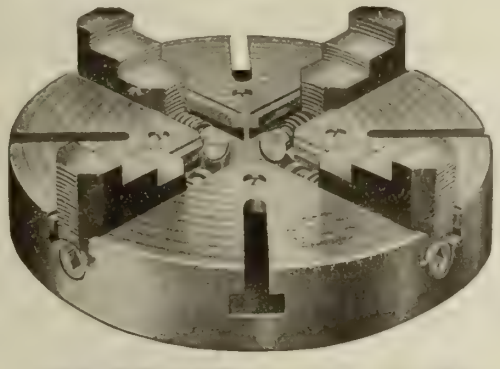
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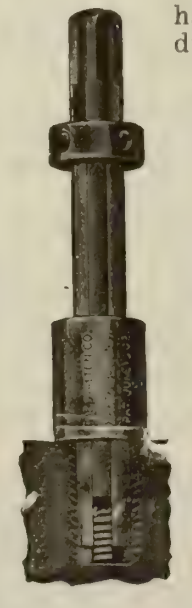
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London Bolt & Hinge Wks., London, Ont.

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Morris Crane & Hoist Co., Herbert.
Niagara Falls, Ont.
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Garvin Machine Co., New York.
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Wood Turret Machine Co., Brazil, Ind.

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Canada Machinery Corp., Galt, Ont.

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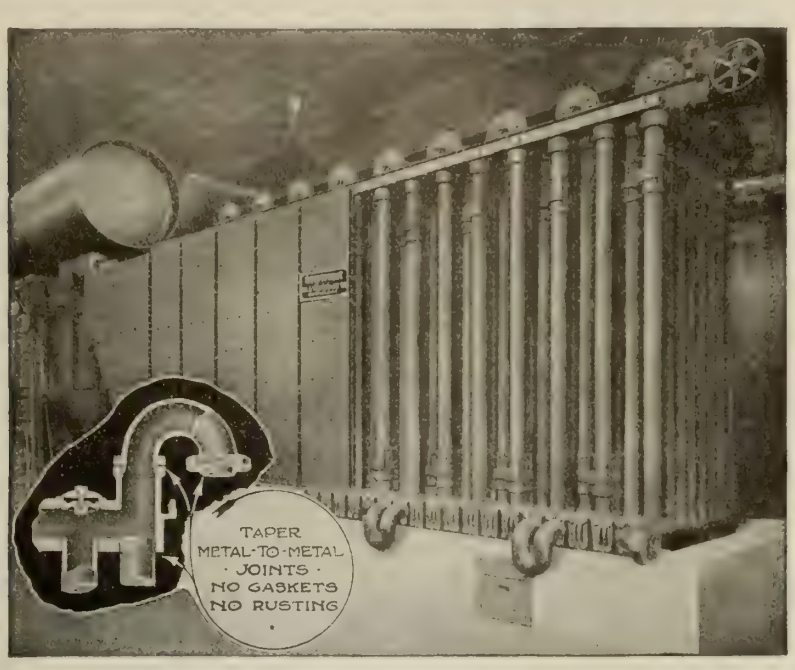
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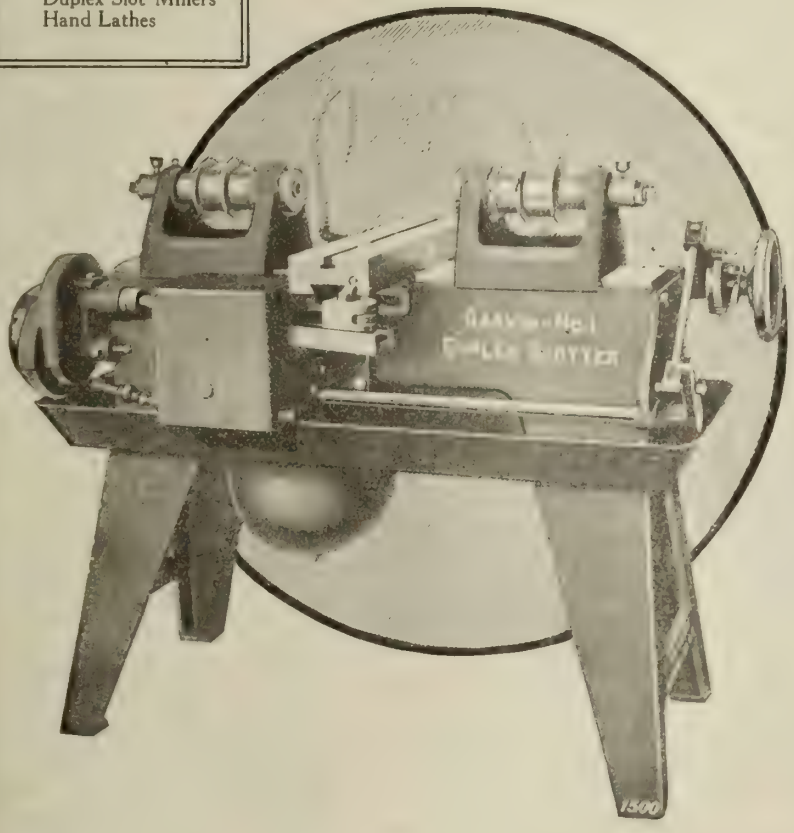
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It is full automatic. You place the work and the machine does the rest and stops when the cut is finished. One operator can feed several machines, except where the speed of turning out small slots prevents.

You will save money by employing a Garvin Slot Milling Machine for such work as

Drift slots in spindles; tool-post elongated holes; keyways; slots in castings; open fork end cuts in both ends of a piece to be in line.

The machine is speedy, accurate and either mills from both sides at once or mills two separate pieces handled at one time. You save time and effort over the obsolete methods of doing such work.

The work table can be set for any length of feed, within the machine's capacity limit, or to feed at any desirable speed.

The heads are fed into cut simultaneously and automatically. In milling a through slot, one head backs away automatically when almost through, leaving the other to complete the slot without leaving a partition to be broken out. Adjustable feed can be set to automatically stop feeding when cut has reached required depth.

From the uniformity of its work, the ease of operation and the sustained efficiency of its correct design and careful building, the Garvin Slot Millers leave nothing to be desired.

Described in the 340-page Garvin catalogue with other equally worth having tools. Ask your dealer or address

The Garvin Machine Company
Spring and Varick Streets
New York City, U.S.A.

G-18

GARVIN

BUILDER OF BETTER MACHINE TOOLS

If interested tear out this page and place with letters to be answered

PIPE TOOLS AND DIES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE CUTTERS AND REAMERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE STOCKS AND THREADERS
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE TAPS AND VISES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PIPE WRENCHES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

PISTON AND PISTON RING MACHINES
National Acme Co., Windsor, Vt.

PLANER BOLTS
Atkins & Co., E. C., Hamilton, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont

PLANER JACKS
Armstrong Bros. Tool Co., Chicago.

PLANERS, STANDARD AND ROTARY
Betts Machine Co., Rochester, N.Y.
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Oliver Machy. Co., Grand Rapids, Mich.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner & Son, Robt., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Moston Mfg. Co., Muskegon Heights, Mich
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Standard Equipment & Tool Wks., Montreal.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

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Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.
Ohio Mach. Tool Co., Kenton, Ohio.
Perrin, Ltd., William, Toronto.
Williams Mchy Co. Ltd., A. R., Montreal

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Lund-Farquhar Co., Boston.
Petrie, Ltd., H. W., Toronto.

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Quickwork Co., St. Marys, Ohio.

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MacGovern & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Galt, Ont.

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Can. Billings & Spencer, Ltd., Welland.
Peck, Stow & Wilcox Co., Southington, Ct.
Rice Lewis & Son, Toronto, Ont.

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Can. Ingersoll-Rand Co., Montreal, Que.
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Garlock-Walker Machy. Co., Toronto.
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MacKinnon Steel Co., Sherbrooke, Que.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto.

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Elec. Steel & Metals, Welland, Ont.

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Morris Crane & Hoist Co., Ltd., Herbert. Niagara Falls, Ont.
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Petrie, Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo.
Stoll Co., D. H., Buffalo, N.Y.
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Metalwood Mfg. Co., Detroit, Mich.
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Toledo Machine & Tool Co, Toledo.
U. S. Ordnance, Toronto, Ont.

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Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto.

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Williams Mchy Co., Ltd., A. R., Montreal

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Manhattan Machine & Tool Co., Grand Rapids, Mich.
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Petrie, Ltd., H. W., Toronto.
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Bernard Industrial Co., Fortierville, Que.
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Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
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Pratt & Whitney Co., Dundas, Ont.
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Globe Engineering Co., Hamilton, Ont.

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Perrin, Ltd., William R., Toronto.

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Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

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Darling Bros., Ltd., Montreal, Que.
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Gaspinet & Son, Robert Montreal.
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Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

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Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
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Williams Mchy Co., A. R., Toronto, Ont.

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Bertrams & Sons, John, Dundas, Ont.
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Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
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Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
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QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

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Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Pratt & Whitney Co., Dundas, Ont.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

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Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
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Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
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Taylor Instrument Co., Rochester, N.Y.

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St Lawrence Welding Co, Ltd., Montreal

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Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

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Can. Ingersoll-Rand Co., Montreal.
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Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

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Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
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Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.



I Am A Beach Chuck

MADE BY THE

Morse Twist Drill & Mch. Co., New Bedford, Mass., U.S.A.

I Always Run True

And when I grip a shank, there is NO LET GO until YOU RELEASE ME

"STAR"

LATHES

With Motor Drive Attachment

Saves Time, Saves Power and Very Convenient to Operate

This new "STAR" design embraces all the essentials of a first-class tool room lathe. It is compact, powerfully built and is capable of turning out a big variety of work. Being equipped with motor-driven attachments the machine gets a direct, independent drive which saves time, saves power and makes for convenience in operating.

In the rapid manufacturing on small parts "STAR" lathes are the tools you should use. They can be depended upon to cut costs! Complete description on request.

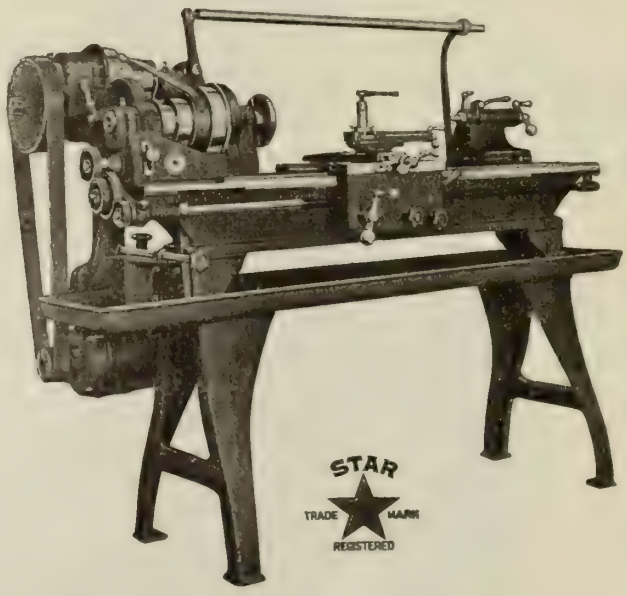


Illustration shows the "STAR" 11-inch swing, 5-foot bed, with Electric Motor Drive showing gear guard removed. Motor-drive can be furnished for 9", 12" and 13" "Star" Lathes on long legs or oil-pan.

THE SENECA FALLS MFG. CO., Inc.

366 W. Falls Street, SENECA FALLS, N.Y.

If interested tear out this page and place with letters to be answered

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Can. Link-Belt Co., Toronto.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

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Elec. Steel & Metals, Welland, Ont.

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H. H. Robertson, Ltd., Sarnia, Ont.

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Can. Driver-Harris Co., Ltd., Walkerville.

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The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

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Manhattan Machine & Tool Co., Grand Rapids, Mich.

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Can. Link-Belt Co., Toronto.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

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Dominion Abrasive Co., Mimico, Ont.

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James Chesterman & Co., Ltd., Sheffield.
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

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Lufkin Rule Co. of Can., Windsor.

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Lufkin Rule Co. of Can., Windsor.

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SAW MILL CONVEYORS
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Petrie, Ltd., H. W., Toronto.

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Strong, Kennard & Nutt Co., Cleveland.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

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SAND BLAST SUPPLIES AND ACCESSORIES
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Lawrence Welding Co, Ltd., Montreal

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SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md.

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Frost Mfg. Co., Chicago, Ill.

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Puro Sanitary Drinking Fountain Co. Haydenville.

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Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis.
A. R. Williams Machy Co., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

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Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Pierce Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

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Atkins & Co., E. C., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

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E. C. Atkins & Co., Inc., Indianapolis.

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Hunter Saw & Machine Co., Pittsburgh.
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Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

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Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

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Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

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Shore Instrument & Mfg. Co., New York.
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SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co. Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

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John Morrow Screw & Nut Co., Ingersoll.
National Acme Co. Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

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Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

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Butterfield & Co., Inc. Rock Island, Que.
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Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
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Jacobs Mfg. Co., Hartford, Conn.

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John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Geo. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y. Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

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Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

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John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

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E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
Quickwork Co., St. Mary's, Ohio.

SHEARS, SPLITTING
Dom. Steel Products Co., Ltd., Brantford.
Peck, Stow & Wilcox Co., Southington.

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SHEARS, SERPENTINE
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Peck, Stow & Wilcox Co., Southington, C.
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Peckovers, Ltd., Toronto, Ont.

SHEETS, NICKEL, RESIST, ALLOY
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Rice Lewis & Son, Toronto, Ont.
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Katie Foundry, Galt, Ont.

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Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

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Canada Machinery Corp., Galt, Ont.
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Niles-Bement-Pond Co., New York.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

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SOLDERING IRONS
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Prest-O-Lite Co., Inc., Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Globe Engineering Co., Ltd., Hamilton.
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John H. Hall & Sons, Brantford.
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Katie Foundry, Galt, Ont.
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.
National-Acme Co., Cleveland, Ohio.
Mesta Machine Co., Pittsburgh, Pa.
Rae Mach. Tool Co., Hamilton.
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Morse Chain Co., Ithaca, New York.

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Grant Gear Works, Boston, Mass.
Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia.

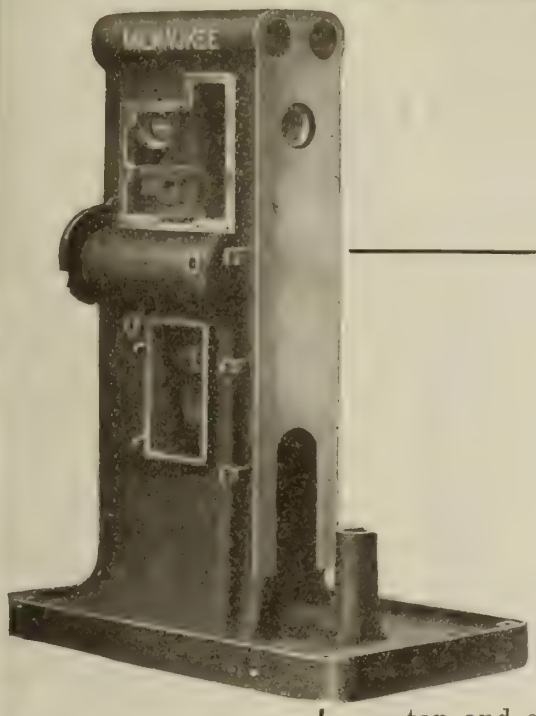
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Lyman Tube & Supply Co., Ltd., Montreal
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Katie Foundry, Galt, Ont.

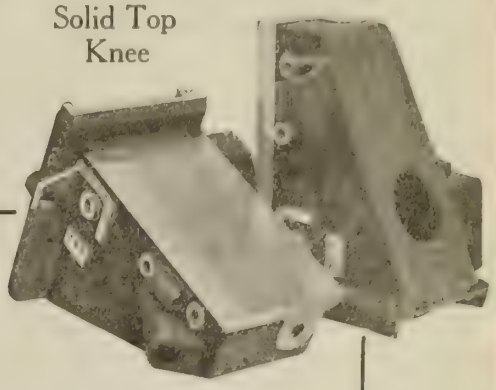
SQUARES
Peck, Stow & Wilcox Co., Southington, Conn.

MILWAUKEE MILLING MACHINES



Rigid
Box Section
Column

Solid Top
Knee

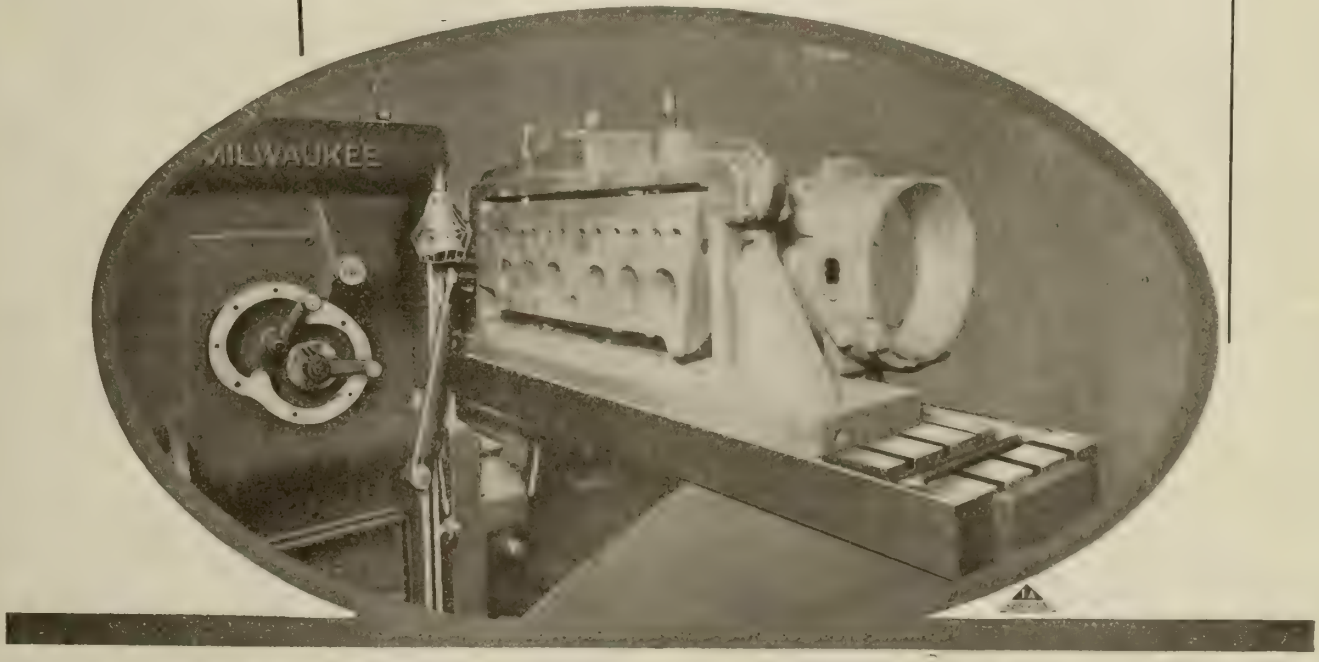


Rigidly Constructed

The column of Milwaukee Milling Machines is a one-piece, box section, heavily ribbed, semi-steel casting, reinforced with heavy vertical and horizontal internal walls. The base is pan-shaped to catch splashing oil and chips. The knee, like the column, is a semi-steel, box section casting with solid top and extended bearing. This combination gives Milwaukee Milling Machines maximum rigidity to withstand the severest strains of load or cut.

The illustration below shows a Milwaukee Milling Machine milling the cylinder casting of a six-cylinder motor. This casting with the jig used to hold it puts a weight of 1125 pounds on the column and knee. Not only have they held this tremendous weight, but the accuracy and alignment of the machine have not been affected. Let this superior construction help solve your milling problems.

Write for catalogue No. 21.



KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.

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SANDERS
Oliver Mach. Co., Grand Rapids, Mich.

SAW BENCHES
Oliver Mach. Co., Grand Rapids, Mich.

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Drury Co., H. A., Montreal, Que.
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Lyman Tube & Supply Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto, Ont.
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Vanadium-Alloys Steel Co., Pittsburgh.
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Bertrams, Ltd., Edinburgh, Scotland.

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MacKinnon Steel Co., Sherbrooke, Que.
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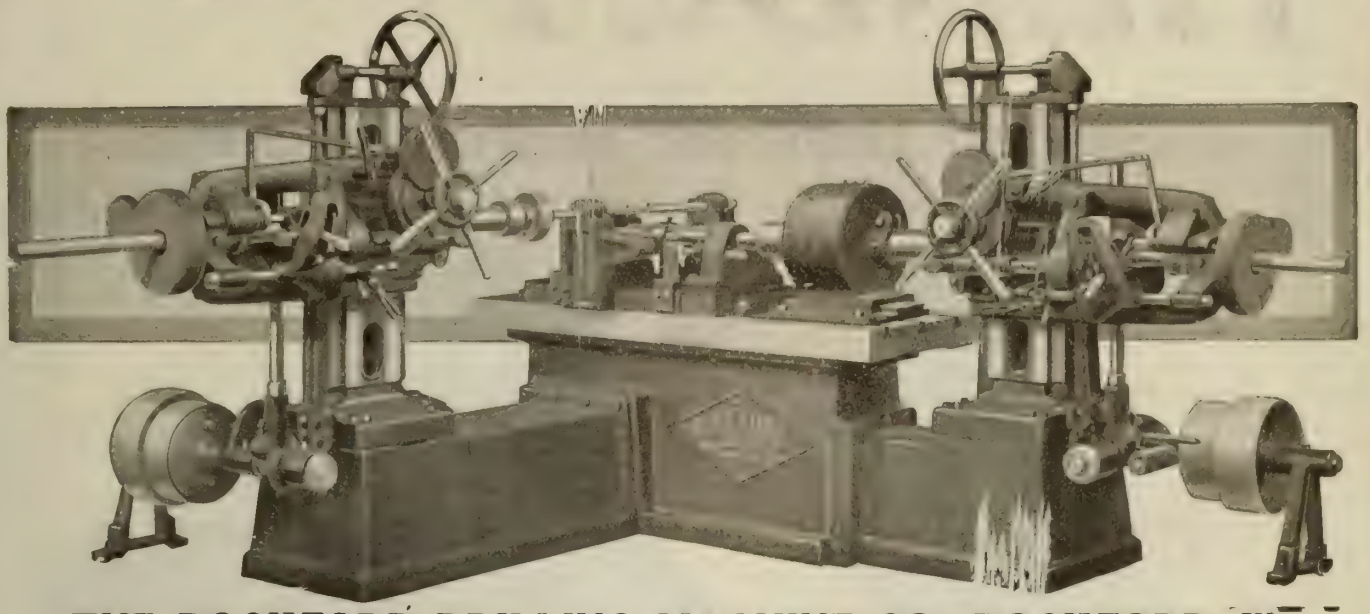
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"Best Lathe for Tool and Die Work"

According to a Statement by THE DOEHLER DIE CASTING CO.

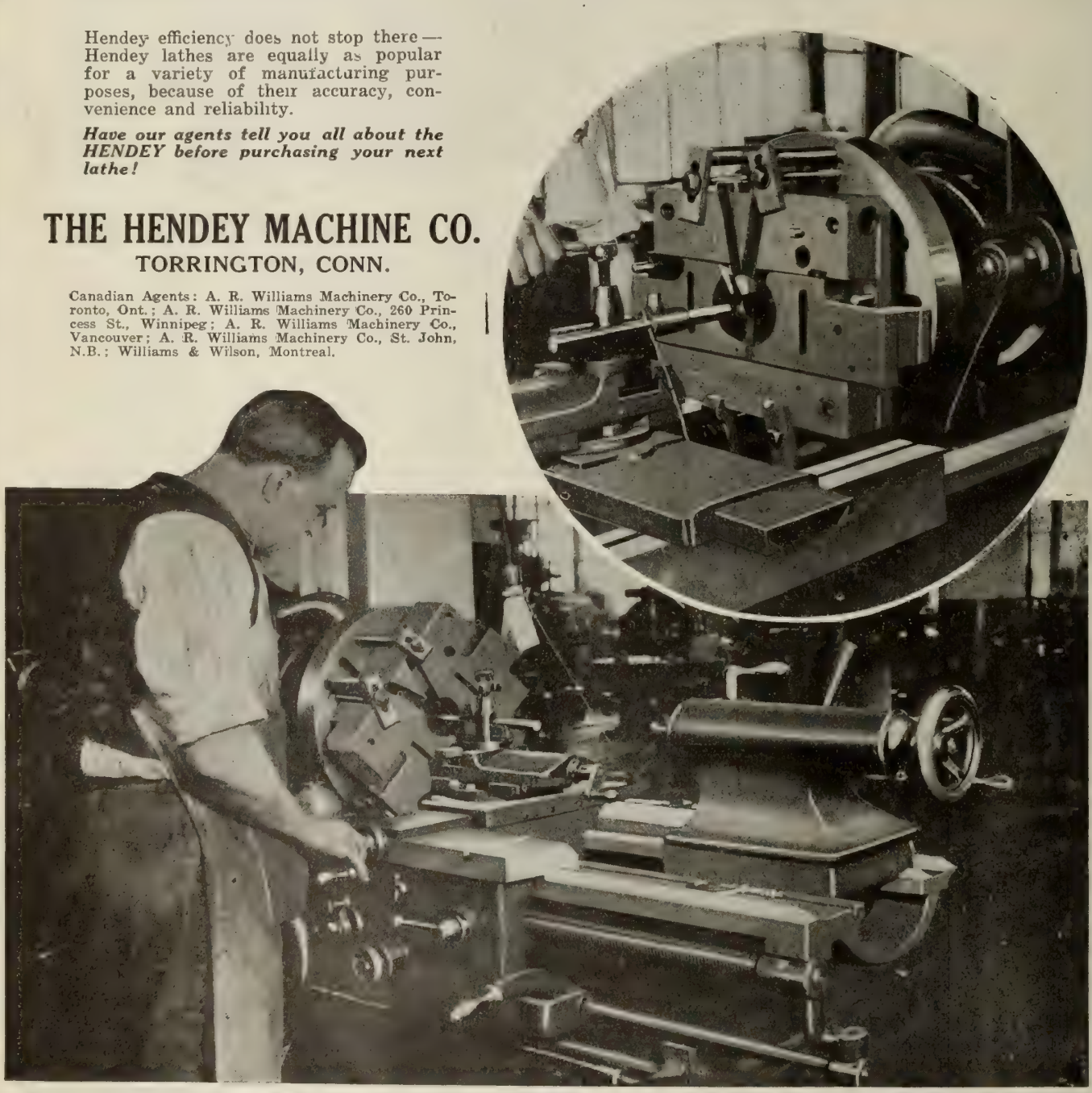
The illustrations show the Hendey finishing a die for casting parts for the Lewis Machine Gun in the Doehler Die-Casting Company shops.

Hendey efficiency does not stop there — Hendey lathes are equally as popular for a variety of manufacturing purposes, because of their accuracy, convenience and reliability.

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THE HENDEY MACHINE CO.
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FRASER No. 1 Universal Convertible Grinder

(Patented May 28, 1918)

MACHINE SET UP AS AN INTERNAL GRINDER



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By the change of heads the machine can be converted into an efficient high-speed internal grinder; also a surface grinder of considerable range.

PATENTED APRON CONSTRUCTION. All the springs on this machine are enclosed and can be removed or replaced without disturbing any other part of the machine.

Capacity: Cylindrical work 8 in. x 2 in.
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and up to 8 in. in height.

Some of the Lines we represent:

Tungsten Hack Saw Blades
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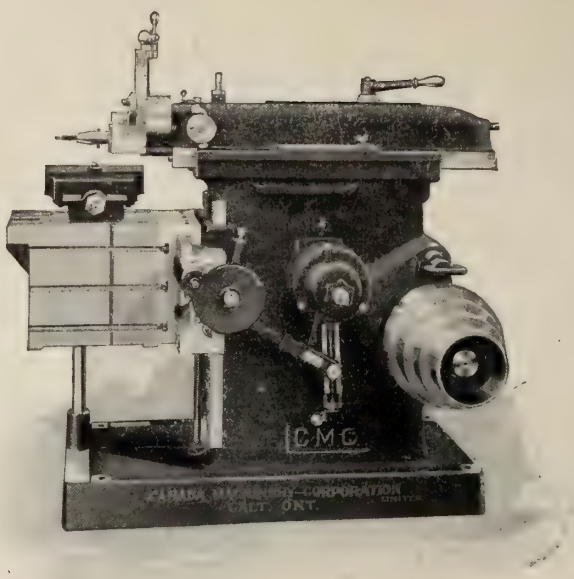
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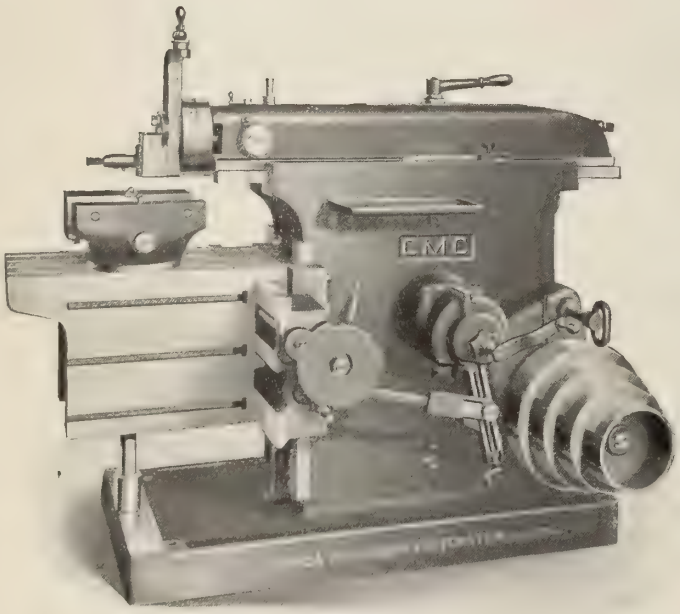
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- BEARINGS INTEGRAL WITH COLUMN



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SIZE 26"x30"

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CANADA MACHINERY CORPORATION LIMITED

GALT ONTARIO

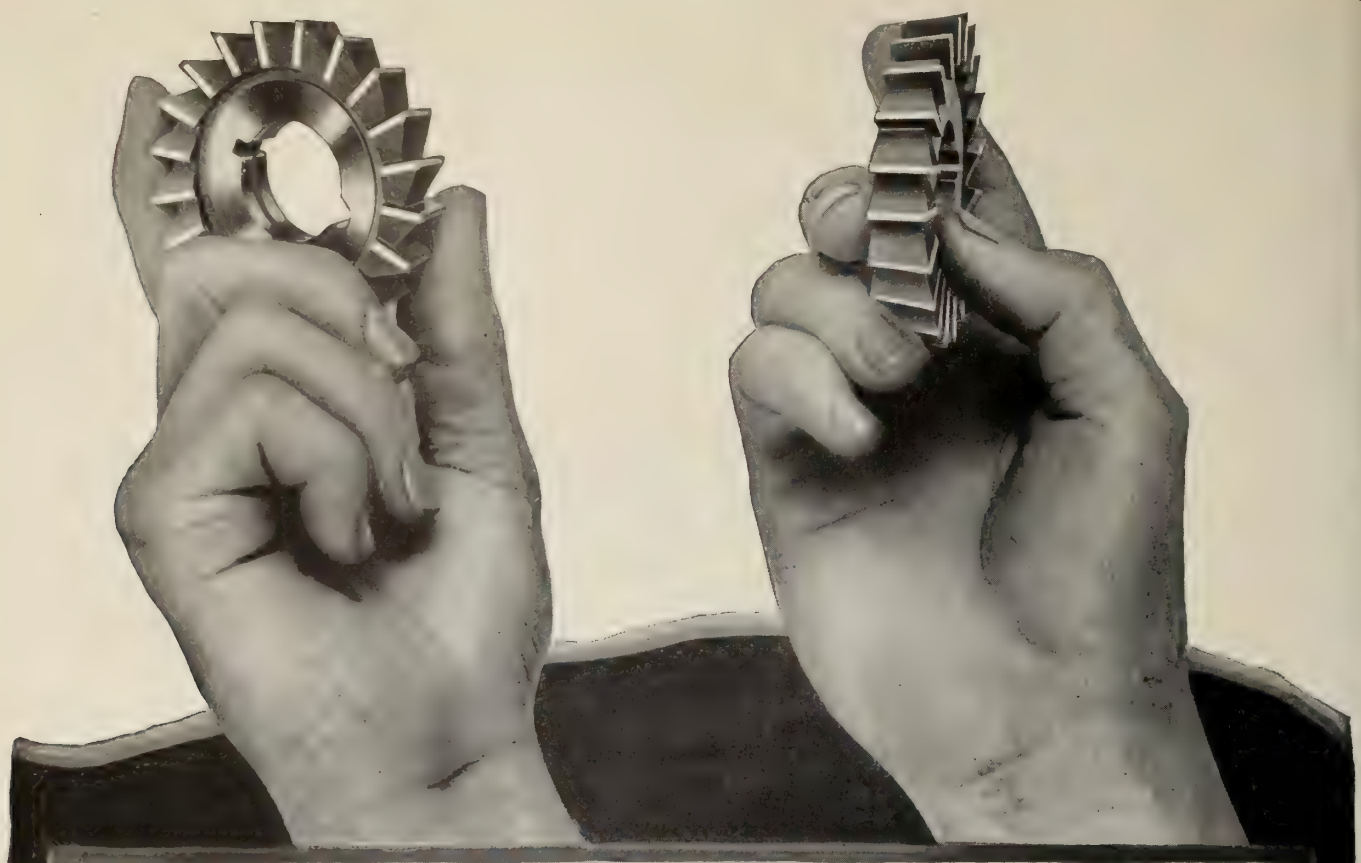
Toronto Office and Warerooms, Brock Avenue Subway

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

Vol. XXIII. No. 13. Publication Office: Toronto, March 25, 1920. $3.00 per year. Subscription Price





If it's speed you need—

One trial will prove the advantage of Pratt & Whitney Milling Cutters. No matter what the nature of the work they will give you the highest production the machine is capable of.

They're designed for free, fast cutting. And tempered and seasoned to last longer.

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Ask us for prices and details on Plain Milling Cutters, Side Milling Cutters, Inserted Blade End and Side Cutters, Screw Slot Cutters, Coarse Tooth Side or Plain Milling Cutters, Involute Gear Cutters, Concave, Convex and Double Angle Cutters, Cutters for Spiral Mills, Roll Thread Die Hobs, Key-Seating and Slotting Cutters, Straight and Spiral Cut End Mills (B. & S. and M. T. Shank), Spiral and Straight Shell End Mills, etc.

And we make formed cutters for special work also. All are backed by the guarantee for goodness that the P. & W. trademark indicates.

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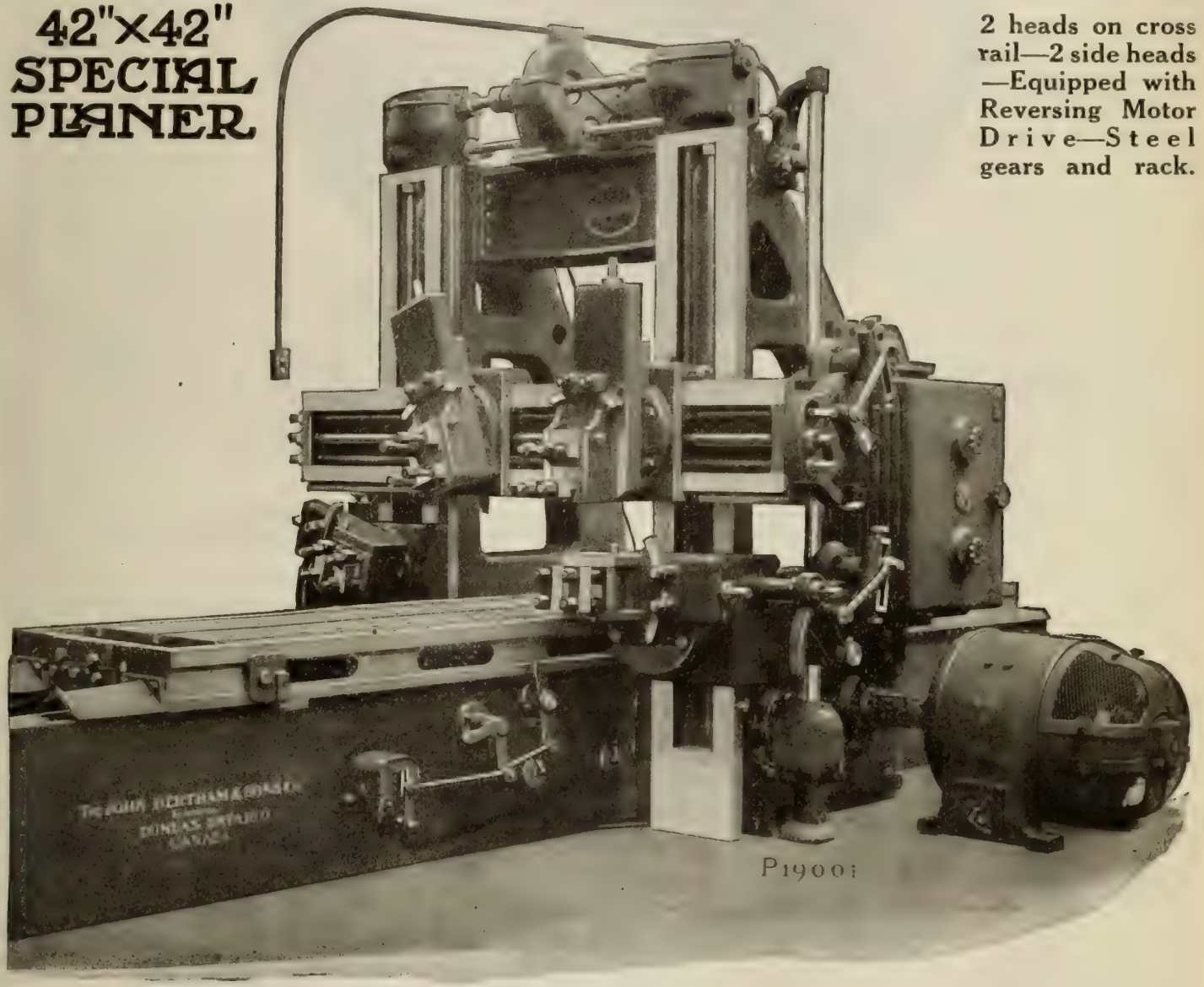
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42"x42" SPECIAL PLANER

2 heads on cross rail—2 side heads —Equipped with Reversing Motor Drive—Steel gears and rack.

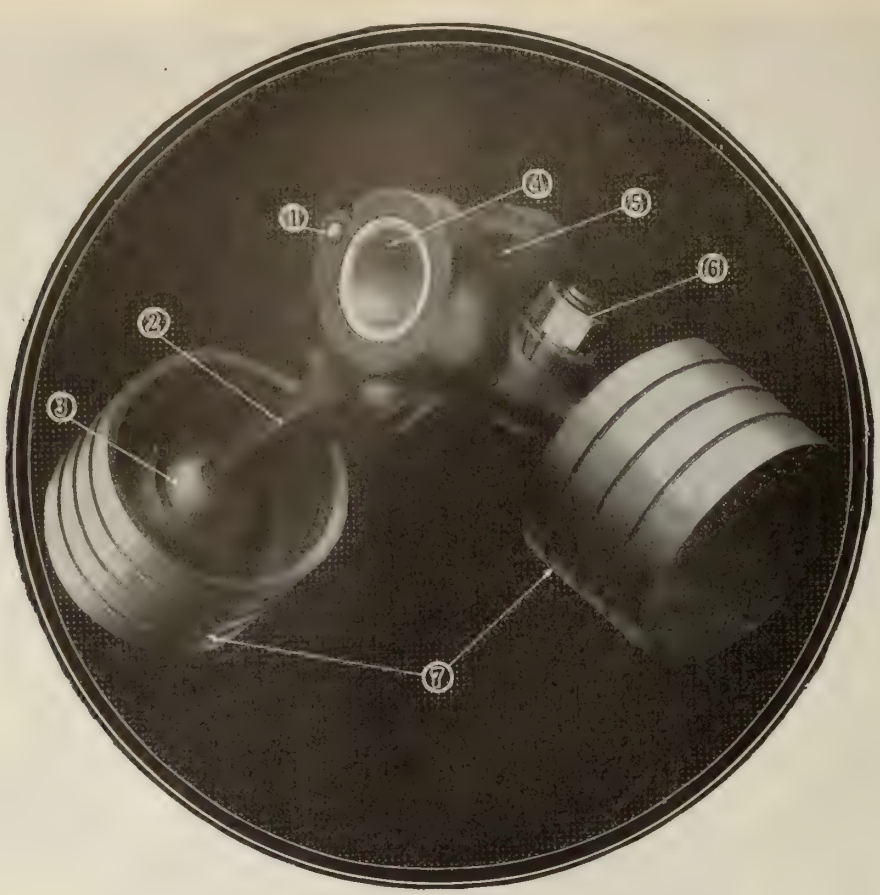


The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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Canadian Machinery and Manufacturing News, March 25th, 1920. Vol. 23, No. 9. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class [illegible] Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.



A new factor in the elimination of drill repairs

1 Hinge pin inserted in blind hole with outer end spun over—prevents pin from coming out.

2 One-piece connecting rod—eliminates all joints, eye-holes and toggle nuts.

3 Spherical bearing—allows piston perfect freedom of action.

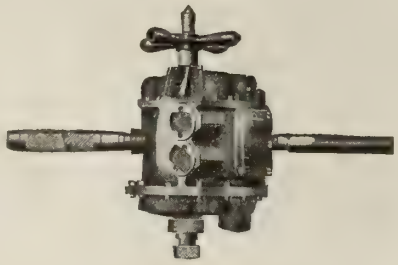
4 Hardened steel crank pin bearing—quickly replaceable when worn.

5 Large opening to bearing—assures constant and abundant lubrication.

6 Taper-seated lock nut on a through bolt—eliminates cotter pins, lock washers, etc., simplifies assembly.

7 One-piece hardened and ground pistons—thoroughly heat-treated.

THE economy of quickly *replacing* a worn or burned out toggle bearing, instead of scrapping and replacing an entire toggle, will be recognized



by every user of air drills.

Stock delivery of Little Giant Air Drills is now possible from any of the Company's branches listed below.

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BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · · VACUUM PUMPS · · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · · ROCK DRILLS · · COAL DRILLS

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Canada's Premier Machinery House

Toronto Hamilton

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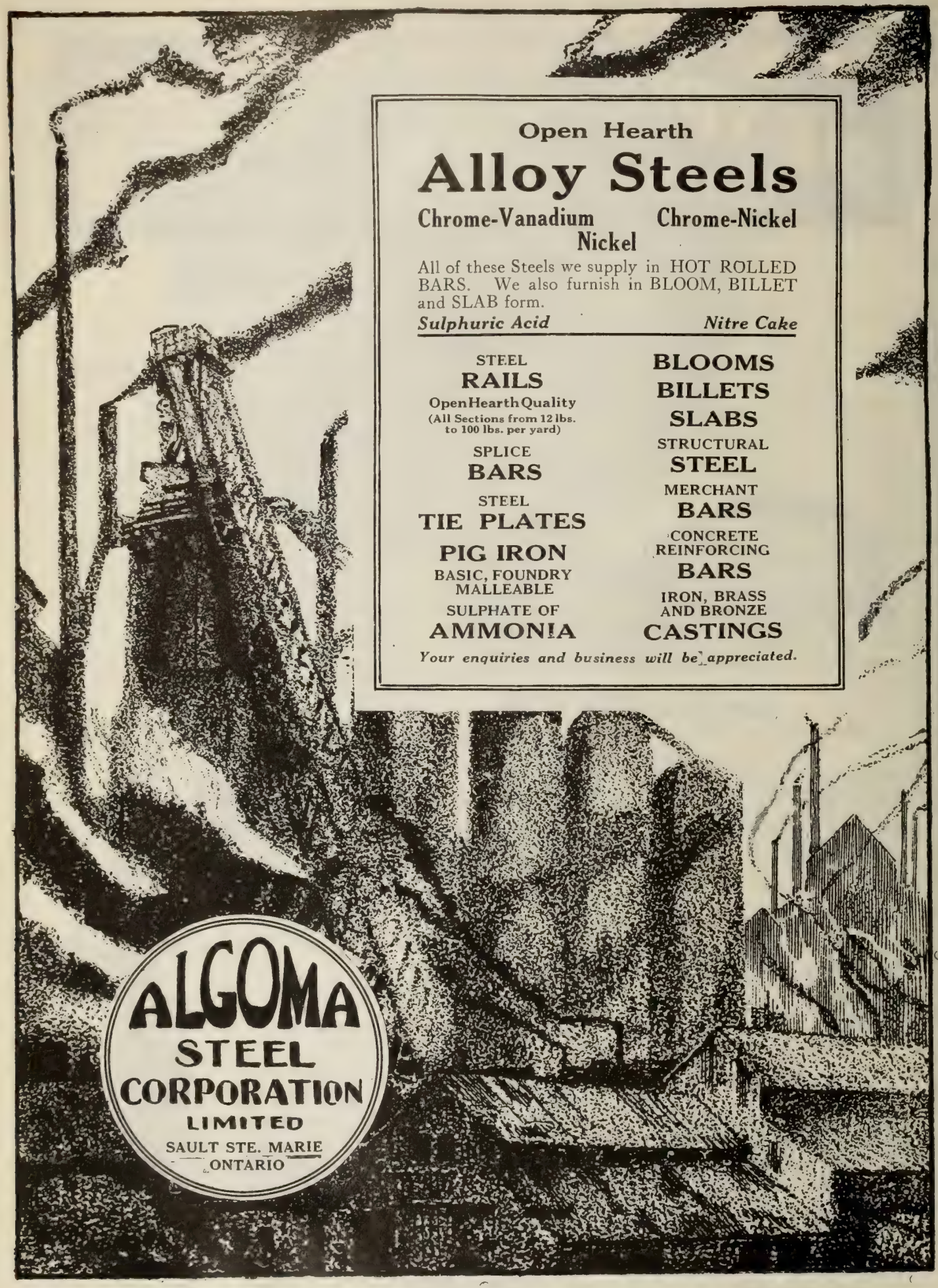
American Pulley Co.,
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MR. MANUFACTURER:
We have a staff of experts which we have developed and retained to give advice on machinery problems. Consult us freely. You'll find our advice both valuable and authoritative, as well as prompt.
Write, wire or phone.

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Alloy Steels
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All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.
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ONTARIO

WILT

HIGH SPEED & CARBON TWIST DRILLS, REAMERS AND MILLING CUTTERS



"There's a Tool You can Depend upon"

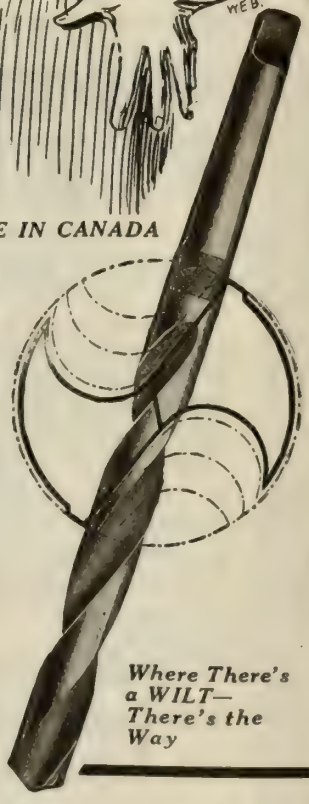
When a mechanic points to a WILT TOOL and exclaims: "There's a tool you can depend upon" (which is frequently the case) he means that WILT TOOLS have impressed him with their

Remarkable Strength, Endurance and Ability to Stand Up Under High Speed with Minimum Re-grinding

Any mechanic who has used WILT PRODUCTS will tell you that you can drive them hard—that they are unsurpassed for heavy, steady duty, and they proved it in the shops of Canada during the high-speed production days of the war.

Use Wilt Products for dependable and economical service

MADE IN CANADA



Where There's a WILT— There's the Way

WILT TWIST DRILL COMPANY OF CANADA, LIMITED

WALKERVILLE ONTARIO

London Office: **Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London, E.C.2, Eng.**

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CUT DOWN YOUR OVERHEAD EXPENSE

With "CIRCO" Direct Lift Air Hoists



Frank Richards, Technical Editor of Compressed Air Magazine, estimates that at a gauge pressure of 100 pounds, compressed air costs 5c per 1,000 cubic feet, and basing his determination on this, the rated lifting capacities and free air consumption of various sized direct-lift hoists per foot of lift at 90 pounds pressure and allowing a margin of 30% for such contingencies as taking up slack in the rope, etc., has compiled the following table of costs per 4-foot lift and per 100 4-foot lifts.

TABLE OF HOISTING COSTS

Diam. of Cyl.	Effective Area of Piston	Maximum Weight Lifted	Cu. Ft. of Free Air per 4-ft. Lift	Cost of Air Per Lift	Cost of Air per 100 Lifts
3	6.87	618	1.67	$.000084	$.0084
4	12.22	1,099	2.97	.000149	.0149
5	19.09	1,718	4.64	.000232	.0232
6	27.49	2,444	6.68	.000334	.0334
7	37.42	3,367	9.09	.000455	.0455
8	48.47	4,398	11.88	.000594	.0594
9	61.85	5,566	15.03	.000752	.0752
10	76.36	6,872	18.56	.000928	.0928
11	92.39	8,315	22.46	.001123	.1123
12	109.96	9,896	26.73	.001337	.1337

Study these figures, then ask our nearest branch for bulletins and any other information on air hoists that you would like to have.

CANADIAN INGERSOLL-RAND CO., LIMITED

SYDNEY SHERBROOKE MONTREAL TORONTO COBALT WINNIPEG NELSON VANCOUVER

STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.



Steel Ingots
by the
HARMET
Liquid Process

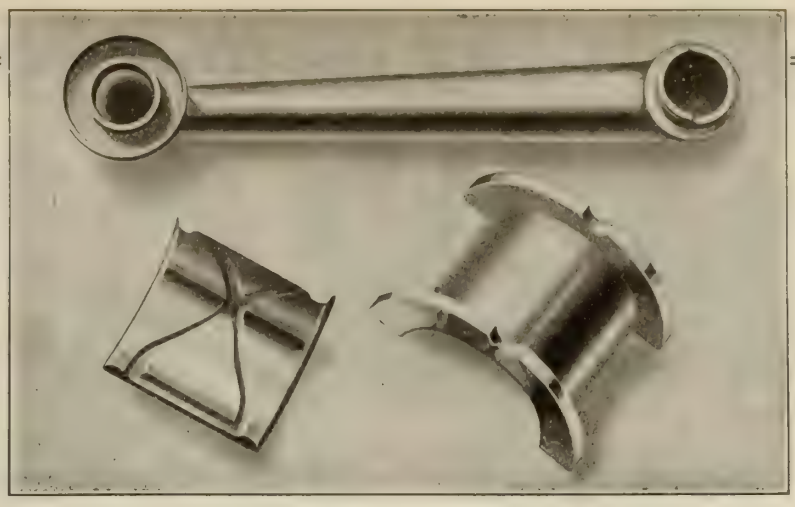
Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

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Room 14 Windsor Hotel
MONTREAL

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Doehler Service



Die Castings

Doehler Quality

We have purchased the Canadian Rights for the Doehler Die Casting Process and are now manufacturing castings in our factory at Hamilton.

Enquiries Solicited

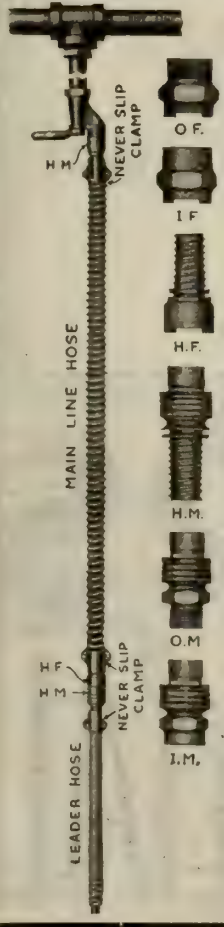


Tallman Brass & Metal Limited

HAMILTON, ONT.



CLEVELAND HOSE SPECIALTIES



Bowes Automatic Air Hose Couplings

Standard Equipment Everywhere

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.
STYLE I.F. is an inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.
STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-in. to 1½-in.
STYLE O.M. is an Inside Thread Male Pipe End Made in sizes ¼-in. to 1½-in.
STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-in. to 1½-in.
The Male and Female Ends of Bowes Couplings interchange in sizes ¼-in. to ¾-in. Sizes 1-in. and 1¼-in. interchange. The 1½-in. ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-in.

The Cleco Never Slip Hose Clamp

Made in same sizes as Bowes Couplings

The adjoining cut of Cleco Never Slip Hose Clamp shows the "Flanges" which engage the groove provided in all hose ends of Bowes Couplings. The "Model Hose Line" illustrated shows correct styles of couplings and valve to use and proper way to attach the clamps.



CLECO GROOVED HOSE NIPPLE



Grooved Nipples when attached to hose with the wire clamp cannot "blow-out," as one-half of the Wire Clamp lies in Nipple Groove, and the other half on the hose, uniting nipple and hose permanently.

WIRE CLAMP TOOL

To apply Wire Clamps to Grooved Hose Nipples you need the Wire Clamp Tool illustrated, a small hand-operated tool at moderate cost which we carry in stock for immediate delivery. In Stock: Riveting and Chipping Hammers, Four-piston Air Drills, Corner Drills, Emery Grinders, Sand Rammers, Holder Ons, etc.



Use Annealed Wire No. 14

Write for Bulletin 38 illustrating Cleco Hose Fittings, Couplings, Valves, etc.

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and stop costly leaks.

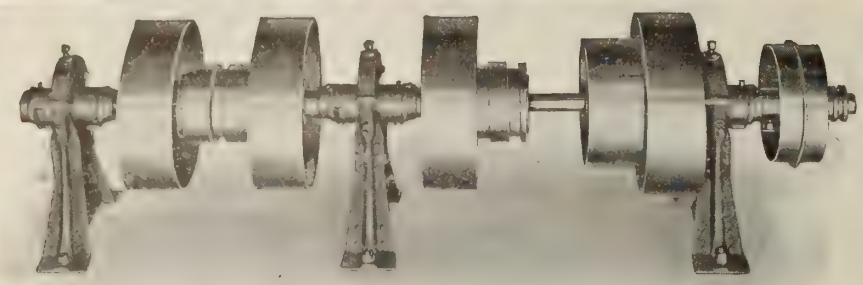
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A. R. WILLIAMS MACHINERY CO., TORONTO, 337 Craig St., W., MONTREAL. WILLIAMS & WILSON, MONTREAL

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THE JOHNSON FRICTION CLUTCH



Put Johnson Clutches on Your Countershafts

Here's a countershaft equipped with three Johnson Clutches—two of the single type and one of the double—providing two speeds, a reverse, and a light auxiliary drive. An exceptionally neat and compact construction is obtained, light in weight and smooth running.

Wherever reliable high grade equipment is desired, Johnson Clutches are the selection. For general transmission purposes there is no clutch more reliable, and none so adaptable to all conditions. Johnson Clutches in special types have also been incorporated successfully in machinery of all kinds. Their exceptional fitness for this line of work is described in our booklet, "Clutches as Applied to Machine Building."

Write for our Yellow Catalog.

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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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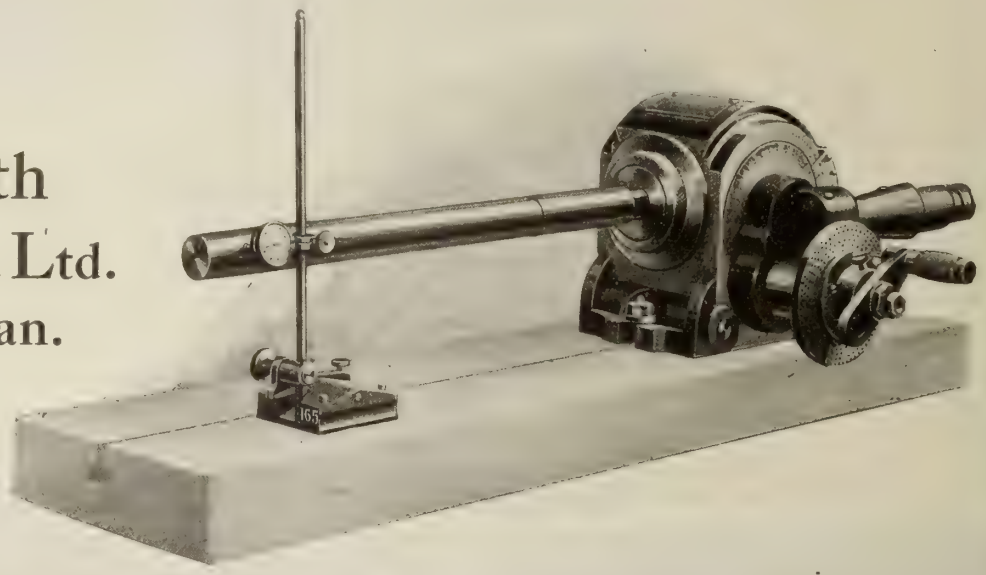
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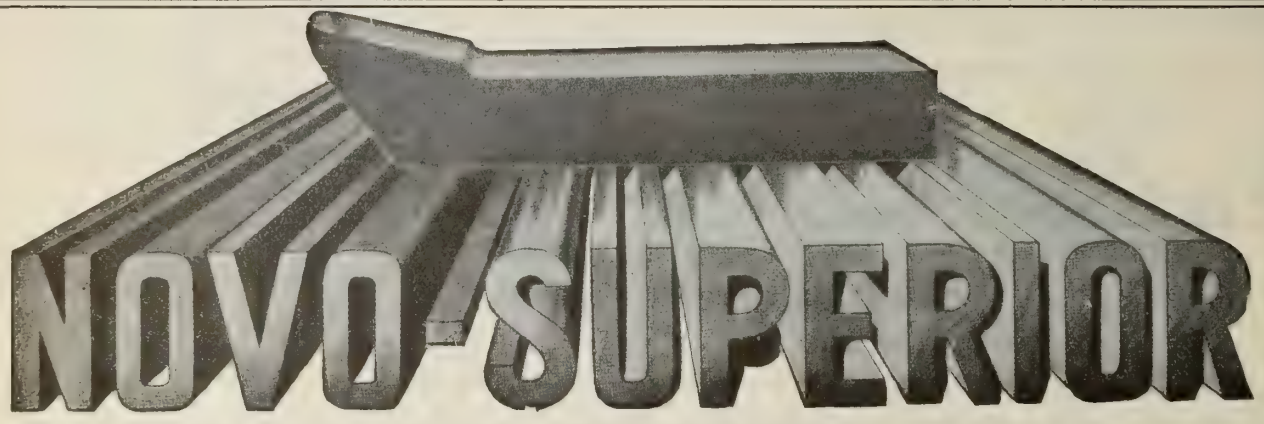
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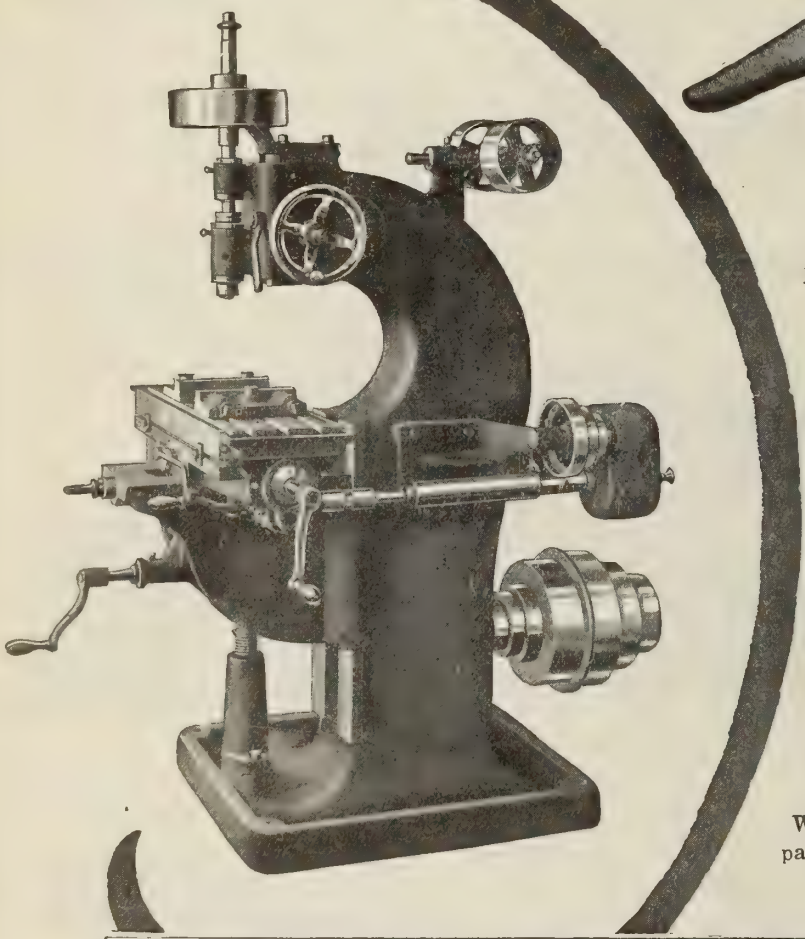
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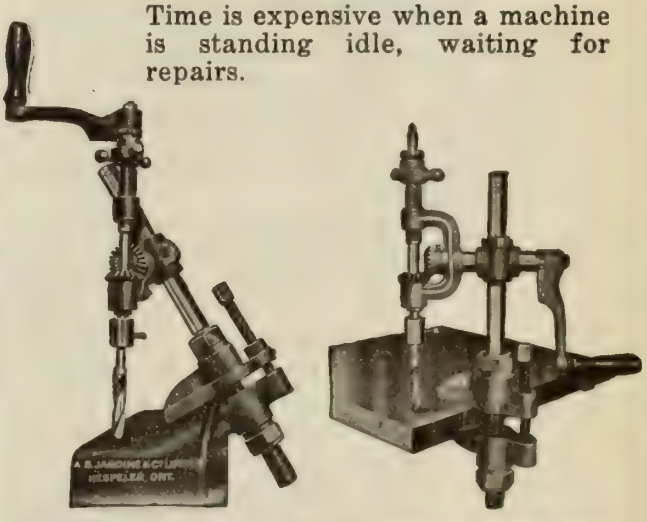
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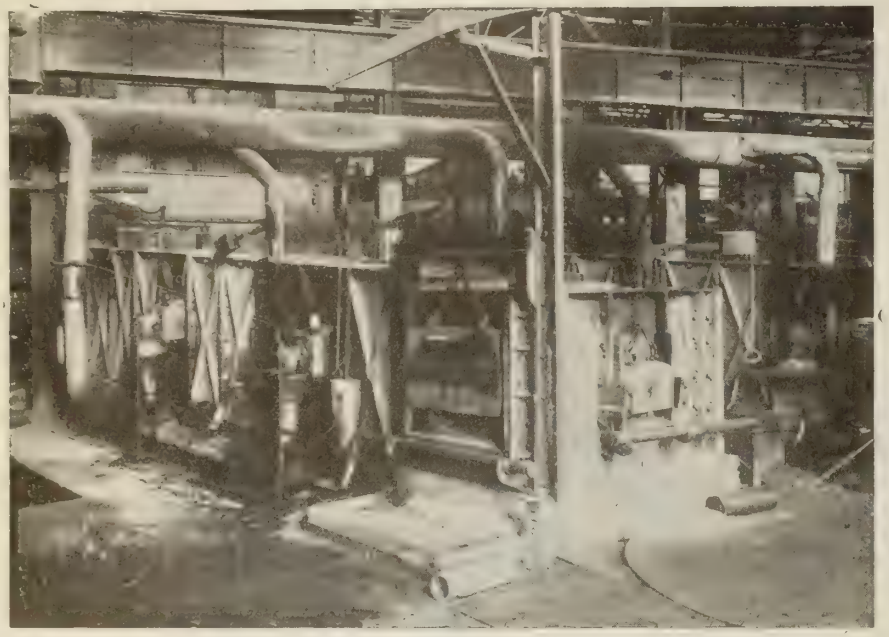
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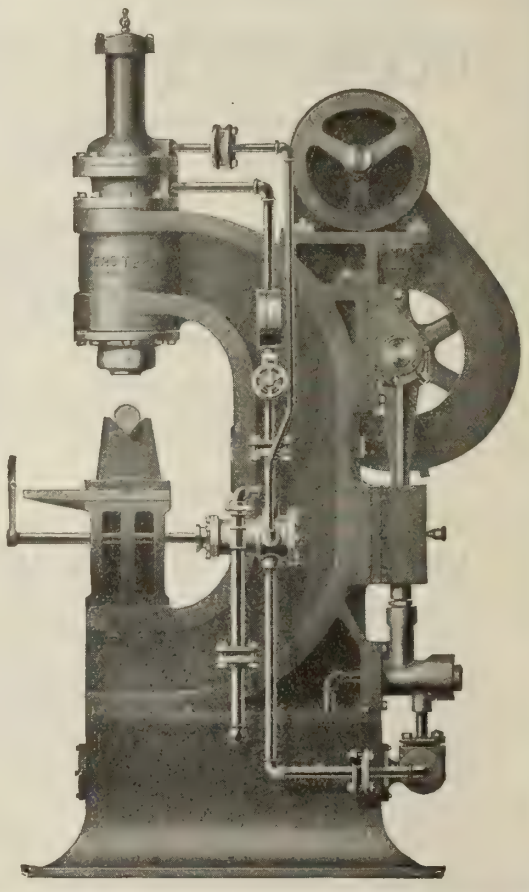
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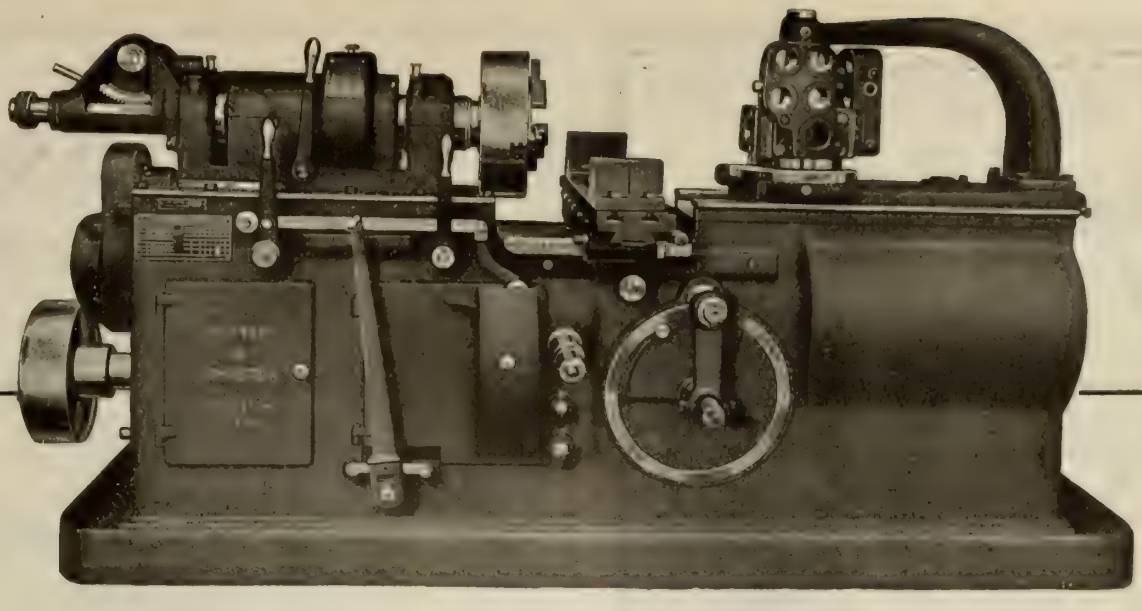
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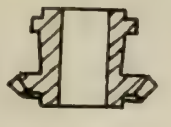
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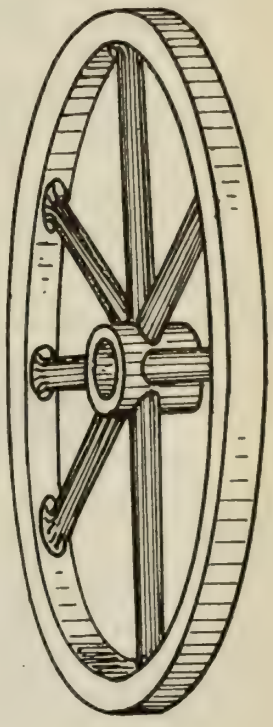
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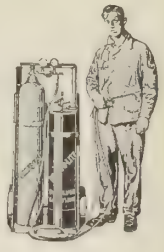
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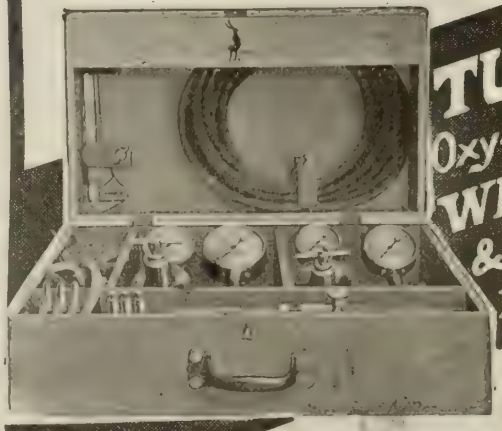
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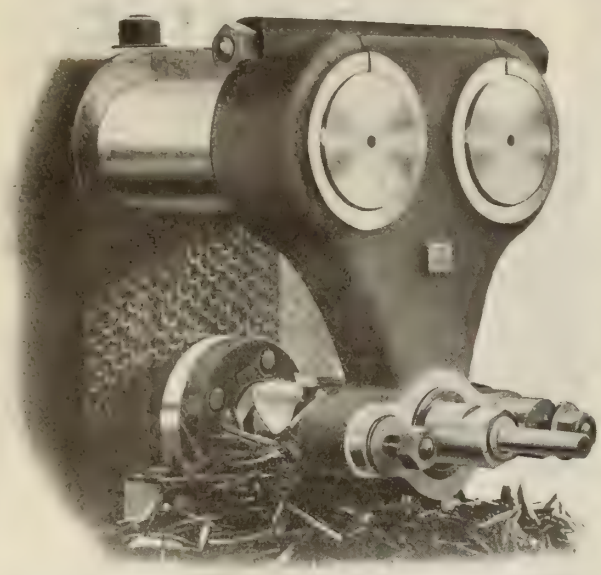
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These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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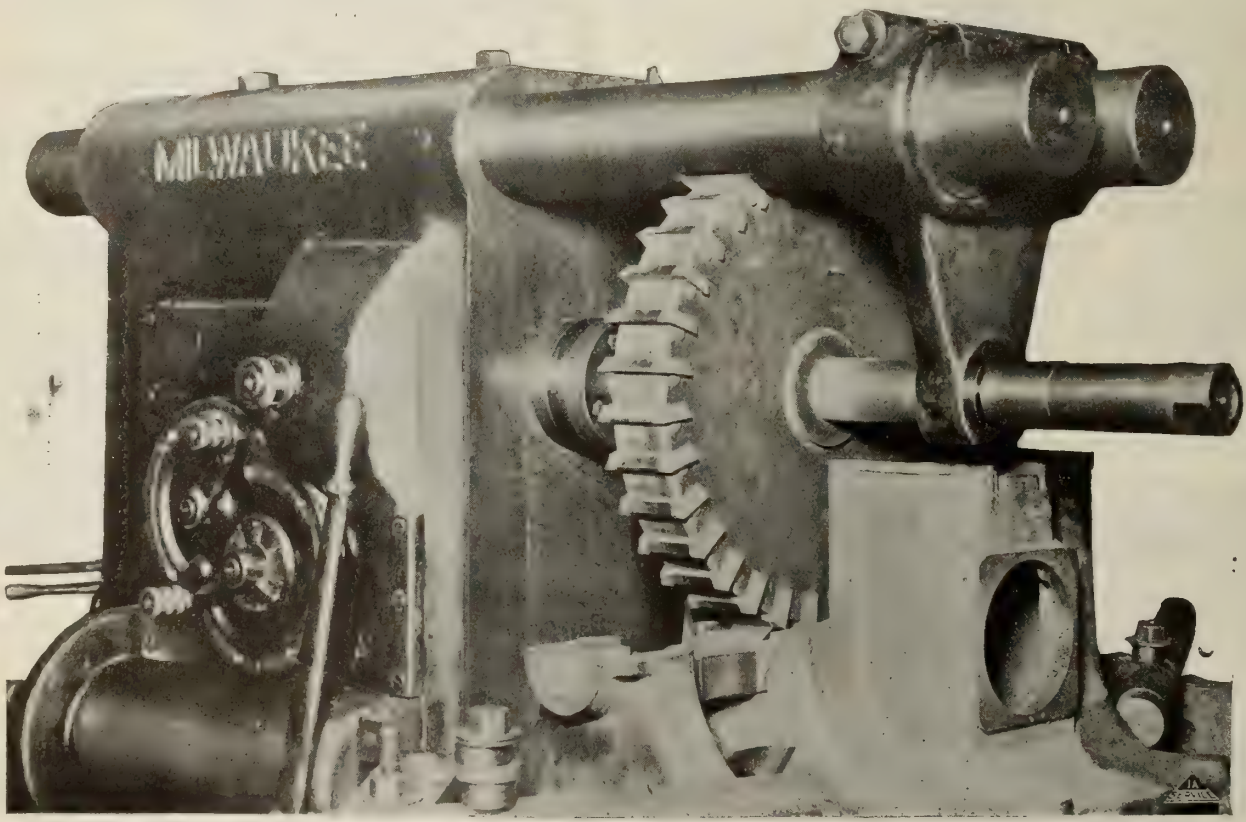
Rigid Under Any Cut

The illustration below shows the milling of cap seats of a crank case on a No. 3B Plain Milwaukee Milling Machine.

Owing to the design of the piece it was necessary to employ a cutter 18 in. in diameter with 3⅛ in. face. On account of the large size of the cutter a part of the double overarm had to be cut away. However, even this did not impair the efficiency of the machine.

The double overarm provides for positive alignment of the arbor and allows effective milling to be performed at a greater distance from the face of the column. This construction also affords such a degree of rigidity that milling may often be done without the arm braces.

Milwaukee Milling Machines possess many other features of merit. They are all illustrated and described in catalogue No. 21, a copy of which will be sent on request.



KEARNEY & TRECKER CO. MILWAUKEE, WIS. U.S.A.



Pointers on Better Gaging



Locating Holes with a Johansson Compound Slide

A NEW tool has been designed to make easy, as well as accurate, the spacing of holes in drill jigs, dies and master plates. Every toolmaker knows the amount of time required to do such laying out by means of the button method and realizes the chance for mistakes. Although the use of size blocks directly on the face of the plate is better than the button method and is accurate as well as fairly rapid, still this direct method calls for parallels which must be carefully adjusted at right angles on the face plate of the lathe or miller table. Also, this usually means that it is necessary to square and finish the sides of the working piece. Then, too, as the work progresses, the toolmaker must unclamp and reclamp the pieces on every shift. Therefore, it will be seen that the Compound Slide developed by Mr. Johansson not only insures "Johansson Accuracy," but also gives great simplicity of operation and saving of time.

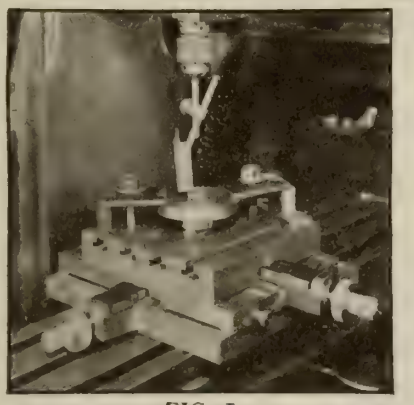


FIG. I
Locating the Center Hole

The fixture consists of a base on which there are two sliding planes operating at right angles. Each plane has a range of three and one-half inches giving a wide working area. The top plane measures 7½ x 7½ inches and the distance from its surface through the base is three and one-half inches. The weight of the whole fixture is fifty-five pounds.

The planes are operated by two thumb screws. These screws have ratchet stops so that the pressure is uniform on the blocks inserted to secure the required spacing. The sides are also equipped with clamping screws so that they may be held fast during the working operation.

As the size of the slides is known, the distance of the first hole from the sides may be taken directly from the drawing. After one hole has been bored and located, Figure I, the piece may be quickly positioned for the next hole by merely making up the required distance with Johansson Blocks and inserting these combinations in their places above the thumb screws, see Figure II. No errors are possible through the misreading of a graduation, through the play of a lead screw, or the other usual sources of slips. Figure III shows the last hole being drilled in a die. The four small holes in line having been located in the same, simple, accurate manner by using the Johansson Blocks in the slides after first fixing the position of the large hole in the die shown just back of the drill in the view.

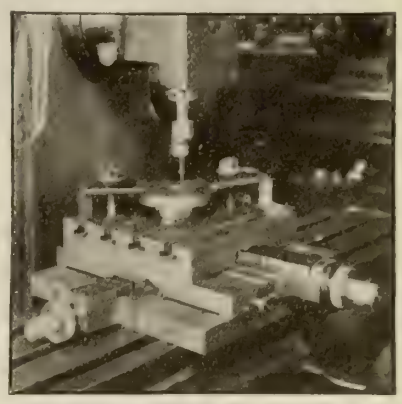


FIG. II
Using Johansson Gages of the correct sizes in the Slides to locate other holes

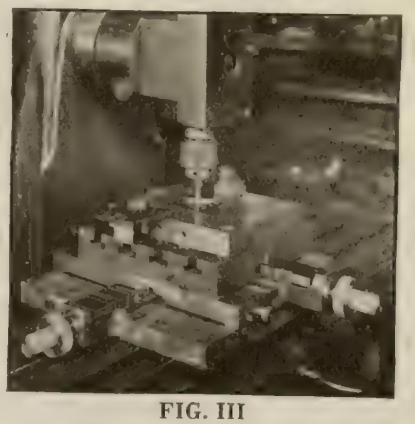


FIG. III
Drilling a hole in a Die

If you are interested in the possibilities of the Johansson Compound Slide as a working tool in your shop, drop us a line

C-E-Johansson-Inc Johansson ACCURACY Poughkeepsie-N-Y



Wide Range, Few Dies, Small Expense

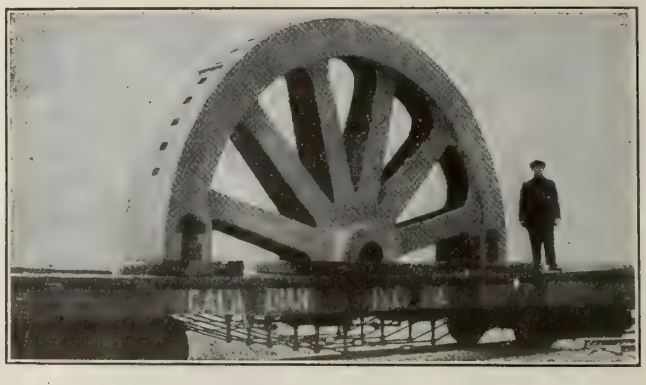
The No. 1 Hartness die will thread from 3/32 inch to 9/16 inch diameter, all pitches.
The entire range from ¼ inch to 2¾ inch for standard threads, and to 3 inches for 8 pitch or finer, is covered by three sizes of dies, whose ranges overlap.
And any of these dies, even the large No. 9, will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

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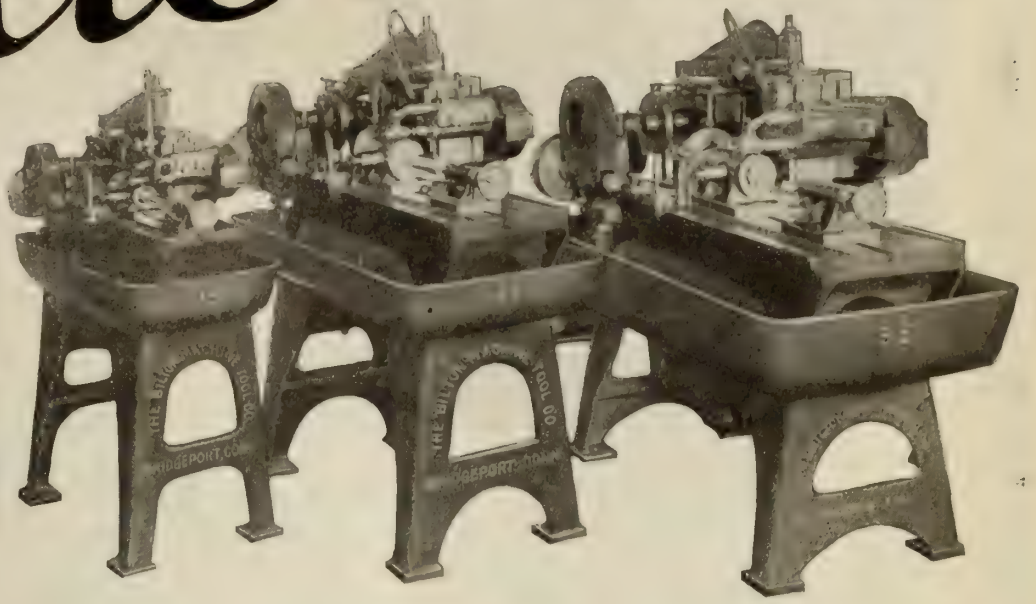
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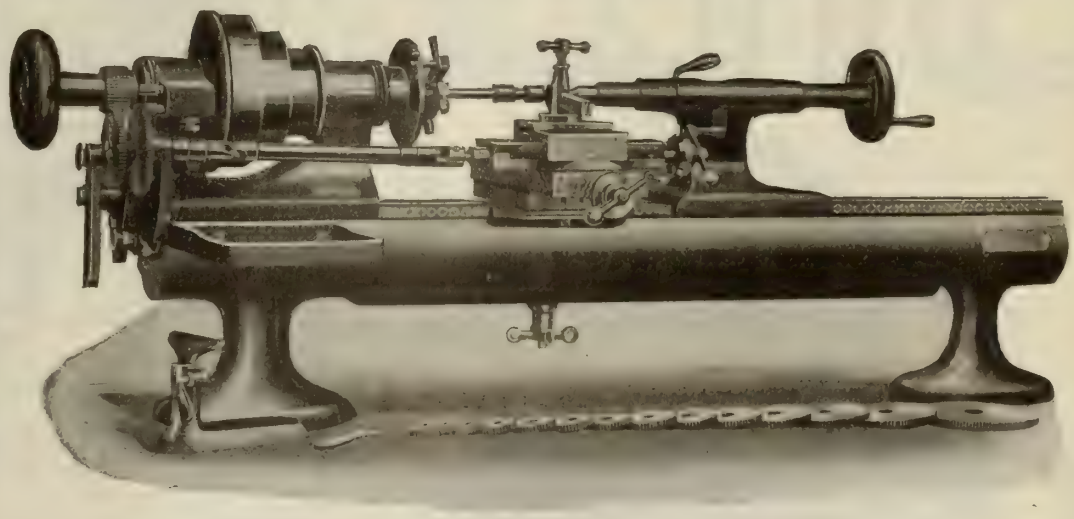
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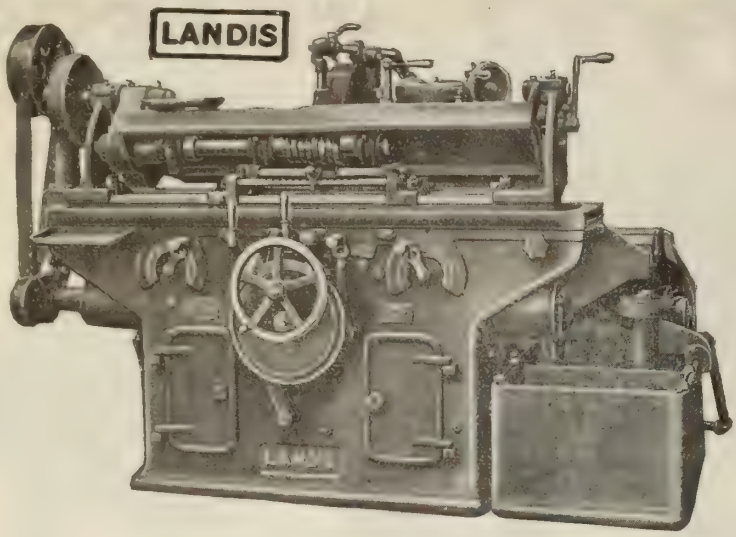
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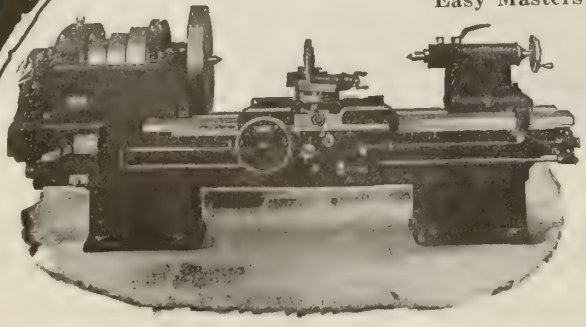
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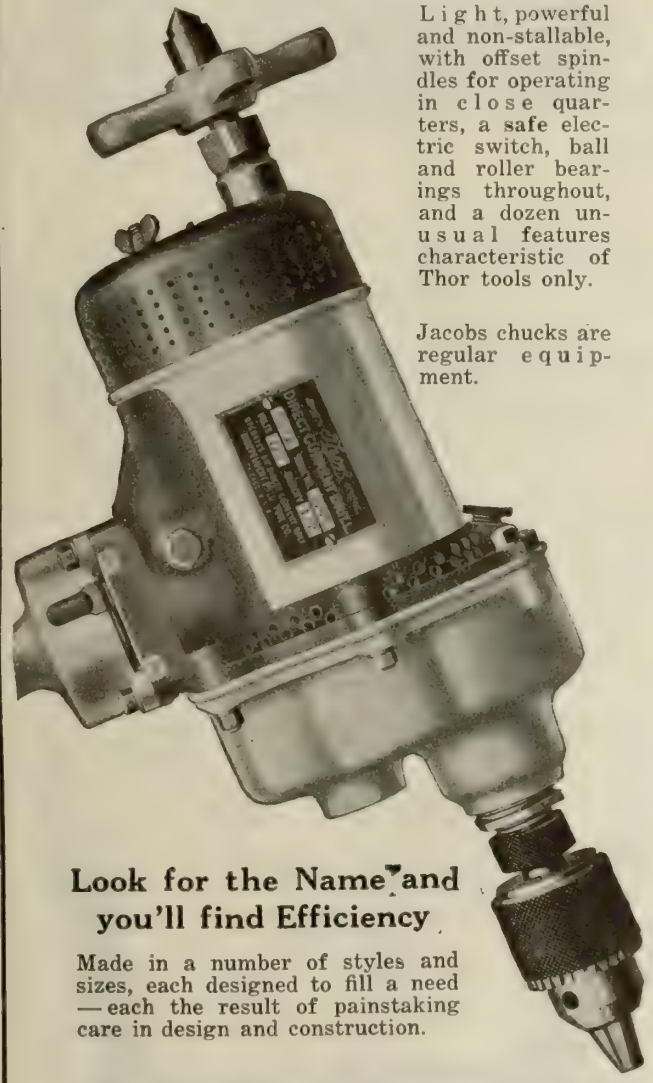
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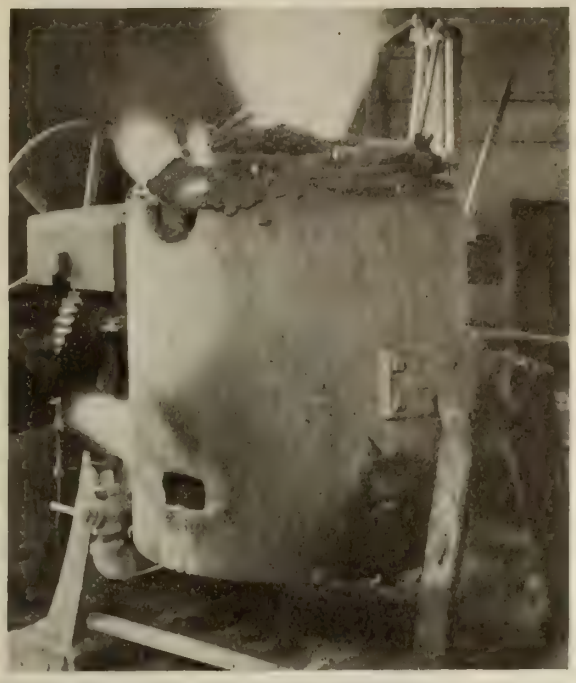
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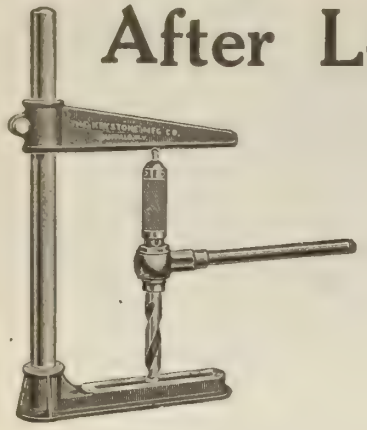
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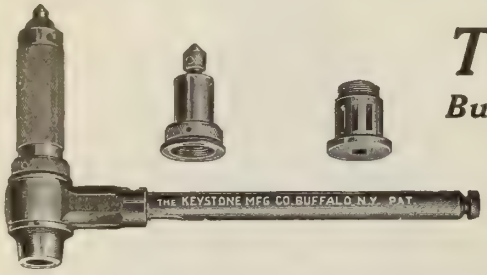
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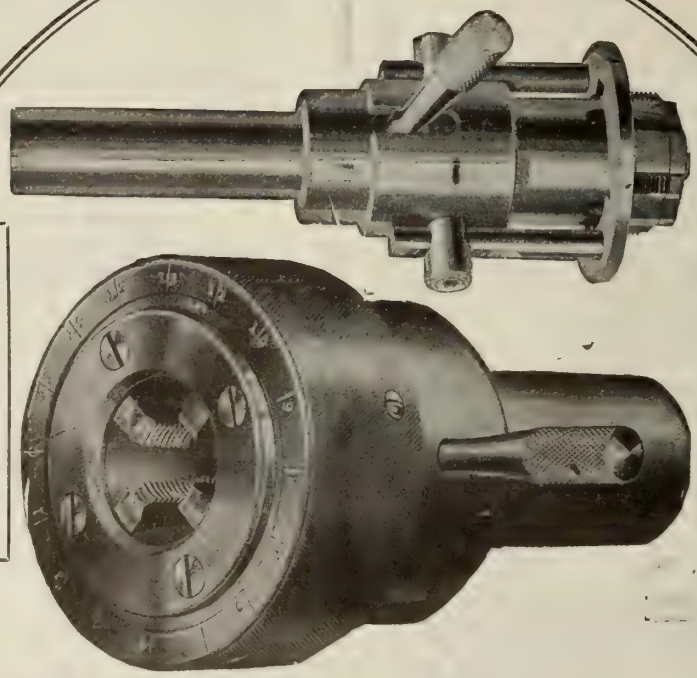
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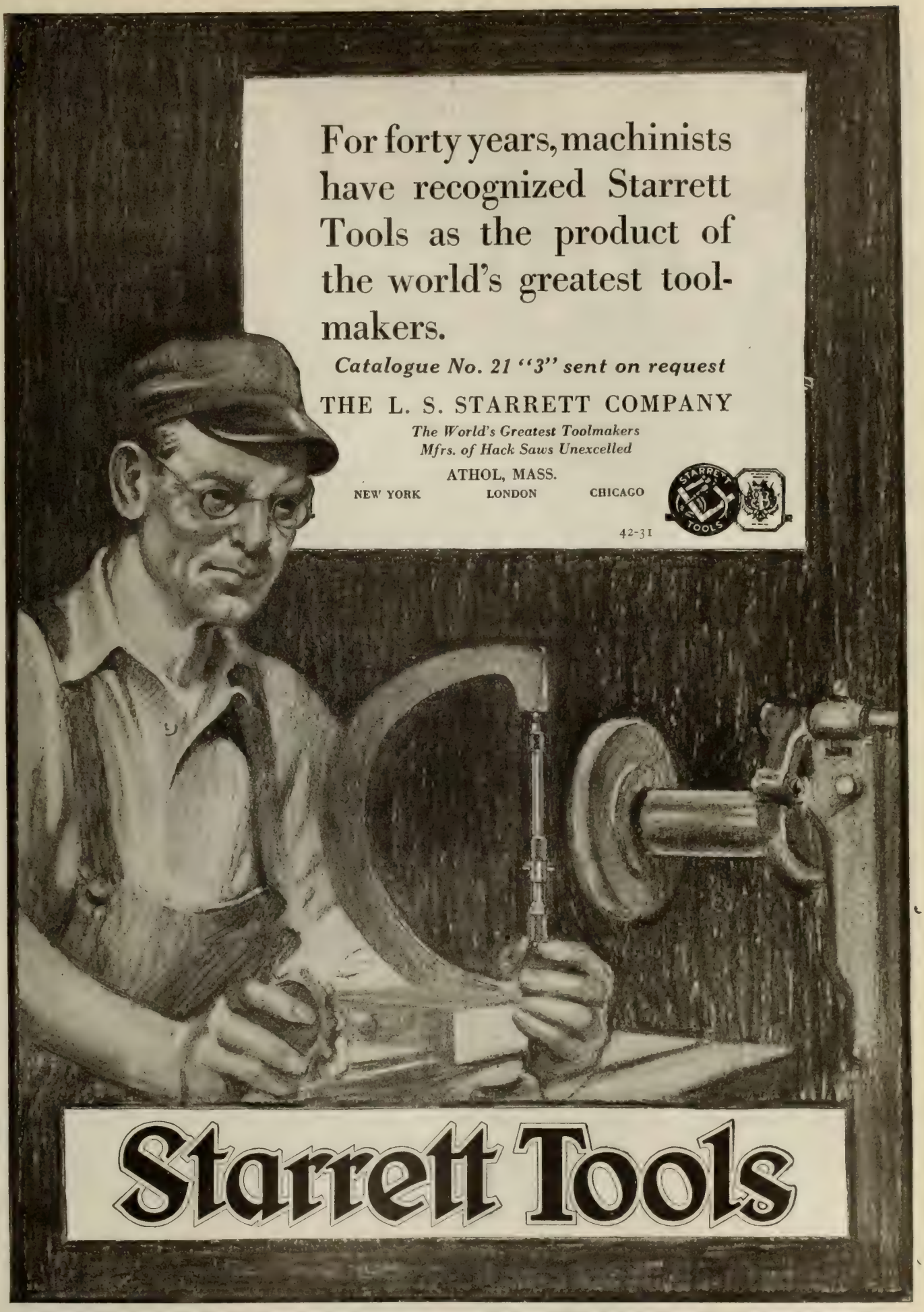
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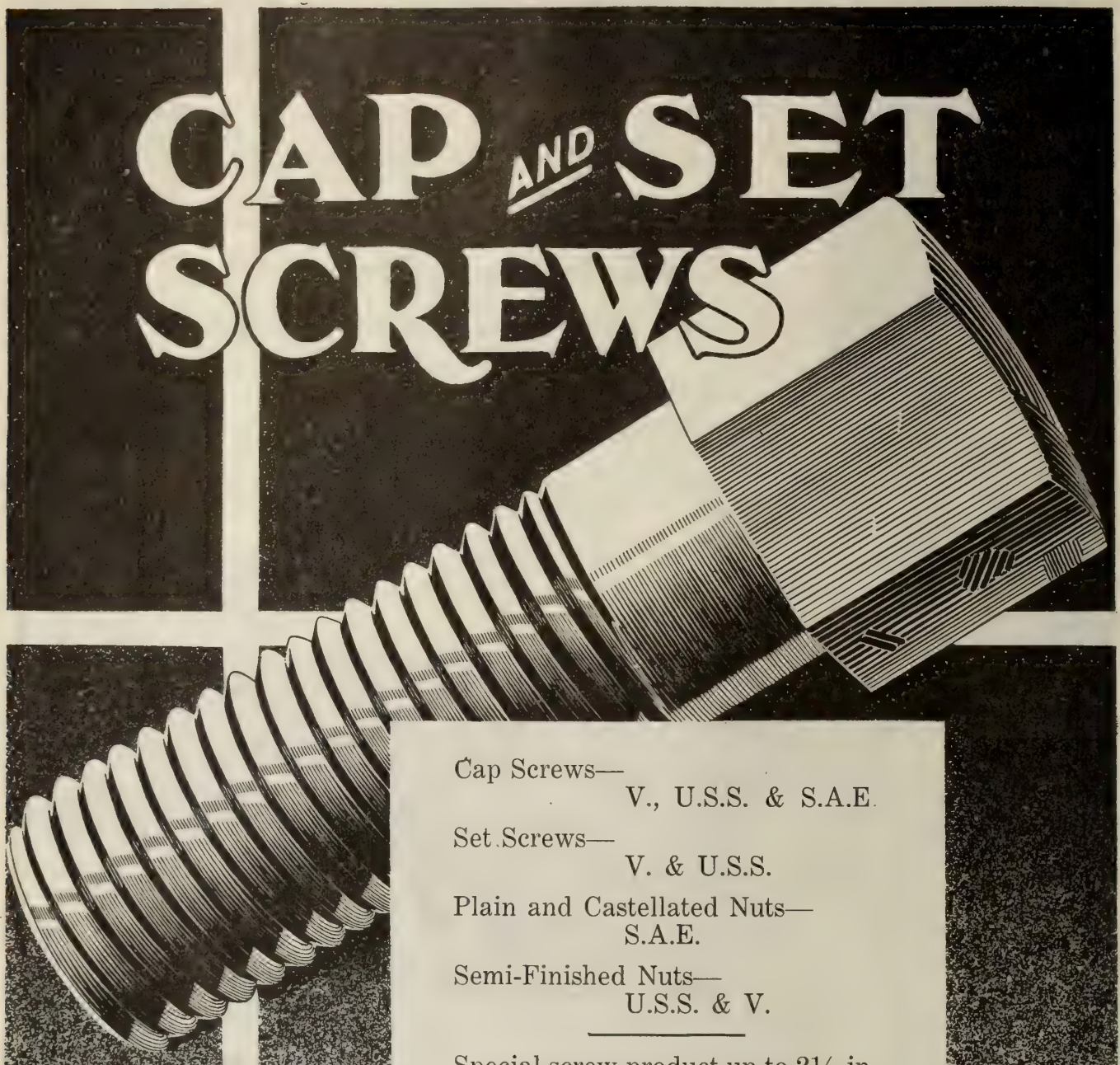
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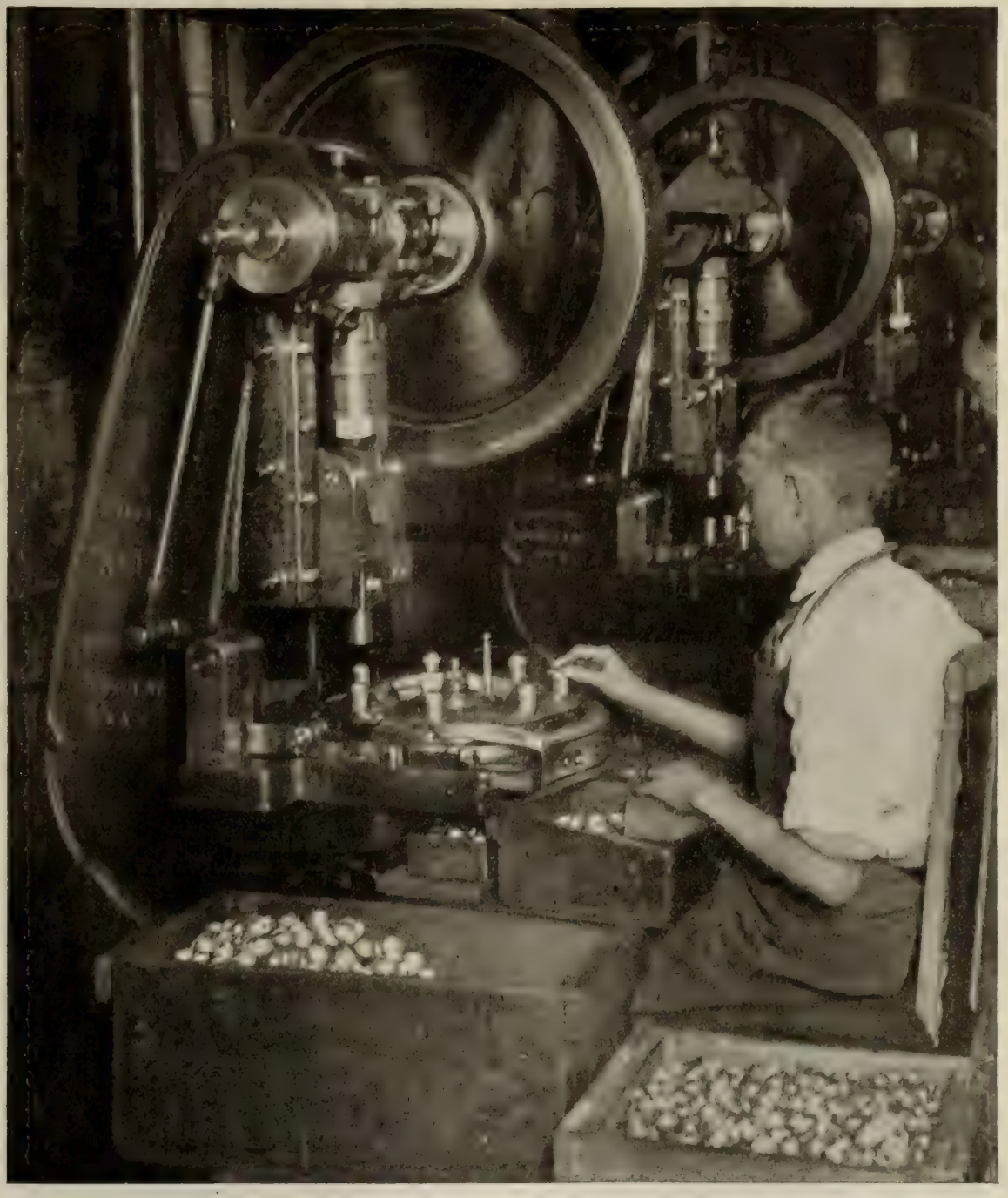
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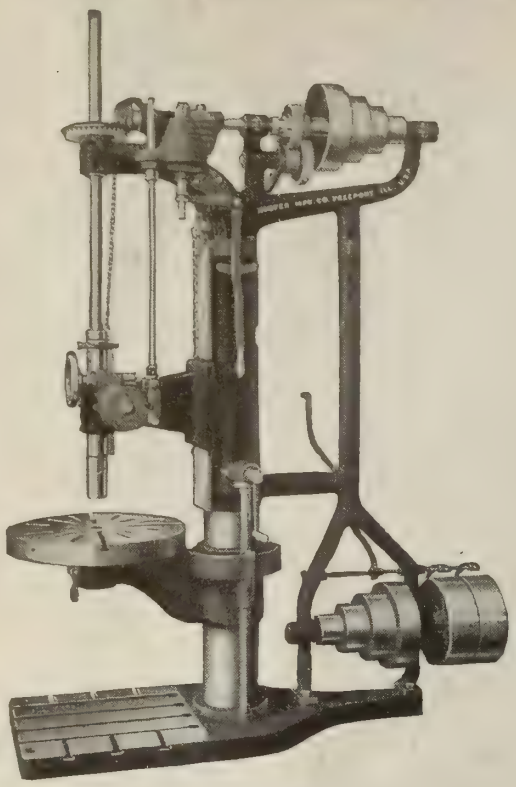
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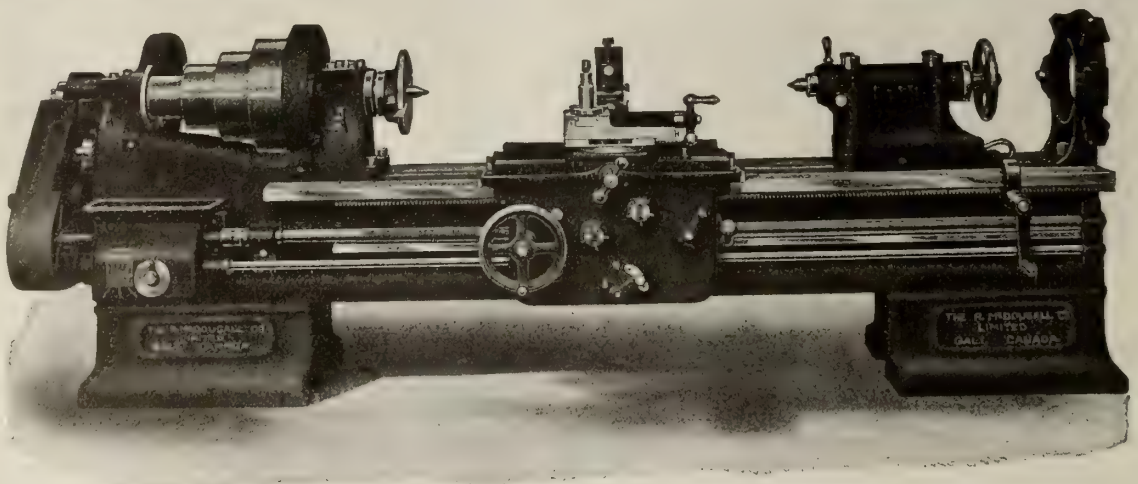
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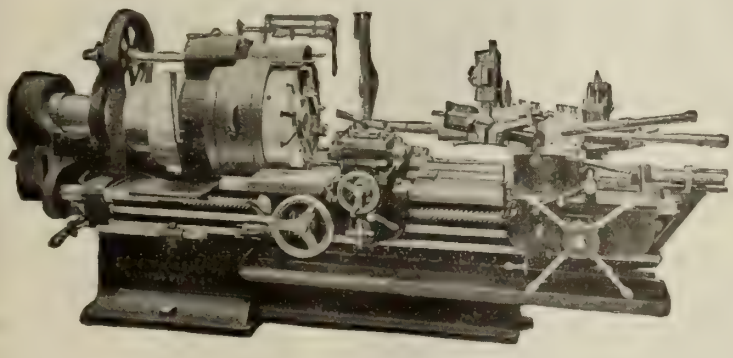
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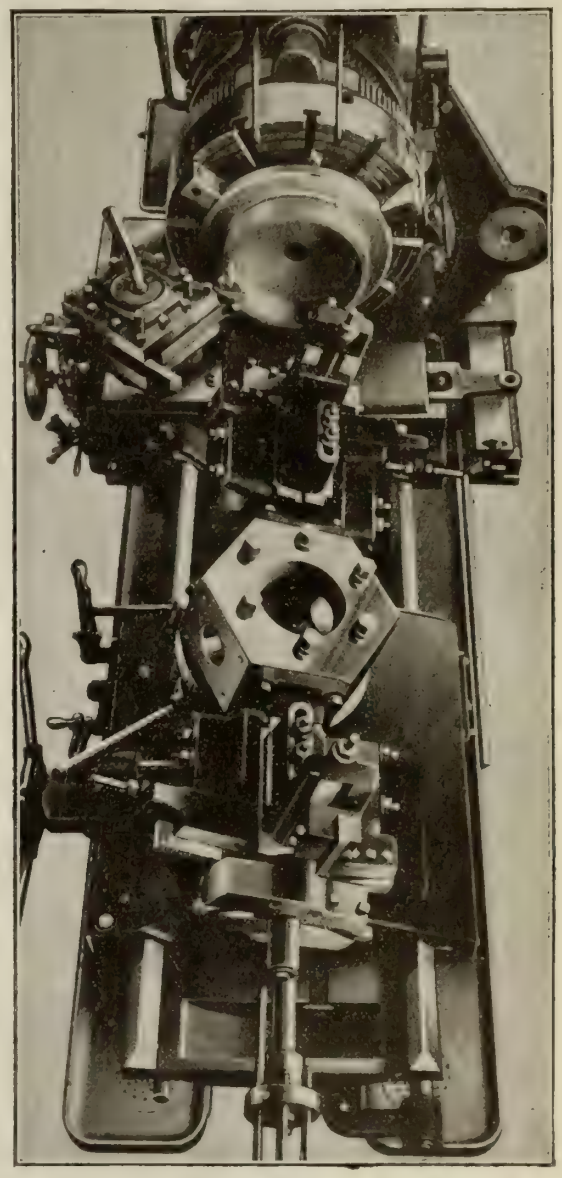
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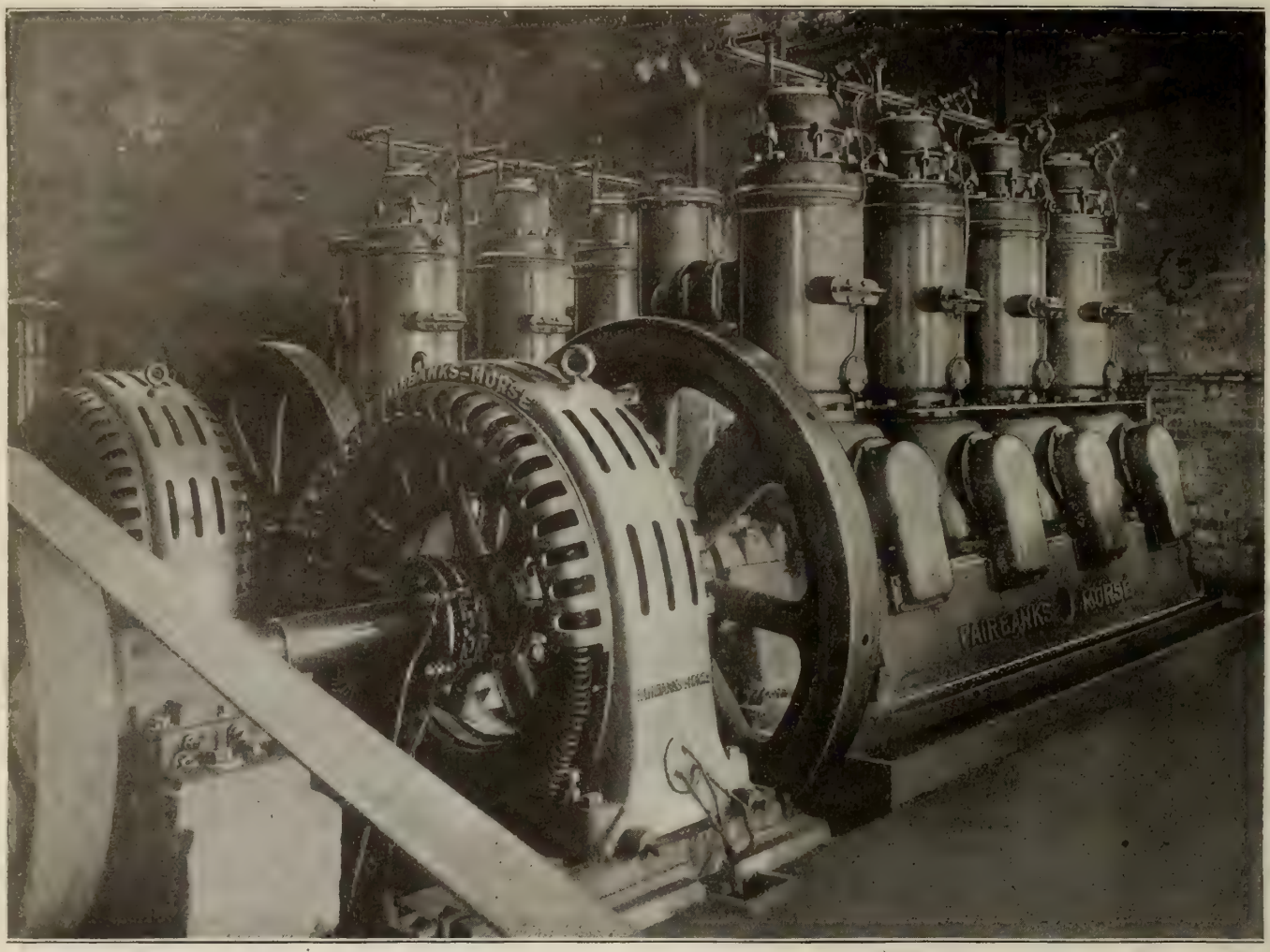
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CANADIAN MACHINERY
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MANUFACTURING NEWS

Vol. XXIII., No. 13. March 25, 1920

Are You Watching the Details of Your Business?

The Habit of Grasping Business Details is Worth Cultivating. You Pay Attention to the Details of Your Personal Life, so Why Not Do Likewise in Business Matters?

By J. H. Moore

HAVE you ever overheard a discussion regarding some executive who has reached the top of the ladder, and landed into a position of prominence? If so, you will, no doubt, have experienced surprise when you discover that the answer to his success was not so much his education, as his wonderful ability to grasp details, and make the most of them. Nine cases out of ten, it is this watching of the details, or in other words, the little things that count.

What applies to the personal side of anyone's life, likewise applies to their business. To make a success, you must pay as strict attention to the details of your business as you do to your personal matters. Only through this channel can you reach efficiency.

The points brought out are truths, met with every day, so we need not champion them, but will go on to prove by various illustrations and text, how the Willys-Overland Co., of West Toronto, have adopted certain schemes to speed up production. Schemes are nothing more or less than the outcome of thinking upon the details, wondering how to improve existing conditions, and so on. Studying detail is often described as looking for short cuts, which is a rather good way of putting it, for if, by a short cut (or quicker method, to use another expression) you can reach the same goal, then the time spent studying the detail was worth while.

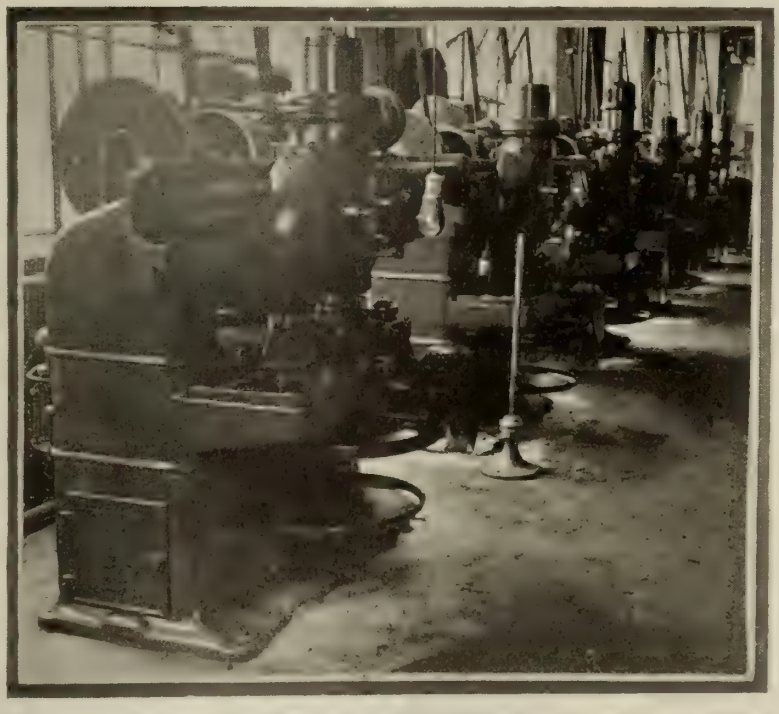


FIG. 1—A WELL LAID OUT LINE OF MACHINERY, YET NOT RECEIVING THE BEST OF LIGHT POSSIBLE.

The Placing of Machinery

The subject of proper placing of machinery is one that, unfortunately, does not receive the attention it deserves. It is only recently that the value of floor space has been considered. The up-to-date plant of to-day weighs carefully the question of placing equipment in their factory, not only as to position on the floor, but also on what floor (if more than one) to place it. Sequence of operations enters into the question, for maximum production demands that no lost movement be allowed.

A good plan adopted in many cases is as follows: It is first decided how the product to be manufactured will pass through the plant. This being settled, the operations are considered in proper sequence. Having decided these points, the next step is to instal the equipment best suited to the various operations. A plan view of the different floors is made, showing all windows, posts, etc. Small pieces of cardboard are now cut out, each one of such size as to represent a particular machine tool, the size cut out being the greatest possible space which the machine can occupy, with all tables, etc., out to their limit. Through each outline of a machine is placed a pin, or thumb tack.

Now commences the real task, sometimes called in the argot of the drawing office, juggling the junk around. The machines are moved to whatever position the draftsman thinks best, then the various executive heads are consulted. A regular confab takes place, machines are moved here and there, at a minute's notice. Lighting, floor space, proper drive from line shaft, etc., are all considered before the final layout is adopted, and passed upon as satisfactory. This juggling around is not accomplished in a hurry, but is carefully gone over, cussed and discussed till everyone is satisfied. The writer has had the pleasure (?) of presiding over such a board on many occasions, raising arguments and answering arguments, relative to the placing of perhaps a turret lathe or even a humble hack saw. In spite of the fact that sometimes time seems wasted in useless argument, it will always prove that every minute taken up in such discussion is time well spent. You will find that it is never necessary to alter the tool installation in any way after such a plan for all possible contingencies have been provided for.

A Sample Installation

For purposes of illustration, let us refer to Fig. 1. In this photograph is shown a battery of Fellows' gear shapers, neatly arranged along the wall of building. The least possible floor space

is occupied, and the greatest utility obtained from placing the machines in the manner shown. The question of equipment layout is one that this concern has given great thought to, the result being that to tour through their plant is a pleasure, open aisle space is assured, every machine is placed just so, in other words, each tool is laid out on the floor according to a well-thought-out plan. The attention to this one detail has saved considerable money for this concern.

To illustrate what happens when no thought is given to the placing of equipment, we quote the following story. Names are, of course, left out for obvious reasons. This million dollar concern ought to have known better, but they didn't, with the result that after installing their machinery haphazard, they found themselves, in a very short time, suffering from congestion of aisle space, and confusion of belt drives. The situation was becoming rather desperate,

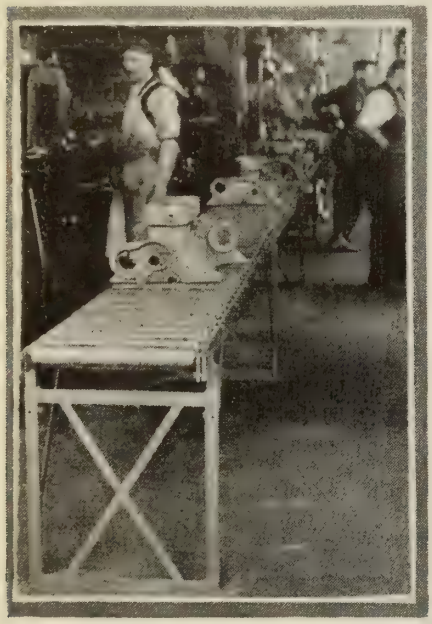


FIG. 3—THERE IS NO QUESTION AS TO THE ADVANTAGE OF GRAVITY CONVEYORS IN CASES OF THIS KIND.

so they called in an expert to look the plant over. Reorganization of tool equipment was his verdict. He named a figure which nearly staggered them, still they realized the work must be done, besides he guaranteed results, so the deal was closed and work begun.

Machines were moved by the hundreds, but not before a definite plan was arranged upon. To make a long story short, results well repaid the firm for its efforts at improvement, for not only were the machines, operations and routing changed, but so much floor space was recovered that two new departments were added. This story gives a concrete example of the advantages derived from a careful study of this important problem.

Another detail which deserves attention is the proper handling of material between operations. Careful study of this problem makes for more adequate floor space, together with speedy handling of product. Take for example Fig. 2.



FIG. 5.—STANDS SUCH AS ILLUSTRATED ALLOW THE WORKMAN TO DEVOTE ALL HIS ATTENTION TO THE ASSEMBLING OF THE AXLES.

This illustration depicts three crankshaft storing racks. Note the simplicity of the arrangement. Wooden pins set at an angle act as rests for each shaft. These are placed just far enough apart to allow the shafts to clear, yet no waste space is evident. The racks, or to use a better word, trucks, are mounted on four wheels, allowing easy moving from one operation to another. Schemes such as this take very little expenditure to put in operation, and save money for the firm the moment they are installed. Although we only show this particular form of truck, the plant spoken of adopts similar types on other portions of their car, each occupying as little floor space as possible, yet holding as many parts on it as practical.

The Gravity Conveyor

Gravity conveyors are used at different portions of the plant, similar to the illustration at Fig. 3. The work is much easier transferred to other succeeding operations. A good plan is to run these



FIG. 4—A SIMPLE, BUT MOST EFFICIENT TYPE OF CONVEYOR.

conveyors between two lines of machines arranging your operations to suit. In this way the workmen can place his finished product directly on to the conveyor, pushing it along to the next workman on the line, who in turn performs the succeeding operation. A conveyor such as described may seem at first a needless expenditure, but once used, will prove itself to be still another of those little details that count.

Another Style Conveyor

The next illustration, Fig. 4, is, to the reader's mind, entirely out of the ordinary run of conveyors. The number of operations through which a automobile piston must go before its completion would surprise the uninitiated. To speed up the handling between these operations, the chute illustrated was designed. It is made of ordinary flat and angle iron, being so arranged that a section stands directly at the side or rear of each machine performing an operation of the piston. Sufficient slope is placed on the chute to allow the piston to gently roll to the bottom. Each section is complete in itself, therefore the piston really enters a new chute after every operation, getting a fresh start on its journey on each occasion. The workman never needs to leave his machine in search of pistons for they are always on the job. The rough product, is of course, placed on the first chute by a workman delegated to such task. Here is another example where attention to a detail counted.

Assembling Stand

The same principle which holds good for the transferring of work applies to the assembling of the same product. If by any scheme or fixture, you can expedite the work through the plant, you are accomplishing a definite object, thereby deserving of credit for paying attention to the details.

The fixture shown at Fig. 5, represents a device used for assembling the front axle on the Overland Four car. Note that the solution was very simple, consisting of two iron stands placed on the floor, the correct distance apart, with pins on them of similar diameter to the holes in axle. By placing axle on these pins, the worker can use both hands freely, as he knows the axle is held perfectly secure by the fixture. The remaining details on this photograph are so self apparent we feel further comment is unnecesary.

As a conclusion, there is only one point to be emphasized, and that is the watching of the details. Keep an eye on the small leaks of time. Study labor motion, for there is more to such a study than some imagine. The result will well repay you for any time spent on the watching, for it is the pesky details that eat away the profits and hinder production.

Eternal vigilance is the price of liberty, so if we wish liberty from congestion, liberty from costly delays, we must keep ever vigilant, watching even the trifles which do not seem to amount to so much. Remember above all that it's the little things that count.



FIG. 2—RACKS SUCH AS THE ONES ILLUSTRATED MEAN LESS CONFUSION, MORE AVAILABLE FLOOR SPACE, AND UNINJURED WORK.

At the Broken Hill Mine in Rhodesia there exists, according to the "Mining Magazine," probably over a million tons of oxidized ores containing about 35 per cent. of zinc cum lead, which, owing to local conditions, will require special processes of treatment. It is hoped to produce a certain amount of zinc oxide for sale as a pigment. It seems probable that the electrolytic method will be preferable to distilling, as water power is available for the generation of current, and the necessary acid can be made from sulphides.

It is reported that a basin to the south of the Victoria River in the northern territory of Australia is probably the site of coal or oil deposits. The area is about 100 miles square. Its borders are on the Victoria River on the north side, with the coast on the west side, the Ord and Negri Rivers on the south side, and the dividing range on the east side. The indications of oil are reported about 20 miles south of the Victoria River. Shale that will burn is exposed on the west side. A small seam of coal outcrops on the Ord River.

Commenting on the iron smelting prospects of the Transvaal, the "South African Mining and Engineering Journal" says that an encouraging report has been received regarding a large deposit of iron ore situate about 10 miles from Navar siding on the Indwe-Maclear line. There were 1,701 tons of iron ore railed from Ermelo during the year, the bulk of it to local ore reduction plants, and a few samples to Europe. Iron ore has been found on native lands about four miles from Wolhuterskop, and ore in payable quantities is said to have been discovered in the Lydenburg district.

Among the new hydro-electric power companies, the formation of which in Japan has been hastened by the high price of coal, is one with a capital of 50 million yen, which has taken over the water power rights of three old companies. It is proposed to begin with the generation of 105,000 kilowatts, the works to be completed in two years; but eventually the output will be raised to 300,000 kilowatts. The two electric light companies of Osaka and Kyoto have agreed to take all the power they require from this new company. Another company, now amalgamated with this one, has a power house capable of generating 7,200 kilowatts, and is devoted to the manufacture of sulphate of ammonia.

Errors in Designing and Machining Bearings

The design and Operation of Journal Bearings as Presented at the Meeting of the American Society of Mechanical Engineers. This Should be of Interest to Designers in General

By C. H. BIERBAUM

IN considering the subject of bearings, their design, construction and lubrication, it is desirable to have in mind the fundamental laws relating thereto—those discovered by Tower, Thurston, Goodman, Lasche, Stribeck and others. Taking the work of these investigators in the light of what is now known concerning these laws, it follows that in the operation of a properly designed, constructed and lubricated bearing we may lay down the following ten principles:

(a) The bearing surfaces are completely separated by a film of oil.

(b) The friction of operation is the fluid friction in the oil film, and adequate thickness of film is essential.

(c) During construction proper clearance or space should be provided for a normal thickness of oil film.

(d) The advance edge of a bearing surface must be rounded or chamfered off in order to permit a supporting film of oil to form.

(e) The oil film forms most effectively upon a bearing surface, whose advance edge is at right angles to the direction of motion.

(f) An increase of speed increases the thickness of film, all other conditions remaining constant and clearance permitting.

(g) An increase in the viscosity of the oil increases the thickness of film, all other conditions remaining constant and clearance permitting.

(h) The larger the unbroken film of oil, the greater will be the average pressure-supporting capacity per unit area, other conditions remaining constant.

(i) Every unnecessary oil groove or interruption in the continuity of the oil film reduces the supporting capacity of the film.

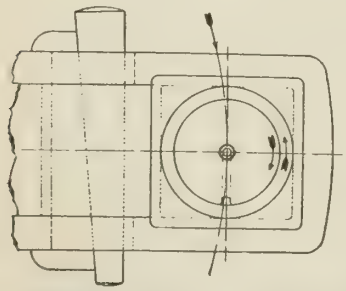


FIG. 1—PRACTICAL AND EFFICIENT METHOD OF LUBRICATING A CRANK-PIN BEARING.

(j) For every bearing condition there is a film thickness corresponding to maximum lubrication efficiency.

(2) The law governing the proper thickness of oil film has not as yet been investigated to the extent that the importance of the subject demands. In modern machinery the average thickness of film varies from 0.0002 in. to 0.006 in.

Precautions Regarding Oil Grooves

(3) Since the lubrication of every bearing is a study in itself, the application of the known laws can be discussed

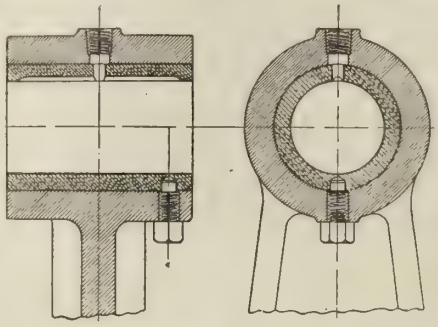


FIG. 2—TRANSVERSE AND LONGITUDINAL SECTIONS OF AN ORDINARY BUSHING DRIVEN INTO A CAST-IRON HOUSING.

to the best advantage by considering specific cases. Fig. 1 represents a theoretical ideal, as well as practical and efficient, method of lubricating a crankpin bearing, the journal receiving oil through the crankpin. The rotation of the crankshaft is in the direction indicated by the upper arrow, and in the position shown the engine is on a dead centre at a point of reversal of pressure. The direction of relative motion of the rubbing surfaces is shown by the two arrows at the right of the figure. The oil film enveloping the right half of the crankpin has been completely restored during the stroke just finished, since the oil groove passed over this half of the bearing while no pressure was being exerted upon it. After the dead centre has been passed, the entire pressure is then exerted upon the crankpin with its

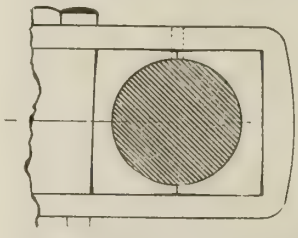


FIG. 3—PROPER METHOD OF FINISHING THE BRASSES OF A CRANK-PIN BEARING TO PROVIDE FOR NECESSARY EXPANSION IN SERVICE.

fully restored oil film, and at the same time the oil groove wipes over the other half of the bearing and restores its oil film while no pressure is being exerted upon it, after which it in turn is ready to receive a reversal of pressure upon a fully restored oil film. Thus both halves of this crankpin bearing present alternately, for the maximum pressure of each stroke, a complete and uninterrupted surface for maintaining the film on an area equal to the projected area of the crankpin, but it is impossible to obtain so perfect a condition of lubrication in a bearing having the old-fashioned cross oil grooves, which are still too often found in this class of bearing.

(4) In case the direction of rotation is to be reversed, the oil groove in Fig.

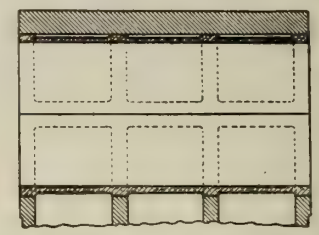


FIG. 4 — SPLIT BRONZE BUSHING OF TOO LIGHT DESIGN TO WITHSTAND THE STRESSES IMPOSED UPON IT.

1 should be placed diametrically opposite to its present position. The function of the oil grooves is, of course, that of supplying oil. In many cases they are necessary evils, which should be minimized as much as possible by avoiding a useless excess of grooves, and especially grooves in the direct line of maximum pressure of the bearing. Unless good and sufficient reason exists to the contrary, oil grooves should be cut parallel with the journal.

Disadvantages of Tight-Fitting Bushings

(5) One matter very frequently neglected, or not thoroughly understood, is that of driving in bushings. Fig. 2 shows a transverse and a longitudinal section of an ordinary bushing driven into a cast-iron housing. As all bearing alloys have a temperature coefficient of

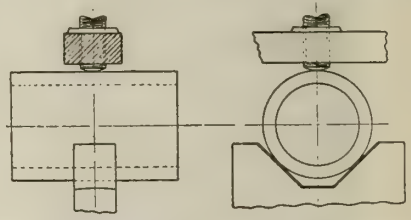


FIG. 5—IMPROPER METHOD OF CLAMPING A BUSHING FOR TOOLING.

expansion higher than that of cast iron, and as the bearing is directly subject to the friction of the journal, it follows that the bearing is at a higher temperature than the cast-iron housing and that all bearings must have an appreciable

outward expansion when in operation. For this reason bushings should be driven in with just enough pressure to prevent looseness during operation.

(6) The practice of driving in bushings so tight that they require reaming before they can be put into service cannot be condemned too severely. The

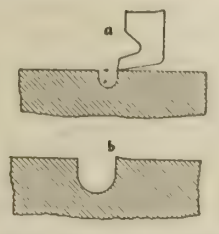


FIG. 6—SHARP EDGE PRODUCED AT THE EDGE OF AN OIL GROOVE BY AN ORDINARY TOOL.

subsequent reaming does not remedy the evil, in that a bushing driven in so tight will and must continue to contract inwardly when in operation, since the outside pressure upon it is not removed by the reaming. In the tooling of a bearing a definite amount of clearance should be provided for, in order to insure the best service conditions. When a bushing is driven in too tight, although it has been reamed before being placed in service, the amount of clearance which it will then have becomes a matter of guesswork and the amount of oil-film space provided an uncertainty. This condition frequently gives rise to heating and bearing troubles, even though the amount of internal contraction may not be sufficient to positively grip or stop the journal. The idea that bushings must be driven in tightly in order to hold them in place is fundamentally wrong, and excessive tightness of the bushing in its housing should always be avoided. For all ordinary machinery it will suffice if a bushing may be driven in place with a blow of the hand or with a small block of wood. The provision for fastening the bushing in place should be such that it will not bind or clamp the latter against outward expansion. In the construction shown in Fig. 2 a set screw engages a hole in the bushing, but does not, however, bottom in the hole.

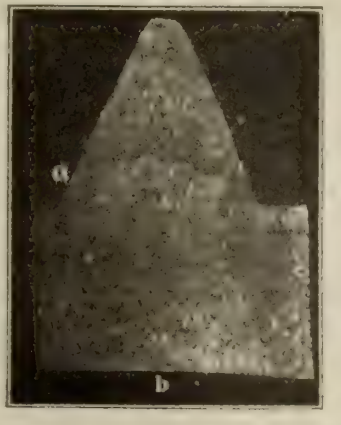


FIG. 8—CROSS-SECTION OF THE TEETH OF A MOTOR TRUCK DRIVE WORM WHEEL.

Proper Method of Finishing a Crankpin Bearing

(7) The finishing of bearings in such a manner that they may expand while warming up is of very considerable importance, and this can be done in many cases by simply giving the matter the full consideration which it deserves.



FIG. 7—IMPROPER FORMS OF LATHE, PLANER AND BORING TOOLS.

Fig. 3 shows a crankpin bearing finished in a manner providing for necessary expansion in service. The two edges of the two half-bearings should be "brass bound," that is, they should bear solidly against each other and should exert a pressure against each other somewhat in excess of the maximum crankpin load. The outer surfaces of both bearings near these edges should be relieved so as not to bear upon the straps, as shown, somewhat exaggerated, in Fig. 3. The four corners of the bearings should be relieved in like manner so that the horizontal thrust will be mainly borne upon the surfaces falling within the area of the horizontal projection of the crankpin. A bearing thus constructed expands with the first slight increase of temperature, relieving the crankpin instead of clamping it as when these precautions are not taken.

Designing for Strength Important

(8) The matter of proper design of bearings as to strength is likewise of importance. Fig. 4 shows a bearing put in service by one of the oldest-established machine builders and which gave very considerable trouble. It is a split bronze bushing 12 in. long, supporting a journal 6 in. in diameter; the maximum thickness of the bushing was ⅜ in. and it was recessed on its back to a depth of ⅛ in. as shown, leaving a thickness for the larger part of the bearing of only ¼ in. The cap of the bearing was held down by ten ⅝-in. studs. Now it is obvious that by clamping this bearing the bearing surfaces were materially distorted by the pressure consequent on the tightening of the ten nuts. It is also apparent that the thickness of the recessed and unsupported part of the shell was not sufficient to withstand distortion under a fluid film pressure such as would normally be exerted upon it. The trouble with this bearing was therefore due entirely to the fact that it was too light a design.

(9) Mention may here be made of another class of bearings, which, together with their supports, are often improperly designed, namely, self-oiling ring bushings. These are nearly cut in half at mid-length in order to provide space in which the ring may operate, and the supporting wall beneath the bushing is slotted correspondingly at the centre to permit the insertion of the ring into the oil well. This often unduly weakens the bearing at a point where normally the greatest film pressure is exerted. In general, much of the trouble at present encountered in bearings can be overcome by simply increasing the strength and rigidity of the bearings and their supports, since an insensible amount of distortion and deflection is sufficient to produce all manner of annoyances.

Bearings Should Be Clamped Endwise For Tooling

(10) Another matter very often overlooked is that of the manner in which bushings or bearings in general are clamped during tooling. Fig. 5 shows end and longitudinal views of an improperly clamped bushing. With a ⅝-in. 16-thread set screw and the application of, say, a 50-lb. pull upon a 12-in. monkey wrench, a pressure of 50,000 lb., can be carelessly exerted upon the bushing in question, and it must be remembered that the composition of a bearing material is never one that would be selected for maximum strength. Bushings tooled when clamped

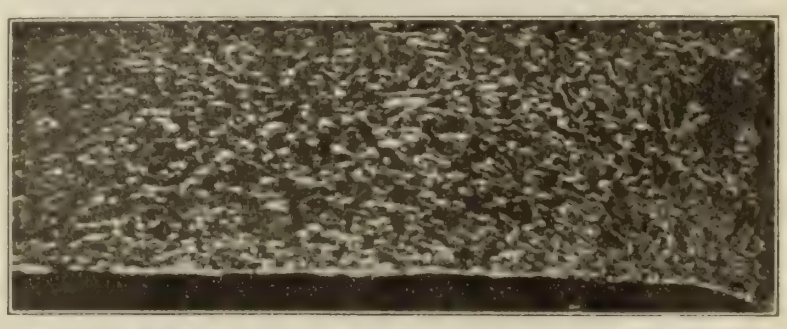


FIG. 9—PHOTOMICROGRAPH OF FIELD AT G, FIG. 8 (60 MAGNIFICATIONS), SHOWING DISTURBANCE OF CRYSTALLINE STRUCTURE DUE TO THE USE OF A DULL HOBB IN TOOLING.



FIG. 10—PORTION OF FIG. 9 MORE HIGHLY MAGNIFIED (120 MAGNIFICATIONS) SHOWING CLEARLY THE COLD ROLLED EFFECT ON THE BEARING SURFACE OF THE TOOTH.

in the manner shown in Fig. 6 seldom have a bore that even approaches a true cylindrical surface, and if they are then driven upon an arbor and finished on the outside a very inaccurate product is the result, a bushing that can never give the most satisfactory service. The best and most satisfactory method of holding bushings for tooling is that of clamping them endwise. The importance of this is very generally underestimated; in general, bearings should be held in a manner such as to produce the least possible amount of strain and distortion.

Chamfering the Edges of Oil Grooves

(11) The matter of chamfering oil-groove edges deserves special attention in that all advance edges of a bearing should be rounded and chamfered off, and the fact that this work should be done last, after all of the other tooling of the bearing has been completed, is important. At a, in Fig. 6, is shown an ordinary lathe tool at the edge of a groove on a finished surface. It is obvious that there are being exerted two forces upon any surface which is being tooled, one horizontal or parallel to the finished surface and the other vertical or in a direction normal to that surface. The resultant of these two forces is a force indicated by the dotted arrow, in a direction tending to deflect the edge of the groove obliquely downward, producing an effect which is shown somewhat exaggerated at b, Fig. 6. It can readily be appreciated what an injurious effect is produced in a bearing if any tooling is done after the oil grooves have been cut, especially so if the direction of rotation of the journal is opposite to that of the tooling. In all cases sharp edges of the groove prevent the formation of an adequate oil film and should be carefully avoided.

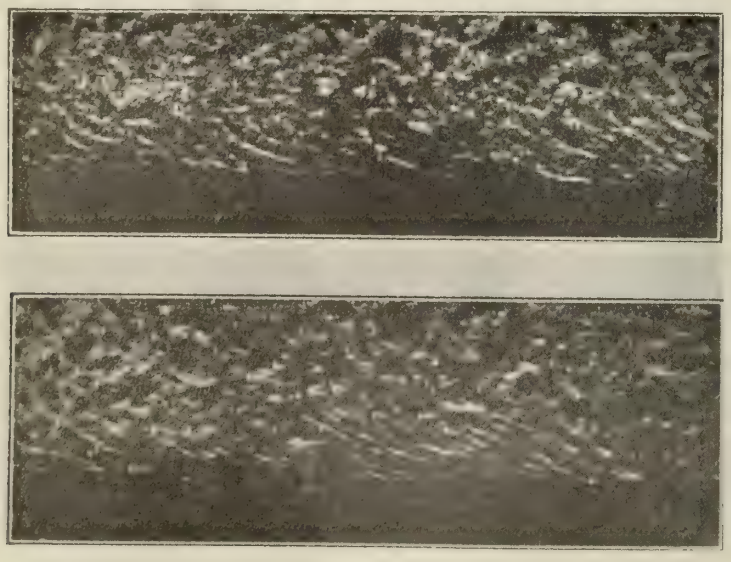
Why Bearing Surfaces Should Be Machined With Sharp Tools

(12) For best results it is very necessary and it is also general practice that a cutting tool should have rake. The tools shown in Fig. 7 would be readily condemned even by a person with a very limited shop experience, and no journeyman machinist would think of setting a lathe tool as shown at a, a planer as at b, or a boring tool as at c. In the last mentioned case the amount of normal or radial pressure which it exerts upon the finished surfaces is far in excess of what is necessary. Consider now the standard multiple-cutting-edge reamer which is very often used in finishing bearings. A 2½ in. reamer would have, say, 14 edges, and the amount of bursting or internal pressure that it would exert within a bushing would be at least 14 times that exerted in case the bushing were reamed with only one improper tool, as shown at c, Fig. 7. This practice is one that cannot be condemned too severely.

(13) The final finishing in bearings should be done by reamers or cutting heads having only one or a very limited number of cutting edges, and these cutting edges should have the proper amount of rake—such as would be given to any other proper cutting tool. Experiments made in a large manufacturing plant on bushings of the same dimensions, from the same lot of material, finished at the same time, some, however, being reamed with the standard multiple-cutting-edge reamer, and others with a single cutting blade, showed that, after a storage of six months, those bushings which had been reamed with a proper single cutting edge retained their accuracy and shape much better than those finished with the so-called standard reamer. The latter bushings exhibited a decided tendency to decrease in inside diameter, and to assume inaccurate, elliptical forms. It was also brought out at this time, that not only did a superior product result from the use of a proper tool, but that, by its use, the production could be increased from 15 to 20 per cent.



FG. 11—PHOTOMICROGRAPH OF EDGE 6, FIG. 8 (90 MAGNIFICATIONS), SHOWING THAT A SHARP TOOL WITH SUFFICIENT RAKE WILL NOT DISTURB CRYSTALLINE STRUCTURE.



FIGS. 12 AND 13—PHOTOMICROGRAPHS OF THE INNER EDGE OF A BUSHING FINISHED WITH A DULL BROACH (60 MAGNIFICATIONS), SHOWING MUTILATION OF THE SURFACE MATERIAL.

Defects in Bearing Surfaces Revealed by the Microscope

(14) Another reason why bearing surfaces should be tooled with sharp tools having the proper amount of rake is brought out by a microscopic study of bearing surfaces. In order to obtain the full value of bearing alloys, it is necessary that these alloys should be presented as bearing surfaces having their natural crystallization undisturbed. The reason for this is given in the report of the Society's Research Sub-Committee on Bearing Metals. The hard or bear-

ing crystals should be embedded in a softer material, permitting the former to adapt themselves to the journal surface. The softer crystals, under proper service conditions, will wear slightly below the surface of the harder crystals. In order to retain these conditions, it is necessary to preserve the natural crystallization upon the bearing surfaces; but this cannot obtain where they have been mutilated by improper tooling. This mutilation of the bearing surfaces gives rise to the crushing of the harder crystals, and embeds these crushed particles into a compressed material which does not function as a normal bearing alloy.

(15) A very forcible illustration of this is furnished by the bronze worm wheel of a certain motor-truck drive in which the teeth had been finished with a dull hob, Fig. 8, showing a cross-section of one of the teeth. After giving unsatisfactory service, the worm wheel was examined in the usual way by chemical and physical tests, neither of which showed any defect whatsoever. On the other hand, microscopic examination showed that the trouble was due to improper tooling. Fig. 9 shows a photomicrographic section of a field at a, Fig. 8. This view clearly shows that the natural crystallization of the greater part of the arena has been disturbed, and that the edge of the tooth has had a cold-rolled or wire-drawn effect produced upon it by improper tooling. It is true this effect is not very deep; nevertheless, it is on the very surface which is brought into play when the worm wheel is put into operation. Fig. 10 shows a part of Fig. 9 more highly magnified, in which the cold-rolled effect upon the surface is seen to be even more complete, a condition which proved to be the sole cause for the very unsatisfactory performance which this wheel gave in service. Fig. 11 shows a magnification of part of the edge b of Fig. 8, the inner edge or surface of this wheel from which it is centred accurately to within a thousandth of an inch upon its spider. This surface had been tooled in a horizontal boring mill with a single cut, the tool set so as to produce a smooth finished surface. The cutting of this surface, however, was done with a tool that was sharp and had sufficient rake, showing that it is an easy matter to cut a bronze surface satisfactorily without distorting the natural orientation of its crystalline structure.

(16) Figs. 12 and 13 are photomicrographic sections of the inner edges of a bronze bushing which had been finished or tooled by broaching with a dull broach. These micrographs distinctly show what not to do; they show that the surface material has been distinctly mutilated, and that the compression of the material upon the bearing surface is very uneven; and they prove, conclusive- to best service requirements.

PREHEATING CAST IRON

Preheating cast iron should be done slowly but thoroughly. There is great danger of warping or cracking a thin iron casting by improper preheating in an open fire. It is advisable, whenever possible, to interpose a steel sheet between the part to be preheated and the direct flame. The time required for heating will be increased, it is true, but the danger of excessive unequal expansion and overheating will be eliminated. The top of a stove is an ideal place for preheating small parts. The heat obtained with a hot fire is sufficient for all general preheating requirements, and there is no danger of overheating.

The uses that can be made of the oxy-acetylene torch are without limit and new ones are discovered every day. The possibility of quickly restoring a broken part to use often means saving many times the cost of the part. It is not the cost of the thing that counts so much as the want of it. If a machine or department is held up, and work is waiting for a new part to come from the factory, the loss may run into hundreds or thousands of dollars. What, then, is the value of a repair apparatus which, in the hands of a skilled operator, will make the broken part as good as new in an hour or so? It is simply incalculable.

The parts of machines are united by screws, bolts, and rivets. Screws and bolts are necessary in many places in order that the parts may be separated when changes or repairs are required, but in many cases screw connections are used which are practically permanent, after being once assembled, as they are never separated when disassembling the machine for repairs. Such parts, of course, might as well be welded together as screwed. Often there will be a distinct gain in strength, simplicity and appearance. There is also a gain often in cost of fitting.—"Welding Engineer."

DEVELOPMENT OF COAL AND IRON RESOURCES

THE "Monthly Bulletin" of the British Chamber of Commerce in Brazil (Rio de Janeiro) states that public interest continues to be largely directed to the development of the coal and iron resources of the country. In the State of Minas the President and Legislature have been occupied with a Bill designed to promote more rapid development of the mining projects in the rich iron region embracing a considerable part of the Cordilheira do Espinhoso. The Itabira Iron Ore Co. reports that prospecting in Conceicao has led to the discovery of hard mineral eminently suitable for export in Europe, and that thus 50,000,000 tons of high grade mineral have been added to the estimate of the productivity of the company's mines. It is considered that as soon as export can be established there will be a great demand for the mineral for the purpose of the British iron and steel industry—the quality of the Itabira ore being excellent and calculated to supply the present shortage of non-phosphoric mineral of high grade.

A complete study of the facts up to date is furnished by Snr. Elysio de Corvalho in his publication "Brazil as a World of Power," in which he regards the establishment of a national iron and steel industry as the key to the solution of Brazilian economic problems and even political destinies. The fabulous mineral deposits of Brazil only await capital and energy to place her in a position of exceptional eminence on her side of the Atlantic. Snr. Corvalho considers that the prospects of the national industry are not dependent either on the national coal or imported coke, but that smelting may be well established either by high furnaces fed by charcoal, which Brazilian forest reserves can supply or by electricity processes for which many sources of water power on a great scale furnish ample scope. The Government have already legislated for the financing of such national enterprises, but the initial difficulties in the way of a rapid development of an iron industry in Brazil remain the same. Among others there is that of transport, and the question is not merely one of building railways. The general level of cost in the country has been so raised that in normal times nothing short of a practical prohibition of importation can enable Brazilian home manufacturers of many kinds to compete. During the war, when many articles could not be imported, a number of national industries sprang into being, and as regards iron and metal goods many articles, including machinery parts, were made locally to fill the place of what could not be imported.

The importance of Brazil's iron resources, however, does not lie in local industries for home supply; it lies in the export of ore or of metal. If the ore can be reduced to metal at a low cost in Brazil, then millions of tons are made available for European and other markets. If, on the other hand, the ore has to be exported, the cost of rail and rolling stock, besides freight for the ore in bulk, must continue to weigh heavily against Brazilian export.

For the time being, therefore, Brazil is only a potential seller of iron ore on a great scale, and must continue to import iron and steel materials and manufacturers. The United States has been the chief source of supply during the years of shortage, and it now lies with other iron and steel exporting countries to regain their footing as far as they can.

The Rickert-Shafer Co., of Erie, Pa., manufacturing the Boehm Automatic Die Heads and the Rickert-Shafer line of Automatic Tapping Machines, are announcing recent appointments in their organization, as follows: A. A. Shafer, secretary and general manager; C. W. Howard, formerly with the General Electric Co., general sales manager; A. J. Patterson, formerly with the Crucible Steel Co., general superintendent; Geo. Paterson, production manager.

Reclaiming and Using Broken High Speed Tools

The Possibility of Saving Money in This Way Has Been Overlooked by Many Concerns. A Furnace is Herein Described and the Method of Its Use is Also Given

By JOHN A. HOPE

RECLAIMING and profitably using up broken parts of high speed steel cutting tools is a proposition that is never entirely overlooked by the management of any progressive manufacturing plant. The alternative to melting and recasting into ingot form this high-speed steel scrap which cannot be otherwise profitably used is to sell or dispose of it to those people who are especially interested in the steel industry or manufacture.

There are only two firms that I know of that are successfully remelting high-speed scrap in Canada on a miniature scale. The perspective drawing herewith is a design that I have installed and worked successfully in reclaiming this steel.

It is necessary before going into melting detail, to consider what portion of high-speed steel would be recommended as purely scrap before setting it aside for melting.

The process of (Tip-It) welding tips on cutting tools, where the body of tool is low carbon steel, has proved, in most shops where this process has been used, that small selected pieces of high-speed steel, which previous to the war were regarded as scrap, became very valuable when applied as tool tips. Large sections of broken cutting tools can also be profitably drawn and hammered into suitable flat milling cutters, etc.

The high-speed steel that would be classed as remelting material would come under the heading of all such broken spiral milling cutters, milled or twisted drills, special broken-toothed form cutters, broken hollow mills, or any high-speed steel with holes or inserts that will not lend itself to be hammered or drawn, high-speed steel cuttings included. Now with our material ready for remelting, we come to the furnace arrangement.

Furnace Shell Construction

Procure second-hand tank plate, either ⅜ or ½ in. thickness with a proportionate amount of 2 in. angle iron to bolt up sides, ends and bottom; this to complete a shell for bricking 8 ft. x 3 ft. x 3 ft. 10½ in. height; rough punch a 3 in. diam. hole at one end of box, approx. 8 in. from top of this box where marked "flare" in perspective. This is the fuel oil burner opening.

This furnace should be preferably located in a grey iron or steel foundry would ensure economic operation in respect to use of foundry man when high-speed steel melting would be required, as this melting would only be required at stated times when scrap accumulation was available.

In any case, wherever it may be decided to locate this furnace, excavate large enough space to sink shell of furnace in ground to level as marked up in perspective. Fill dry sand in around shell of furnace to floor level, allowing for a small concrete box opening at burner end of furnace 18 in. x 18 in. x 16 in. deep to give ample room for entrance of 6 in. blast pipe and burner.

Furnace Bricking

The next step is to fill in furnace shell with approx. 2 ft. depth of dry sand, and apply two layers of fire bricks to form floor of furnace. The usual mode of furnace bricking will now be followed throughout. When completed, it will have finished chamber 5 ft. 6 in. long by 1 ft. deep, the extra height of crucible clearance being obtained in the square built-up section on which furnace cover rests as shown in perspective.

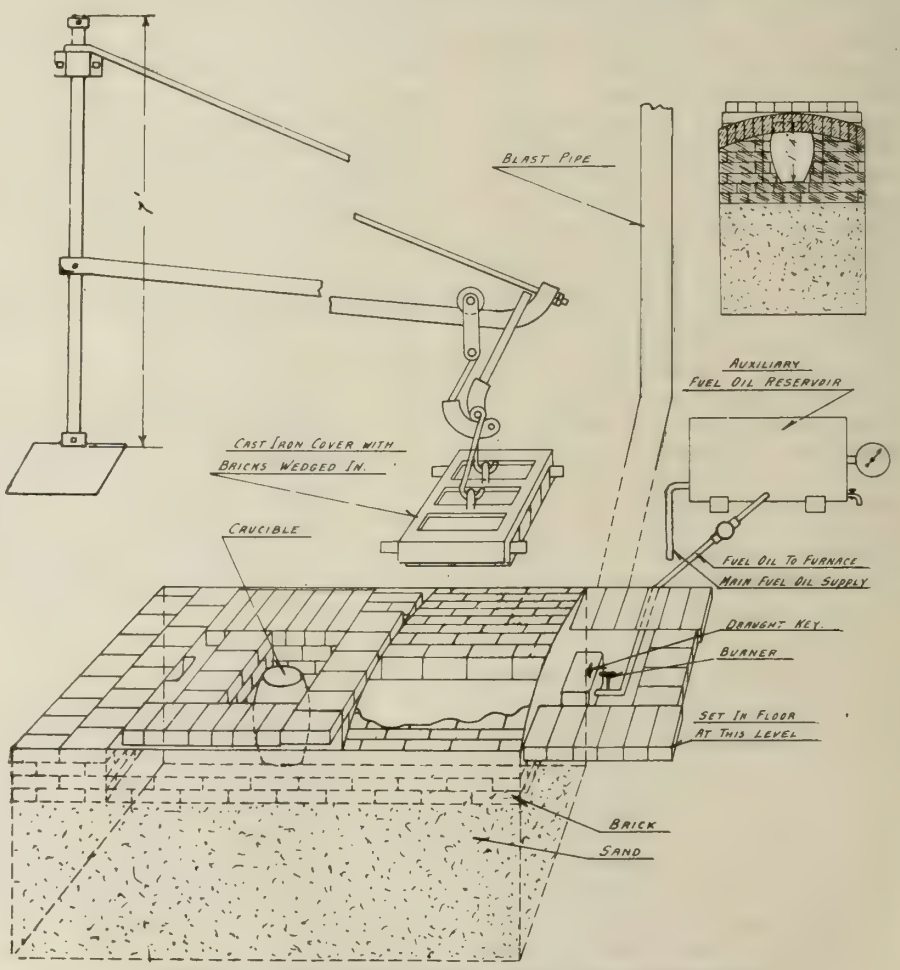
It is necessary to make a gradual sweep from floor of furnace to gas vent in order to avoid flame checking on flat surface at rear end of furnace when being lit up; also to observe flare in bricking at burner entrance to let combustion spread well.

Too much care cannot be given to selection of good fire brick and to using a very light wash of hytempite or other temperature cement rating to stand approx. 3,000 deg. Fahr.

The time expended in carefully keying the brickwork in this small furnace will give very satisfactory returns. If too much cement is used with poorly fitted arch-bricking, the whole will collapse and cave in in less than five or six heat charges. The same applies to the furnace cover. Brick should be carefully keyed in providing a 1 in. test hole in cover centre for rod.

Fuel Oil and Combustion

It is to be noted that this furnace construction is arranged for crude oil operation, and it is necessary to use a crude oil burner of the low pressure type. In experimenting with several of these burners, the Jacobs low pressure burner seemed the best adapted to this design of furnace. It has been successfully used to melt high-speed steel, and is mentioned only to give readers an ap-



DETAILS OF THE HIGH SPEED STEEL MELTING FURNACE.

proximate idea of the class of burner necessary.

Blast and Fuel Oil Arrangement

Burner being fastened central over the orifice before-mentioned, the blast pipe connection is then made, care being taken to have no extreme right angle connections in blast pipe leading from blower to burner. Steel pressure blower of one of the standard make with a 5 in. to 6 in. discharge, and speeded up to indicate 8 to 9 oz. pressure entering furnace is necessary.

It is very desirable to operate this blower independent of other furnace connections, for unless there is a generous excess of oz. pressure to spare the operating of other furnaces will cause an intermittent and varying pressure and give unsatisfactory results. Fuel oil pressure, which is generally pumped to shop lines in pressures varying from 50 to 100 lbs., is quite satisfactory in this pressure range.

I would recommend the use of an auxiliary reservoir as per perspective main oil line being connected to same and oil pipe from reservoir connected to burner. Use of reservoir is advisable for several reasons. First, in diminishing the irregular pumping throbs that cause a noticeable unevenness in furnace combustion. Secondly, it gives better accommodation for applying fuel oil strainer—gauge, drain cock and cut-out valve.

The standard ¼ in. needle valve is recommended as oil regulator, and is placed close to burner with not more than 1/16 orifice opening in seat. It would be necessary where oil pumped pressure is not available to pipe compressed air to this oil reservoir to maintain a pressure on oil of at least 50 lbs., taking care to drain off water from time to time due to condensation. This arrangement will give good, satisfactory results but is more troublesome on account of having to regularly recharge fuel oil reservoir.

Crucible and Moulds

The next care is to procure a good, high heat resisting crucible. The dimensions of same are given in perspective.

The depreciation in crucibles is set up from the interior, a 1/16 layer coming away in scale at each heat. This is the maximum. Crucibles should be kept for a few days on the roof of some slow heat furnace, not subject to assimilating any contacting moisture.

I might say that having placed two of these crucibles on a small core rack in core drying oven, as an ideal spot to keep them well baked, I discovered in the loss of them that a large core being placed adjacent to them transmitted enough moisture to make them defective.

It is also advisable when crucible heat is poured to have another steel-charged crucible sitting on furnace roof to take the next heat, returning used crucible in its place to slowly contract, not putting any steel into it at the time on account of varying temperatures of pot and steel. If crucible is not to be used after the first heat and no second heat to be run, it is best to return it to furnace for gradual cooling down.

The ingot or pouring moulds are fairly produced to suit the needed size of ingots required for particular work. The standard for this miniature process would be made of cast iron.

Procure several cast iron bushes, 10 in. long, 4 in. o.d., and bore taper inside one end 3 in. to 2½ in. at the other end, face of large end, and this completes the regular moulds required for general purposes. Note carefully that inside bore of moulds has no blow holes and machine is smooth, as it is important to produce a nice, smooth ingot, for if this is not given attention, any extreme pitting or seams in ingot will develop trouble when being drawn out under hammer.

Keep moulds on top of furnace to within a few minutes' time of drawing out heat, also a small cast iron even-surfaced plate. Previous to pouring, place plate on a previously determined ground position and lightly dust some fine sand on face, then place row of heated moulds large end down in a row on plate and the sand will seal bottom end securely.

Be careful to pour in exact centre of mould. Note this is where foundry moulder is preferred. Hot metal must not splash the sides of mould, and a novice will invariably do this, causing seams, blow holes, etc.

Drawing Out Ingots

Directly ingots are mould cast, remove ingots and as it is not preferable to draw them out at this time place them in a box of dry lime and cover up.

When entirely cooled down, remove them and examine if piped. With the best of care this trouble will exist in centre but not as a rule to an extended depth. By using a cope or head to feed the core shrinkage, this can be practically eliminated. In just filling the mould, when drawing the ingot under hammer, retain this pipe end in tongs, and when drawn out to desired length this end is cut off and returned for remelting.

Best results in hammer drawing out are obtained by preheating or soaking in a coke oven to ensure entire heat through centre. Ingot can then be brought up to a good working heat in fuel oil furnace and quickly hammer drawn under good, smooth-faced hammer blocks.

Several hundred feet of ⅜ in. x 1½ in. high-speed steel cutters, drawn in the manner described, gave satisfactory service. Note.—To freely machine this steel when drawn out, all that is necessary to do is seal up large quantity in cast iron box with powdered charcoal, place in muffle gas furnace and carry out standard annealing practice.

Procedure in Melting

First.—When in the case of newly constructed furnace, thoroughly bake and dry out. Don't force heat.

Second.—Fill crucible with scrap high-speed steel, preferably placing light material and cuttings at bottom.

Third.—Place crucible in place in furnace with an outside closing pair of double-handled tongs, closing tongs when closed on crucible to form a ring just below crucible centre.

Fourth.—Swing furnace cover in place and lower down, making sure that test hole in furnace cover is relative to centre of crucible.

Fifth.—Apply fuel oil and blast to furnace. Blast on fuel and with enough oil to prevent smoke, gradually increase flow of oil, after period of approximate 20 minutes, and as the heat units increase a soft gradual increasing temperature will build up, showing very little flame from gas vent, and in the course of 1¾ hours will be down to melt.

Sixth.—Use a ⅜ round testing rod dipped in graphite and tap into crucible through hole in furnace cover. Note crust forms on the top of melt and rod will pierce through by applying a little pressure. Drawing test rod sharply out will indicate fluid condition.

Seventh.—When considered ready to pour, quick work is essential. Moulds ready. Tongs handy to lift out crucible and place in pouring tongs, pull slag off top and pour quickly.

Other Useful Information

In checking up the analysis of this recast high-speed steel, it will be found that it is necessary to add hardening contents. At the time crucible has just been drawn from furnace and slag top removed, add 1 per cent. of ferro manganese and half of 1 per cent. ferro chromium, and stirring quickly before pouring will be found to give good cutting per cent.

The Thermit Supply Co., New York, supply this material. To know that furnace is giving correct results, removal of cover should disclose interior appearance known as snowball heat and the outline of crucible is hardly distinguishable without smoked glasses.

Cost Data

Crucible	do	
Crucible		
Fuel oil	cost	= 16c per lb. of H. S. Steel Cast
Labor	do	
Drawing out	do	
Overhead charges, 100%		= 16c per lb. of H. S. Steel Cast
Value of scrap H. Speed Steel at		19c per lb.
Equals		51c per lb. cost of reclaim

Reclaimed by this method from scrap to machine use again.

Three heats per nine-hour day can be easily accomplished, average 75 lbs. each heat, making this reclaim a profitable investment for individual shops having high-speed steel scrap accumulations.

According to the Government "Gazette" of Madagascar a scheme has been approved for a hydro-electric installation at Tamatave. The waterfalls are situated 10 to 15 miles west of Tamatave, on the Ivondrono River, and are estimated to be capable of producing 3,000 horse-power. The water power will be available to furnish power in connection with the electrification of the railway from Tananarive to Tamatave, a distance of 229 miles.

Are Your Planers Fitted With Cast Iron Pulleys?

If So, Read This Article. The Ford-Smith Machine Co., Hamilton, Canada, Took the Trouble to Change Over From Cast Iron to Aluminum Pulleys With Surprising Results

By J. H. MOORE

IT is perhaps not as well known as it should be, that the up-to-date planer of to-day is equipped with aluminum pulleys in place of the regular cast iron variety. In conversation with an honest-to-goodness mechanic the other day, the writer mentioned this fact, when, imagine his surprise to hear the party concerned reply, "Well, do you know, between ourselves, that's the first time I knew they had made any change? Why did they make it? What advantage has it over the old style, except perhaps being a little lighter in weight?"

After explaining the advisability of the change, the idea of an article on the subject suggested itself, so this information to follow will not be constructed on mere theoretical fancies but chuck full of facts and figures.

After deciding on the preparation of such an article, the next step was to secure some actual example showing the advantage of such a change. Upon investigation the writer found that the Ford-Smith Machine Co., Ltd., of Hamilton, Canada, had tried the scheme with great success, so that the article to follow is produced through the courtesy of this company. As Mr. Ford-Smith, the manager of this wide-awake concern, mentioned to the writer: "We tried the scheme for two reasons, first, because we believed in it, and second, because it is absolutely imperative that we get the maximum efficiency out of our planers in order to produce millers that will keep up to our present standard.

"The information and figures we have proved by these tests are yours for the taking, because it is our belief that discoveries such as this should be made public in order to help others in like difficulty."

Having thus explained the origin of the article, and how the idea first came into eing, let us enter into the technical detaails of the matter itself.

No doubt readers already know that the pulleys we have in mind are the two pulleys operating the table of the planer. One pulley drives the table in one direction while the other pulley reverses the direction of motion. Each of these pulleys attain quite a speed, of course creating considerable kinetic energy. The time comes to reverse the motion of table, and over goes the belt. The usual result is a horrible squeak, owing to the slip existing between the belt and pulley. The reason is apparent. The weight of the grey iron pulley is so great that it is really stronger than the power exerted by the belt, the result being that it is some considerable time before the speed and motion of the pulley is arrested.

This slip, creep, or whatever you like to call it, means loss of motion, loss of time, not to speak of the continual squeak. It also means that the cutting tool must be set ahead of the work so as to allow for this creep, in other words a longer stroke is necessary than otherwise would, were the reversal of stroke be dependable.

As all these points are big factors in production, it is not surprising that planer manaufacturers attacked this problem earnestly in order to overcome the bugbear, or that the Ford-Smith Machine Co., Ltd., decided to likewise get the time-killer by the throat, so to speak.

Six planers were used as a test basis, these being of the following makes and sizes: One Butler 26-in.; two Bertram 26-in.; one London Machine Tool Co., and two Bertram 36-in.

Every point was watched carefully in the test even to the cost of the aluminum pulleys installed, and we have arranged for the reader's benefit, this matter in tabulated form. It might be well to add that this table is something worth clipping out for future reference.

Assuming that the average stroke used on planer work is 3 feet long, and that 35 per cent. of the total working hours are used in setting up work, grinding tools, etc., the saving in one year of 50 working weeks would be (with planers rated at $2 per hour) as follows:

The average increase on the 3-ft. stroke is about 14 per cent. One week's work equals 48 hours. Taking off the percentage for setting up, grinding tools, etc., the actual cutting time on each planer would be only 32 hours. This means that the cutting time saved on each planer would be 14 per cent. of 32 hours, which equals 2.75 hours.

As you however save at least 7½ per cent. by the adoption of aluminum pulleys in the shorter stroke possible, we can safely add this amount, bringing the total number of hours saved on each planer to 3.8 hours per week. This means that the cutting time saved by the six machines on test would be 6 x 3.8 x 50 in one year. In dollars and cents (remembering that the basis of cost is $2 per hour on all sizes of planers) we get the following staggering total of $1,240.

In other word $1,240 was being wasted

Test Record	One Ft. Stroke			Two Ft. Stroke			Four Ft. Stroke.		
Name, and Size of Planer	Reversals per Minute		Per Cent Increase	Reversals per Minute		Per Cent Increase	Reversals per Minute		Per Cent Increase
	C. I. Pulleys	Alumin. Pulleys		C. I. Pulleys	Alumin. Pulleys		C. I. Pulleys	Alumin. Pulleys	
Butler – 26"	24	30	25%	15	17	13.3%	8½	10	18%
(2) Bertram 24"	26	30	15.4%	14½	16	11%	8¼	9	9%
London Mch. Tl. 36"	18	21	16.6%	12	14	16.6%	7½	8	7%
(2) Bertram 36"	16¼	20	23%	10¾	13	21%	6½	7	8%

THIS TABLE ILLUSTRATES RESULTS WELL WORTHY OF CAREFUL CONSIDERATION.

every year on these six planers. Suppose a plant is equipped with twenty or thirty planers, imagine the real money that is going to waste through lack of consideration of this point.

The costs of the pulleys for all six planers, including pattern costs, was only $300.

As a conclusion, suppose we view the advantages derived and how the results were so satisfactory. First, they have no belt slip, as the pulleys reverse instantly. This, of course eliminates squeaks, giving more strokes per minute. They also shorten the stroke to just clear the work, for the travel of table is so dependable as to allow their doing so. Belt troubles are a thing of the past, for there is no undue strain exerted on the belts as previously existed.

The reason for these improvements are no doubt already apparent to every reader. The aluminum pulley being so much lighter it cannot store such a large amount of kinetic energy, therefore is easier arrested in its speed. The belt in this way has an easier task, for in place of the preponderance of power being in the pulley the balance of power is in favor of the belt. This guarantees immediate reversal of motion without the attendant squeak.

To every manufacturer reading this article we suggest they consider this problem carefully. These figures given are authentic and definite, not mere theories, so that by installing aluminum pulleys on their already existing cast iron equipped planers they will be plugging a dangerous leak and adding more money in their pocket besides increasing the productive qualities of their machines.



WELDING AND CUTTING



Considerations in Welding of Malleable Iron

This Article, Which Appeared in the "Welding Engineer," Discusses Various Points of Interest

By H. A. SCHWARTZ

UNLIKE most other cast materials, malleable iron possesses its characteristics not only on account of its compositions, but also on account of heat treatment to which the castings are subjected in the process of manufacture.

As originally cast, this material is hard and brittle, and has a white fracture. Its appearance under the microscope is indicated in Figure 1. In this figure the white ingredient is iron carbide (Fe_3C), the greyish background being a solid solution of this carbide in iron. All carbon present is in the combined form.

In the annealing operation the appearance and structure of the hard iron is entirely changed, the resulting product being resistant to blows under the hammer, and of a black velvety or grey silky fracture.

Under the microscope malleable iron has the appearance as shown under Figure 2 in which the rounded dark areas are free carbon in the "temper" form, the white background being a mass of nearly pure iron in the form of separate grains. The latter structure is derived from the former by the heat treatment to which the metal is subjected in the annealing. This heat treatment, in general, consists of raising the temperature of the product to somewhere between 1,500° and 1,700° F., maintaining this

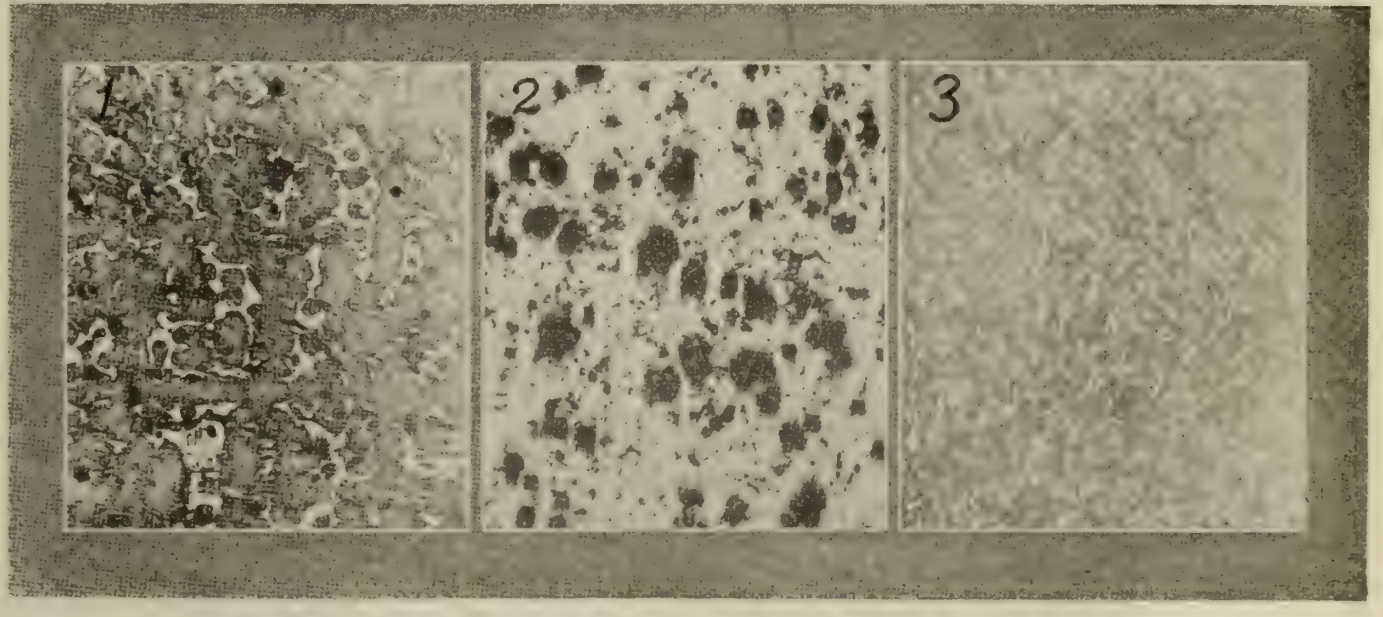


Fig. 1—White Cast Iron (Unonnealed Malleable). Etched with Nitric Acid magnified 60 diameters.
Fig. 2—Malleable Cast Iron. Etched with Nitric Acid magnified 60 diameters.
Fig. 3—Malleable filler welded into Malleable Casting showing fill er material only. Etched with Nitric Acid magnified 60 diameters.

temperature for a period from ten to forty hours, and then allowing the casting to cool very slowly, usually at a rate not more than 10 an hour. The exact time and temperature vary somewhat in different plants, and under different circumstances.

If malleable iron is heated to a temperature above the critical point (Ac1), all, or part of the effect of the annealing is destroyed, depending upon how high a temperature the material has attained. Such reheating unless followed by cooling at least as slowly as is the practice in the original annealing will cause the casting to again become hard and brittle, approximating in character, at least to some degree, the properties of the original hard iron casting.

The welding of this material involves, necessarily, the heating of a part of the article to be welded to a temperature up to its melting point, and is, therefore, accomplished with greater difficulty than will be found in the welding of any other similar product. Generally speaking it is the practice to weld a material, using as a filler a material as nearly identical with that of the article to be welded as may be possible.

In Figure 3 is shown a microphotograph illustrating what happens when an attempt is made to repair a malleable casting by welding malleable iron into the section to be repaired. The photograph represents a section of the weld corresponding to the material derived from the molten filler rod. This section instead of having the structure normal to malleable iron as shown in Figure 2, has a micro-structure differing from that of hard iron shown in Figure 1, only in that it is finer grained. In other words in the process of melting, all of the temper carbon of the malleable iron has been reconverted into the combined condition in which it existed in the original hard iron casting. The structure is close grained merely because the small weld freezes more quickly than a fair sized casting. The material in the weld has the properties one might expect from the micro-structure, in that it is as hard and brittle as the un-annealed casting, therefore, this method of procedure is a total failure.

It may be argued that since the body of a malleable casting consists mainly of nearly pure iron, a weld might be made using Armco iron, or a Swedish wrought iron for the filler.

Figure 4 is a microphotograph of the material filled into a weld, using Armco iron. It will be seen that this structure has not the granular structure of pure iron which can be seen in the background of figure two, but has a confused greyish appearance due to the fact that the pure iron in the molten condition has absorbed carbon from the more highly carbon bearing malleable casting with which it is in contact. It approximates in properties fairly hard steel, and is much too hard and brittle to serve as a welding material in the repair of malleable castings which are in general intended for service involving resistance to shocks and blows.

Welding malleable iron with soft iron is, therefore, impracticable, since it is impossible to prevent the contamination of the molten pure iron by the carbon of the welded casting.

Since grey iron castings can be welded using filler rod of extremely soft cast iron (very high in silicon) the suggestion has occasionally been made that it should perhaps be possible to patch malleage castings with grey iron. The thought was that even though the grey iron casting might be more brittle than the malleable, still it would be soft enough for machining, and particularly in relatively unimportant places might have sufficient strength to render its use possible.

In micrograph 5 is shown a section of a weld made in a malleable casting with grey iron. The grey iron did not preserve its softness, quite possibly due to insufficient silicon, and is present in the form of white cast iron. It shows white areas of iron carbide on a grayish background essentially in character to the white cast iron of Figure 1, and the remelted malleable of Figure 3. Even if this difficulty were overcome, by securing grey iron so high in silicon that it would remain graphitic in spite of the quick cooling, incident to its use as a filling material in welding, another difficulty would be encountered.

It will be seen in Figure 5 that the structure of the malleable iron which the grey iron has welded, has been materially changed. Instead of having the appearance shown in Figure 2, the background has become very dark, so dark that the masses of temper carbon are almost invisible, though they still exist.

This is due to the reabsorption of some of the temper carbon by what was originally the pure iron matrix of the malleable casting, converting the latter into a steely mass similar to that formed in the weld shown in Figure 4.

Figure 6 shows this structure at a higher magnification, and permits some idea to be formed of the ingredients present. This same reabsorption of carbon with a consequent embrittling of the product occurs when welding with malleable, or with soft iron also, being characteristic of the effect of reheating of the original material.

Some process of welding must be adopted which does not involve the heating of the casting to be repaired to a temperature above the critical point. This critical point is at about 1,350° F.

In Figure 7 is shown a piece of malleable iron welded with Tobin bronze. The melting point of this bronze is so little above the critical point that it is quite possible to melt it in the torch without unduly heating the casting being re-

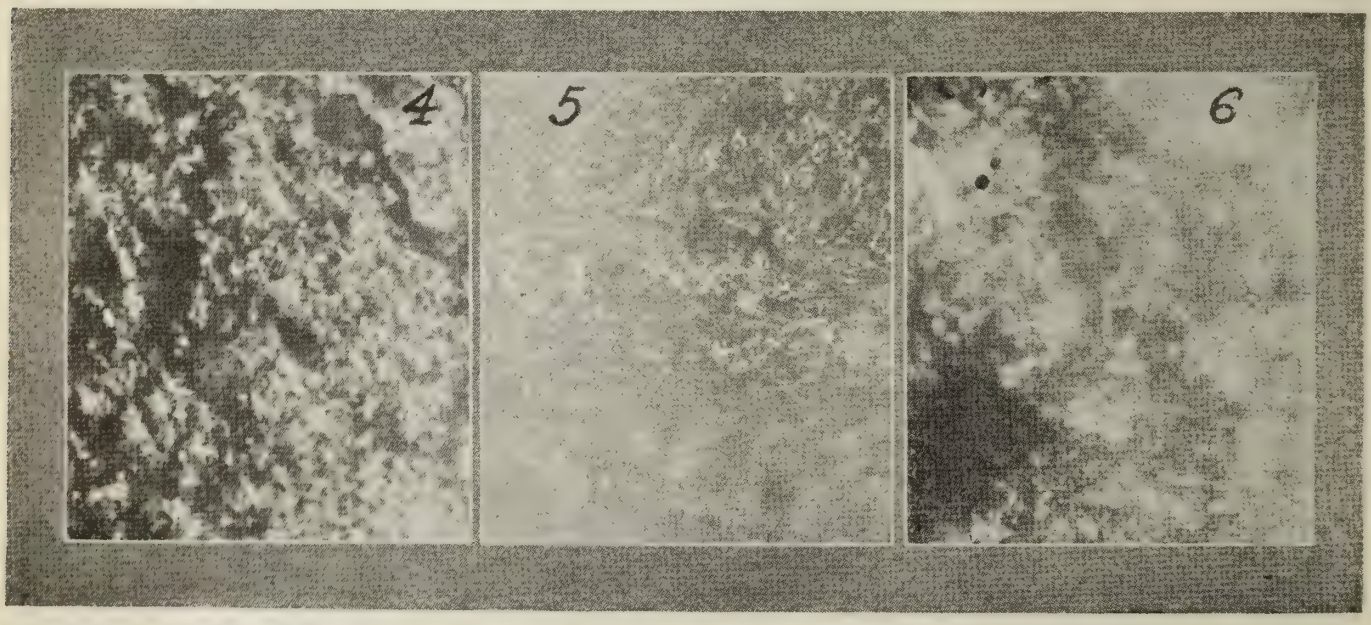


Fig. 4—Boundary between casting (at left) and filler (at right), mallable welded with pure iron. Etched with Nitric Acid and magnified 60 diameters
Fig. 5—Boundary between casting (below) and filler (above), malleable welded with cast iron. Etched with Nitric Acid magnified 60 diameters.
Fig. 6.—Malleable iron reheated in welding. Et tched with Nitric Acid magnified 240 diameters.

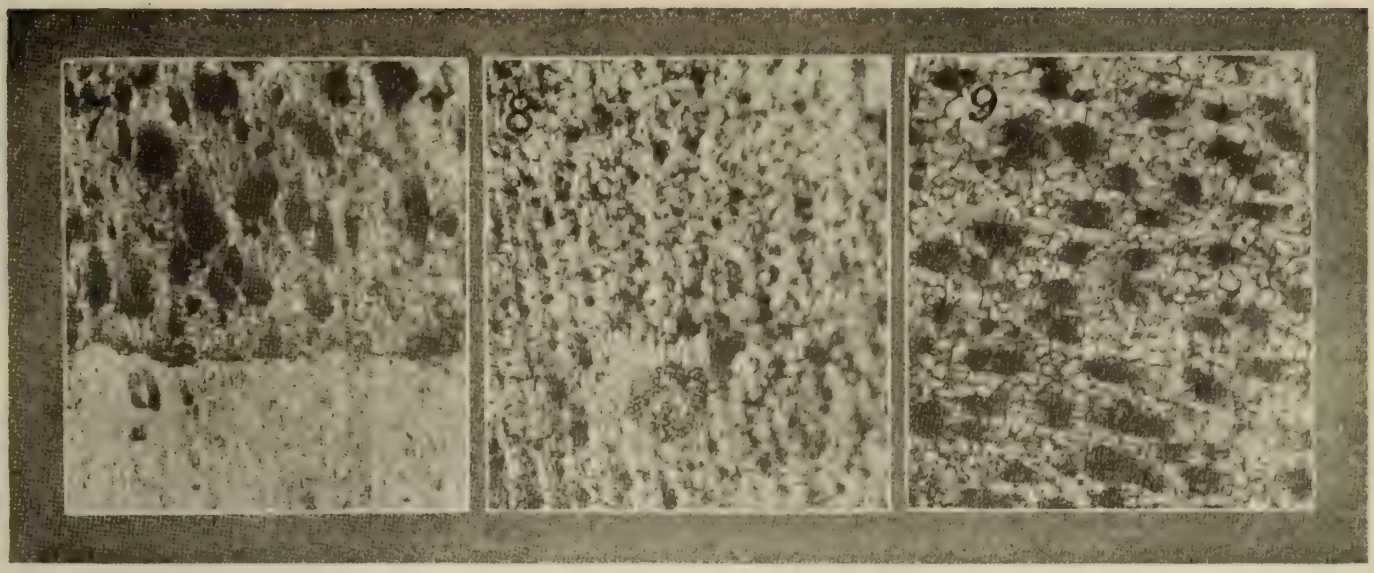


Fig. 7—Malleable Casting (above) welded with Tobin Bronze (below), etched with Nitric Acid magnified 60 diameters.
Fig. 8—Hard iron weld in hard iron casting annealed. Portion of filled in metal. Etched with Nitric Acid magnified 60 diameters.
Fig. 9—Hard iron weld in malleable casting annealed area near junction of castings and filler. Etched with Nitric Acid magnified 60 diameters.

paired. It will be seen in the photograph that little or no change of structure has taken place in the casting being welded. Unfortunately the bronze is not as strong as malleable iron, or does it adhere as perfectly to the iron as would be the case with welds made of some other iron material. However, for the purpose of making repairs where great strength is not required, this is an entirely feasible method of procedure.

It will be seen that all means of welding with iron so far described have been shown to be failures, largely because they undid what the manufacturer had done to the malleable iron in his annealing process. The conclusion is that if repairs could be made before the casting is annealed these difficulties would not be encountered. The microphotograph reproduced in Figure 8 shows a portion of a weld made in a hard iron casting, using hard iron as the welding material, and then annealing the casting as usual.

It proved impossible in this weld to locate the exact boundary between the original casting and the material welded, although the photograph was taken from an area as nearly as practicable where the two materials joined. It will be seen that this weld differs from normal malleable iron only in the finer grain. This is an advantage rather than a disadvantage, and welds made by this method will develop the original strength of the material if the skill of the welder is sufficient to avoid any blows or cracks during the process of welding. Unfortunately, however, this character of welding can be applied only in the malleable foundry, for example to reclaim castings it would otherwise scrap on account of blow holes or similar surface defects. It cannot be applied to the repairing of articles failing in service, since of course these articles have been previously annealed.

It is quite possible to weld broken or defective malleable iron articles using white cast iron as a filler, and then reanneal the casting in order to completely malleablize the latter and to destroy the combined carbon set up in the former due to the re-heating while welding. Figure 8 is a photograph of a weld made in this manner.

It will be seen that this latter method offers a solution of the difficulties encountered in welding malleable iron, provided the welder is equipped with facilities for heat treating the welded article in the same way as they were heat treated by the original manufacturer.

This heat treatment, involving as it does the maintenance of a carefully controlled and fairly high temperature for a considerable time and then the slow decrease in this temperature at a predetermined rate, may present difficulties to the inexperienced operator. It could hardly be attempted except in a heat treating furnace equipped with pyrometers, and would also require expert supervision. Properly executed the excellence of the weld under these conditions is limited only by the skill of the operator. Improperly executed the welded article may be totally ruined and be a source of extreme danger if used in some place where failure would mean serious loss or injury.

The welds discussed in this article were all made with oxy-acetylene. What has been said of course would, however, apply with equal force to welds made in the electric arc. Thermit welding is not likely to be of service in the repairing of malleable castings, due to their relatively small size, also due to the fact that the molten steel of the Thermit reaction would not be as suitable a welding material as is the white cast iron filler which can, and should be employed in arc or acetylene welding.

Malleable iron welded with soft iron would not respond properly to the graphitizing heat treatment since this treatment would not convert the combined carbon in the weld itself into body of the casting.

The company with which the writer is connected has made tests on a fairly considerable number of welds made under different circumstances. The result of these tests indicating first, that the serviceableness of a weld is primarily dependent upon the skill of the operator in producing a perfectly sound material and in avoiding the formation of mechanical defects in the weld itself.

WATER COOLING PROPOSED FOR TURBINES

Discussing the probable development of the large turbo-generators now used in power stations and on board ship, a paper read recently before the British Institute of Electrical Engineers, by Mr. J. Shepherd, suggests that water-cooling is inevitable. Mechanical strength and durability would, the author is convinced, be increased, and the risk of fire or heating diminished by the adoption of this change. He predicts a longer physical life for turbo-generators in consequence, and points out that this factor is of enhanced importance as a result of the world-wide rise in the cost of plant.

WISDOM OF THE HEN

The Smiths had a hen which insisted upon neglecting her comfortable nest to lay a daily egg in the coal cellar.

"I can't think," fretted Mrs. Smith, as she and her small son John together hunted for that particular egg, "why this one hen insists upon using the coal cellar."

"Why, that's easy, mother," exclaimed John. "I suppose she's seen the sign, 'Now is the time to lay in your coal.'"



DEVELOPMENTS IN SHOP EQUIPMENT



CINCINNATI LATHES

The Cincinnati Lathe and Tool Co., Oakley, Cincinnati, Ohio, have placed on the market their latest line of patented gear head lathes. These are made in 16 in., 18 in., 20 in., 22 in., 24 in., 26 in., and 28 in. sizes, with either single pulley or motor drive.

The machine shown at Fig. 1 is what is known as a General Manufacturing Equipment lathe, fitted with hexagon turret on bed, power feed silent chain drive. As the speed variations are obtainable in the head, constant speed motors only are required.

Levers at front of head operate all feed changes and the index plate gives the lever position for each speed. A neutral position is also obtained, permitting to revolve spindle by hand for chucking similar jobs.

Spindle is made of high carbon crucible forging. It carries only the face gear, and one direct driving gear. The intermediate shaft has three sliding gears that mesh with back gears. The back gear shaft carries a pair of sliding gears, and three stationary gears of different diameter. The drive shaft, operating at constant speed, consists of two sliding gears meshing with gears on intermediate shaft. When the gear to the left of this shaft is in mesh with the gear on intermediate shaft, it gives the first six changes of low speed. When meshing the gear to the right on same shaft, the additional six changes for the higher speeds are secured. Shafts in this head are of high carbon nickel steel.

Gears on back gear shaft, also the direct driving gears, are made of steel forgings heat treated. All the others are of high carbon nickel steel, bushed throughout with best bronze. Teeth of gears are rounded. Only the gears actually used for driving and in mesh consuming all the power on work produced.

All bearings and gears, including those not in use, are oiled automatically by the splash system. Indicator shows amount of oil in base of head. Oil is properly distributed by the gears to grooving provided in top cover. The rotating shaft bearings, therefore, are kept oiled.

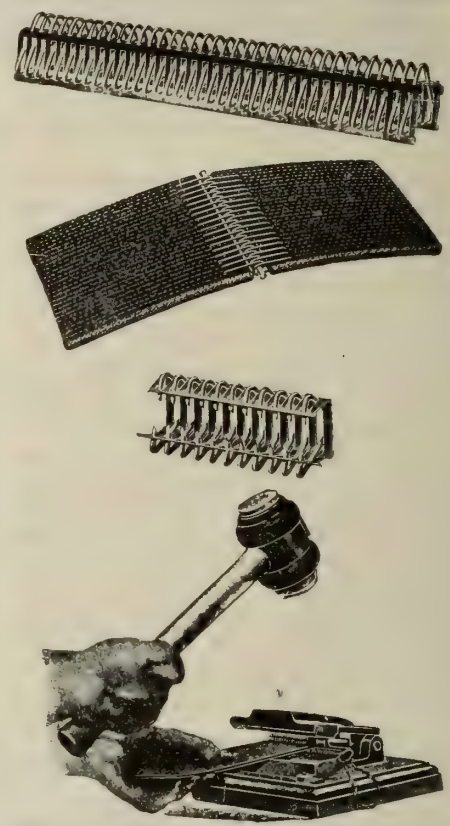
Fig. 2 shows their patented geared head lathe for single pulley belt drive, driven direct from a line shaft, therefore, no countershaft is needed, or direct connected motor drive. The motors are mounted on head stock or in rear of cabinet leg, driving through belting, silent chain or gearing. Variations are obtained in the head, therefore, only constant speed motors are required.

Twelve speed changes in geometric progression are secured on these lathes and all through sliding gears by simply shifting three levers, the levers and gearing being so arranged not permitting them to lock while operating. Any lever may be shifted without interfering with the other.

At the apron is a control by which the spindle may be stopped, started or reversed without stopping the overhead works or the motor.

UNIVERSAL BELT FASTENERS

An improved type of belt fastener, known as the "Universal," has been placed on the Canadian market by the Climax Company, of 244 Lemoine Street, Montreal. These fasteners are the result of careful study and exhaustive experiment on the part of the makers, and are universal in character. They are equally efficient in rubber, balata, leather or cotton belting, and are made in six-inch lengths, of sizes varying to take belts from 3-16 to 7-16 inch in thickness.



VIEWS SHOWING INTERMEDIATE MACHINE AND OTHER DETAILS.

The individual hooks are held in position by a metal frame which retains the hooks in the same relative position all the time the hooks are being forced into the belt. When the hooks are flush with

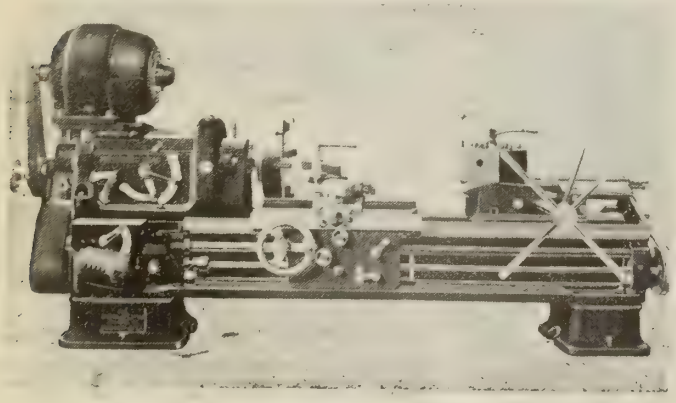


FIG. 1—SHOWING THE GENERAL MANUFACTURING EQUIPMENT.

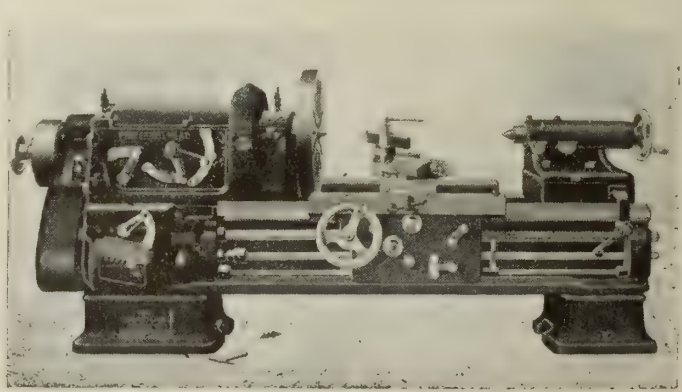
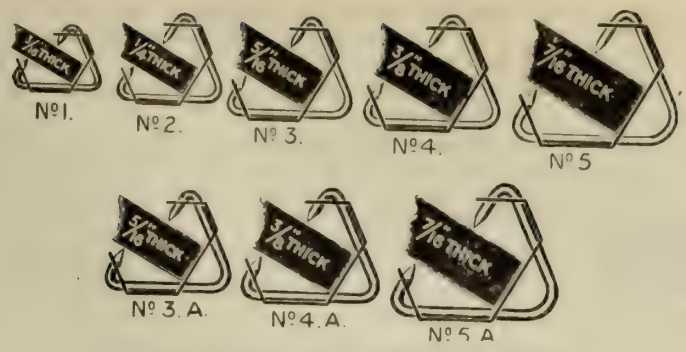


FIG. 2—THE GEARED HEAD, SINGLE PULLEY DRIVE.



VIEW SHOWING THE VARIOUS SIZE HOOKS.

the belt the frame slips off freely. The fasteners are made in two gauges of wire, the larger sizes being adopted to meet the requirements of the user who has extra heavy belts running over small pulleys.

On the intermediate fasteners the wire can be laced into the belt with a simple hammering tool, economically and efficiently. For the larger sizes, a special lacing machine is preferable. On the smallest sizes, the lacing can be performed by using a hammer and a wooden block, the metal frame assuring perfect alignment during the operation. The great advantage of the metal frame is that it prevents the hooks from twisting to one side or the other while being forced into the belt. The fasteners are made with a series of hooks having long and short legs, the short legs entering the belt on the pulley side, this method minimizing the metal contact on the pulley and reducing the possible slip. The hooks do not meet in the belt, but



THE HEAVIER TYPE MACHINE.

are individually staggered, thus increasing the effective pull.

The fasteners can be cut to any desired length without fear of wasted ends, as the metal frame keeps the pieces intact. A pair of narrow scissors are provided for cutting the metal frame.

CLIMAX KNEADABLE METALLIC PACKING

The Climax Kneadable Metallic Packing is another line carried by the Climax Company, and is also universal in character, as it is applicable to every class of service. It is equally efficient in extremes of temperature or pressure, steam engine or refrigeration work, revolving or reciprocating rods and pumps

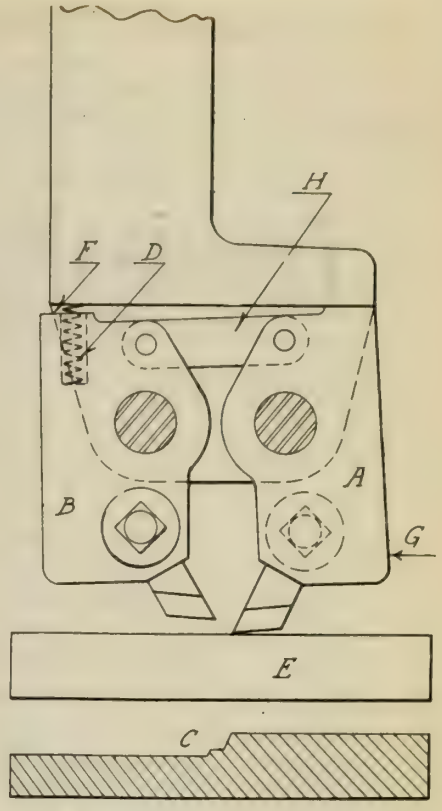


of every description. It is not necessary to provide various sizes of packing to meet the different needs, as the Climax packing can be kneaded into any shape, size of style of gland or stuffing box. It is claimed that the packing never burns or even gets hot, does not harden or crystallize, and is non-destructible, as it can be used over and over again. It is composed largely of asbestos and graphite, and, therefore, is self lubricating. It is easy to get in and easy to get out, and is extremely efficient under severe service.

THE "BOTH WAYS" TOOL HOLDER

The possibility of using, effectively, the return stroke of the planer or shaper, has long been the desire of production men. The tool here illustrated has recently been designed and thoroughly tested, and, it is claimed, found to meet these requirements in every particular. As shown in the sketch, the lower end of the shank is enlarged and slotted to take the two small tool-holders, A and B, that carry the cutting tools. The cutting points of the two tools are offset, so that the finishing cut is taken about 1-16-inch from the roughing cut. In the normal position the finishing tool is retained in a cutting position by the action of the small spring D; the short connecting link H operating the two tool-holders in unison.

In working with the tool, the clapper of the shaper or the planer must be rigidly secured to the toolhead with a locking pin or set screw, to prevent the clapper from oscillating on the return



A DETAIL VIEW OF HOLDER.

stroke. No back drag takes place, as the idle tool on each stroke is raised from the work by the swivel of the small tool-holders. The cross-section at C shows the relative position of the roughing and the finishing cuts. When setting the tool bits, a parallel piece E is placed on the vice or planer bed, and the tool-holder lowered until the front bit or finishing tool, in A, is touching the parallel. The tool-holder is then pressed at the point G until the shoulder at F rests against the bottom of the slot. The roughing tool bit is then allowed to touch the piece E and secured in this position. The tool is then ready for operation. All parts are made of drop-forged, machine steel, packhardened. The pivot pins are of hardened tool steel. The Jas. Buckley Company, Montreal, are the exclusive Canadian distributers for these tools.

Toronto.—In the suit brought by Fred Torno against Frank W. Callaghan, M. J. Shaw and W. R. Sweet for a declaration that they hold the steamer Chicora in trust for him, to become his on the payment of $4,400, Justice Orde reserved his decision. Torno admitted that he was a Russian, and Mr. Callaghan's lawyer questioned the right of anyone not a British subject to own a ship on the British register.

Montreal.—The National Shipbuilding Company of Three Rivers have received contracts for ten cargo carrying steamers from French interests. The purchasers represent three different interests. The vessels will be used as wine carriers and oil tankers.

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The Position of Canada

REPORTS come from New York and other American centres that there is anticipation of a financial "crack." People should be careful of repeating this sort of stuff.

Confidence is the cornerstone of business in any country, and the lack of confidence means disaster and blue ruin.

It requires very little courage to sit back and say "Things are going to crack." And once we get a lot of people sitting back and chanting "Things are going to crack" we are in a fair way to realize our worst expectations.

Now, our times are going to be good or bad in proportion to what we put in the markets of the world. If we sit back, as a people, and loaf, we shall reap the harvest of a loafer.

The manufacturing and commercial interests of Canada are to-day good customers. They want a lot of machine tools, supplies, iron and steel, and metals, in finished and semi-finished stages. They have the money and are not asking for credit. Their books are in good shape, and as a general thing it is safe to say they are more solvent right now than ever before.

Although this paper is interested primarily in mechanical matters, it cannot be blind to the fact that the basis of our real wealth must increasingly continue to be in the land. Our buying power is welded and banded to our ability as a people to produce new wealth, and the places we can produce new wealth are (1) the land, (2) our streams and lakes, with proper care for restocking, and (3) our forests, with a sane and enforced system of replanting. With these three essentials in operation, our manufacturing can go ahead in the certain knowledge of success, and a reasonable return on investments.

There are associations to-day who seem obsessed with the idea that our national success rests on a tariff wall "as high as Haman's gallows," to use a popular phrase. Against this we have a large class who hold tenaciously that the wiping out of tariffs would be the panacea for our national ailments.

These classes are both wrong. They are wrong because they both take a selfish, sectional view of the situation. They get a pet hobby and a notion so close to their eyes that they cannot see past to a national outlook.

There are counties in Canada where there has been a decrease in population of 14 per cent. since the war started in 1914. There are cities where there have been 20 per cent. increases.

The people in Canadian cities and towns should make an honest effort to understand the problems of the farmer, and the farmer should try and see what the town and city man has to contend with. When we go forward together we cannot well be stopped. When we spend our time lining up country against city we can be stopped, and that mighty sudden.

Some high-brow has been delivering a bit of an address on the "Educative Value of the Movies." Our most vivid memories are of scenes where the hero operated on the villain's neck with a meat axe, or where some person dropped a custard pie on Charlie Chaplin's jaw.

Almost every day in the week one hears of something that has taken another advance in price. No doubt we are in an era of high values, with everything steaming along under peak capacity. All will be well until some tinker comes along some day and breaks the peak off.

Howard Elliott, President of the Northern Pacific Railroad, is reported to have stated before the Association of Life Insurance Presidents at New York recently that United States railways need an equipment of $3,000,000,000, and that if provision is not made for developing railways continuously the cost of living, instead of being reduced, will go higher.

Calgary barbers have got behind the price of hair cut and boosted the hang thing up to 75 cents. And it wasn't so many years ago that we used to sing a little ditty about "Johnny, get your hair cut, 15 cents."



Ireland in the Columbus "Dispatch."
"All right, boys, go over and pick out your railroads!"

WHAT HAS BECOME OF THE SHELL BUSTER?

Well, Here's One Chap Who Turned to the Machine Shop and Has Stayed Right There

WHAT has become of the shell buster? When the shell contracts were over there was a lot said about this chap. If he were a barber before, he would go back to his chin-scraping, and if a laborer before, then back to his labor.

Perhaps this turned out to be true, and perhaps it did not. Here is the experience of one with whom CANADIAN MACHINERY came in contact a few days ago. He went into a shell shop early in the game. His highest wages previously had been from $15 to $18 a week, this being from an office position in a shop where a shell contract was secured. It was not long before he had doubled and trebled his best previous earnings. He worked at one operation for almost three years. When the shell business was over he did not go back to his desk. The $15 to $18 chance was still there.

He went to another shop and was soon a piece-worker again. He was not, and is not now, a mechanic, and he makes no pretensions that way. But he is handy and a plugger.

His pay now averages not far from $40 a week, and he has been making this for some time past, and the chances seem to be that he will keep on making it.

Well, what about it? This former shell buster is single. He tried to enlist, but his eyes were against him.

When the chance came to buy Victory Bonds through the shell shop, he went in right to the neck. He has taken a good-sized slice of each loan since. When he gets this year's paid up he will have $4,500 gilt-edged security tucked away. He lives in a modest way—dresses well, and is not miserly by any means. And in these few years, from a $15 to $18 clerk he has turned to the shop and has securities that give him an income of about $250 a year. In other words, his fixed income now is about a third of what his total wages used to be before he turned to the shop end of the business.

In the case of men who are married and have families to support, it is a different proposition, and we are not trying to stretch the case to preach to them.

There are, just the same, quite an assortment of single men making good wages now in mechanical pursuits. The good wages are bringing them a fast pace and a merry one, and nothing more.

This former shell buster may not thank this paper for using his case in print, but it is good business now and then to bring these matters to the front. The habits of thrift that carry with them the average man's only chance for any degree of independence, are not as firmly established as they ought to be.

We know it's a great thing to be a good fellow, a real sport, a good spender, and all that. It's also a nice thing—much nicer, in fact—to have $4,500 of your savings stowed away.

The Moscow Soviet informs the world that the people of Alaska want to leave the States and form a Soviet government. When some of Uncle Sam's subjects get through running Ireland for John Bull they may find a new problem in their own territory.

Speaking of clothes, clothing and the lack of it: "It was eating the apples that taught Eve she was naked, and so far as I can see, it is nearly time to pass the apples again," said Mr. Halbert, former U. F. O. president, speaking at Lambeth recently.

The Recovery of France

REMARKABLE progress has been made in the rebuilding of the devastated areas of industrial France. The Guaranty Trust Company of New York says: "France, instead of idling, as some observers have reported after a cursory survey of the country, has accomplished in the last year so stupendous a task that one marvels how the work has been done. Seventy-six thousand structures had been erected or repaired by the end of August, 1919, and 60,000 additional buildings were then under construction. About 550,000 buildings were destroyed or damaged during the war. In the same period 89 per cent. of the destroyed railroad trackage had been rebuilt, an area of 1,500 square miles of shell-riddled, tillable land cleared up; 80,000,000 cubic yards of trenches filled; 991,000 refugees returned to their homes; 5,000 schools reopened, and 3,872 civic communities reorganized.

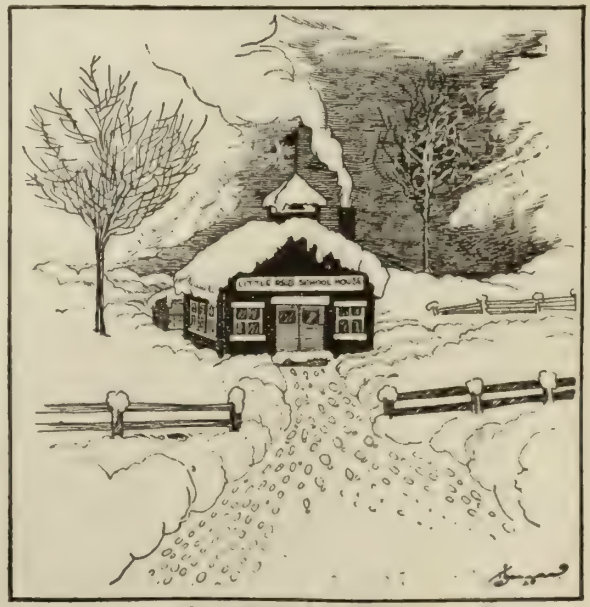
"The French people have made surprising progress in the period since the armistice in readjusting industry to a peace basis. As early as February, 1919, the Minister of Industrial Reconstruction reported that out of a total of 1,700,000 employees occupied on November 11, 1918, in a group of Government and private plants, 1,300,000 were already engaged in peacetime pursuits.

"A later investigation conducted in 1,986 industrial plants in the occupied area, employing more than 20 workmen each, shows that by November 1, 1919, a total of 1,385 establishments had resumed operation. By November 15, 1919, the Government had made advances in excess of 3,000,000,000 francs to the industrial interests of this region for the reconstruction of their factories, and the budget for 1920 provides for the expenditure of nearly 5,000,000,000 francs during the first quarter for the same purpose.

"During 1920 France will need about $650,000,000 worth of foodstuffs and raw materials, as follows: Foodstuffs, $150,000,000; cotton, $200,000,000; copper, $70,000,000; oil, $75,000,000; chemicals, tobacco, metallurgical products, fuel oil and coal, $150,000,000."

Finishing a job is not always an easy matter. Often it's much easier to quit cold. But Carnegie stuck to steel and Rockefeller to oil.

They do tell that in a short time there will be automatic phones in use all over. So when a man asks or rings for a wrong number and gets it he won't be able to call the girl at central a bonehead. Thus will another little pleasure pass away.



The Antidote for "Reds"
—Thomas in the Detroit "News."



MARKET DEVELOPMENTS



Larger Output Not Reflected in Deliveries

Small Shipments Coming Along and No Sign of Betterment—Prices Do Not Interfere With the Demand for New Standard Machine Tools

ALTHOUGH figures show that the production of steel in its several forms was much higher in February than in January, the dealers and users in Canada state that they can see no change yet. They look upon actual deliveries here as a better indication of output than any figures that may be compiled elsewhere. One result of this state is that the premium operators are having a chance to work to quite an extent. The broker and the jobber is doing quite a trade. It is a hard matter to get absolute quotations on several lines, as the price depends upon each individual order and sale. This is especially true regarding sheets, black or galvanized.

Despite the high costs and extras connected with the installation of new machine tools, the trade finds that there is no dropping off, or no particular desire to turn to used machinery. It often turns out that the increased production with the new equipment more than makes up for the increased cost. Labor-saving machinery, of course, is also included in this.

Warehouses are not taking on much stock. There are several reasons for this. In the first place they do not care to in view of the prices, and in the second place, the demand for anything they can secure is so insistent that it goes out to the consumers almost immediately. As high as 12 cents a pound was paid during the week for a lot of galvanized sheets, and the resale price would be above this figure. Of course, that is not the market price, but is given to show where some of the premium operators are working.

The scrap metal trade remains quiet. There is a big market for heavy melting steel, cast iron and stove plate, but unfortunately there is not any quantity of this material coming. There is an old saying in the yards that "When the snow goes the scrap pile grows." It will be a profitable growth this year, as prices for the wanted lines are high and firm.

SHIPPING CONDITIONS HINDERING BUSINESS IN MONTREAL DISTRICT

Special to CANADIAN MACHINERY.

MONTREAL, Que., Mar. 25. — In addition to the exchange handicap that at present affects industrial development in the matter of getting materials from the States, the car situation has increased the difficulties under which the manufacturers here are required to carry on business. The inability to get adequate car service has resulted in holding up large quantities of valuable product that should have been shipped to the States. This is in consequence of some of the American roads placing embargo on all but commodities that are considered essential to American industry. The situation is one that does not reflect favorably on the action of the American roads, as it is reported that 60,000 Canadian cars are at present on United States roads, against 40,000 American cars now in this country. There is little hope that shippers here will be granted a respite in regard to freight charges on goods going to U. S. destination, and prepayment on goods will not be accepted on such shipments. Some arrangements may be made to confine the added charge to the mileage on the other side of the line; and where shipments are sent direct to coast ports for export the charges may be modified. Shippers are anticipating some relief on the opening of navigation, but the actual date of this event is still a question of a river free of ice, and such a condition is dependent on the progress of the ice breakers and on the early weather conditions.

Car Shortage Affects Supply

The demand for steel shows no apparent let-up, and the experience of dealers in getting material in from the States is still one of considerable difficulty. Transportation is a deterring factor and consumers here are seldom in a position where a surplus on hand relieves them from the worry of anxiety as to future needs. There is this about the present situation, that manufacturers who are able to secure sufficient for their immediate needs and for uninterrupted operations, the thought of the distant future is one of optimism. Few consumers are anxious to load up with material at the figures now obtaining. In the matter of plates, sheets and tubes, the customer is satisfied to pay a good stiff price, realizing that it is invariably the practice at the present time for the dealer to pay a fair premium for prompt delivery of this class of material. Prevailing conditions has reacted favorably towards Canadian mills, especially on the smaller bars and shapes, and the tonnage on these lines has shown large increases.

Delivery Still a Drawback

One of the principal reasons for the apparent scarcity of machine tools, or rather the inability to get definite delivery of same, is the undoubted demand that comes from overseas. It has been stated that orders of considerable extent have been placed by some European countries for machine tools in the States, and this condition makes it comparatively difficult for Canadian buyers to secure early shipment on needed machinery. While many machine tool builders in the States have made it less difficult for buyers here to obtain equipment, the situation is still one that prevents a free placing of orders in the States. The trade continues to practise conservatism in the matter of buying,

and this is particularly pronounced in regard to supplies as users are reluctant to acquire any more than they are actually in need of, when prices are at or near the apex of an unusually high market.

The business done in used machinery is still of good volume, and dealers are making a profitable turnover on these lines.

Firm Scrap Market

The old material market reflects the continued demand that prevails for nearly every class of commodity, both in steels and metals. The requirements for the latter are not as pressing as those of iron and steel, but the volume of business is of a steady character. During the past week there was an evident easing of prices, but the market has again developed a firmness that promises to remain for some time. The scrap iron and steel situation has been sustained by the constant demand for all lines of materials and prices quoted are a fair average of those paid by dealers, although quotations on heavy melting steel and cast iron scrap might be marked up a little and still be within the range of the market. Dealers here stated that shipments to the States of steel scrap has dropped, as the mills here are working to capacity and in a position to take care of the greater volume of accumulation. Machinery scrap is still a scarce article on the market and the foundries are always on the lookout for available supplies.

POINTS IN WEEK'S MARKETING NOTES

New York claims that as far as the Eastern States are concerned there has been a falling off in inquiries for machine tools.

—

It is becoming more difficult for dealers to place a price on such articles as plate, sheets, black or galvanized, etc. Much of the stock they are able to secure comes from premium mills, and often sales are made to highest bidders.

—

As high as 12 cents was paid by a Toronto jobber this week for galvanized sheets, the jobbers profit going on top of this again.

—

Scrap metal trade is quiet, but demand for heavy melting steel, cast iron and stove plate continues keen, with prices correspondingly good.

—

A few shipments of boiler tubes have come in, but nothing to meet the demand that has been piling up.

—

Machine-tool dealers in this district claim that high prices have not stopped the sale of production machinery, buyers figuring that the greater output will help to balance the labor costs.

—

There is a fair amount of used machinery moving, but not as much as the price and scarcity of new equipment might indicate.

—

Iron and steel figures show a big improvement in February over January, but dealers and consumers in Canada can see very little change for the better.

—

U.S. railroads are not doing the buying that was predicted for them. They are moving very cautiously.

BECOMES HARDER TO NAME PRICES

Premium Sales Really Set the Pace if Anything Like Prompt Delivery is Desired

TORONTO.—"Yes, we know there is danger in the rising market, and our customers know it also, but that does not seem to make any difference in the amount of trade that is passing, and that is in sight." Such was the view of one large dealer in machine tools to-day. "It is a strange thing," he continued, "but there is always some force ready to meet any unfavorable circumstance that comes into the market. Just now the price might look to be a stickler, but it is not, and the man who comes into the market wants to buy the latest thing in machinery, because he finds that the increased production he will get as a result will more than make up for the added cost in the first place. I believe the present situation in the labor market is having much to do with keeping up the demand for high class production tools."

There is still a good demand for used machinery, although it is not stopping the sale of new machines to any extent. When a person wants a machine in a hurry the chances of placing a used tool come to the fore, but, as stated above, the chance of getting something that will give greater production and cut costs and operating handicaps are not to be overlooked.

Figures given from Pittsburgh, and which are reviewed in the Pittsburgh market letter in this section, mention the gratifying increase that has been made in the month of February over January in the way of ingot production. From this they go on to reason that there will soon be a catching-up noticed in the matter of supplying material to the trade and to the jobbers.

Several of the Toronto dealers, when asked if there was anything coming under their observation to bear out this reported improvement, stated that they could judge very little by the figures given out from Pittsburgh at times. "They can show a lot of things in figures, but the real test is the ability to put material over here. Delivery to the consumer is something far better to go by than statistics."

It is becoming increasingly difficult to quote prices on such lines as plates, sheets (black and galvanized), etc., owing to the varying circumstances that surround each sale. There is no desire on the part of the dealers to work the premium business to the disadvantage of the consumers. Most of the dealers in this district have their line of customers and they are trying to look after them as best they can in the way of supplies. There is nothing to indicate that the supply of sheets, for instance, is going to improve. Galvanized is one of the worst spots in the market, and a number of the dealers have not a galvanized sheet in stock. Under such circumstances they hesitate to name prices. "It is easy to name prices when you have nothing to sell," is the way one put it, "but what is the use?" Small lots of galvanized have gone to jobbers at as high as 12 cents, and the resale price would be above this again.

Jobbers are facing a peculiar situation just now. When they get a shipment of some of the much-wanted lines, they could dispose of the whole thing at one stroke, but they deem it better policy and fairer business to distribute the material, and let all their trade, as far as possible. It takes more work and more accounting, but it is giving a service that is much appreciated just now.

A limited quantity of boiler tubes are coming through now, but against the supply there is an accummulation of orders that it will take some time to satisfy.

An increase has been announced in the selling price of cold rolled, the mills having raised the price by 75c per 100 pounds. The new warehouse prices are $7 per hundred base for rounds and squares, and $8 base for flats and hexagons. These prices, of course, are subject to the standard extras for size.

The prices at which material is selling is not having the tendency to fill up any of warehouses. Dealers who take on a large tonnage get mostly premium steel, and they are anxious to get rid of it and get their money out. None of them are taking a long chance at being loaded with material bought at fancy figures.

Scrap Metal Dull

"As the snow goes down the scrap pile starts to go," is an old saying in the trade, and the dealers are hoping that it will prove true this year, especially in regard to material that looks like heavy melting, cast iron or stove plate.

Cast iron is much wanted, and there is nothing showing up to indicate a coming-in of this stuff. As a general thing it comes in quantities only when a plant is being broken up or replaced. Its origin and volume is quite different from turnings, which always keeps up a fair volume. Heavy melting is also in demand and scarce, and prices which we

quote would no doubt stiffen were a good-sized tonnage to come in sight.

The small dealer, with the coming of spring, will get out into the country again, and there should be an improvement in the volume of material offering. Prices remain firm at the new list announced a week or so ago.

There is little, if any, change in the price of metals. There is a steady demand for all kinds.

EASTERN STATES QUIETER IN TOOLS

New York Reports a Falling Off in Inquiries for Equipment

Special to CANADIAN MACHINERY.

NEW YORK, Mar. 25.—Reports from salesmen covering a larger part of the East for one of the leading machine-toll houses indicate that conditions of business are generally quieter in this line. This has been the trend for the past two or three weeks, as has been indicated in these reports. Of course the comparison is with a period ranging from November until late in February, when an unprecedented volume of business was done. It cannot be said that business is dull, for a very fair volume is still being done in some lines, but the number and size of inquiries have dropped off and orders are a little harder to close. High prices and long deliveries are undoubtedly the principal factors in the slight lull which is now present.

The railroads have not yet bought much new shop equipment, but the indications are that a fair amount of buying will eventually develop from this source. The New York, New Haven & Hartford has closed for a part of the tools it recently inquired for and the New York Central has made some purchases. The Lehigh Valley came into the market recently for a small lot of equipment. The American Locomotive Co., which was a large buyer a few months ago, has inquired for twelve or fifteen more machines to round out its former purchases.

The General Electric Co. has for some months been one of the foremost buyers, and it is evident that it will continue to furnish business to the machine-tool industry for some time to come. Its latest inquiry covers more than fifty tools for its new Bridgeport, Conn., plant, which was one of the war plants of the Remington Arms Co., and which last week was leased for a term of years, with option to purchase at a reported price of $7,000,000. The Bridgeport plant contains considerable equipment, not all of which will be of value to the General Electric Co. for its purpose, which is the manufacture of small motors. The Edison Lamp Works of the General Electric Co. is also in the market for a list of new tools for its machine shop at Waverly, near Newark, N.J.

PITTSBURGH BELIEVES THAT BETTER TIMES ARE COMING FOR CONSUMERS

Special to CANADIAN MACHINERY.

PITTSBURGH, March 25.—Since the steel ingot production report for February, referred to in last letter, came out the trade has had an opportunity to study the remarkable showing it made. It will be recalled that the report indicated that the production during February was at the average rate of 44,200,000 gross tons a year. This was a remarkably heavy tonnage, seeing that during the month the common reports were that the mills were averaging only 75 or 80 per cent. of capacity, while there had been no reputable estimate of capacity being greater than 50,000,000 tons. Either the mills were not hampered nearly as much by weather, by poor transportation conditions, and other factors, as had been assumed, or the capacity is materially greater than hitherto assumed.

The common conclusion in the trade, after studying the evidence, is that the reports of the mills being hampered in their operation in February were wholly or largely true, but that capacity is going to be found materially greater than has been assumed, whenever physical conditions permit of the mills operating at their greatest efficiency. Capacity may be found to be in the neighborhood of 55,000,000 tons of ingots a year, which would mean that the February production was 80 per cent. of capacity.

Still Better Supplies in Prospect

Whatever the capacity, the February production is an accomplished fact, and if under favorable conditions one-fourth or one-fifth more steel can be made, supplies will eventually be greater than was expected. Even now there are not a few reports of manufacturing consumers being comfortably supplied with steel, if not more than comfortably.

Supplies to consumers are better not only by reason of the increased production, but also by reason of better rail movement. The accumulation of finished steel at the mills have been reduced somewhat, while a more important factor is that freight is less delayed in transit. As the time shipments are on the road is decreased the quantity of steel delivered exceeds the quantity shipped in the same period from mills.

The position of jobbers is different from that of manufacturing consumers. Whether because the mills have definitely given preference in the past few months to manufacturing consumers rather than to jobbers, or because the call upon jobbers' stocks has been especially heavy, nearly all the jobbers are practically bare of stocks.

Railroad Buying

The railroads are buying quite cautiously. Freight car orders placed thus far make no large total, and orders placed plus present inquiries in the market total only about 50,000 cars. However, such an amount of car buying would keep the car shops busy until late in the year, as they will require some time to get into quantity production. There is very little bridge and other structural work coming from the railroads, while rail orders are small, nearly all the year's requirements being covered by previous purchases. The requirements are only for replacement purposes, there being practically no track laying in contemplation at present. This will follow the formulation of comprehensive plans for improvements, to come later.

While the railroads are prevented from making heavy purchases at this time by the fact that extensive financing would be necessary, it is probable that they are pursuing a conservative course partly on account of the price situation. The Steel Corporation will sell to railroads, or for railroad account, at March 21 or Industrial Board prices, but has no large amount of steel to spare for this year, while among the independents there are few if any that will sell even to railroads at those prices. Doubtless the railroads expect that later they will be able to buy on more advantageous terms than at present, when the steel market is still feeling the effects of shortage in supplies.

Price Trends

There is a very strong balance of probability that about April 15 or shortly thereafter, the American Sheet and Tin Plate Company (Steel Corporation) will open its books for sheet and tin plate contracts, for second half delivery in the case of manufacturing consumers and for third quarter in the case of jobbers, naming prices the same as hitherto adhered to, the March 21, 1919, or Industrial Board schedule, with blue annealed sheets, 10 gauge, at 3.55c; black sheets, 28 gauge, at 4.35c; galvanized sheets, 28 gauge, at 5.70c and tin plate, 100-pound at $7.00, base. Late in February sheets for prompt shipment sold up to a basis of 10c for common black, while in the past week or two the maximum has been about 8c. With the prospect of 4.35c being named on black sheets for second half, therefore, it is quite improbable that the Steel Corporation will make any general price advances. There is even considerable doubt now whether it will advance nails, as was expected, on the basis that an advance in nails would be in the nature of a readjustment, since the $3.25 price in the Industrial Board schedule is particularly low by reference to cost of production.

In prompt deliveries steel prices are certainly on the down grade, though outside of the case of prompt sheets, noted above, the declines thus far have been small or imperceptible. Offerings for early deliveries are so very light that it would not require much tonnage demand to hold up the market or even

LeBLOND

HEAVY DUTY

Universal Millers

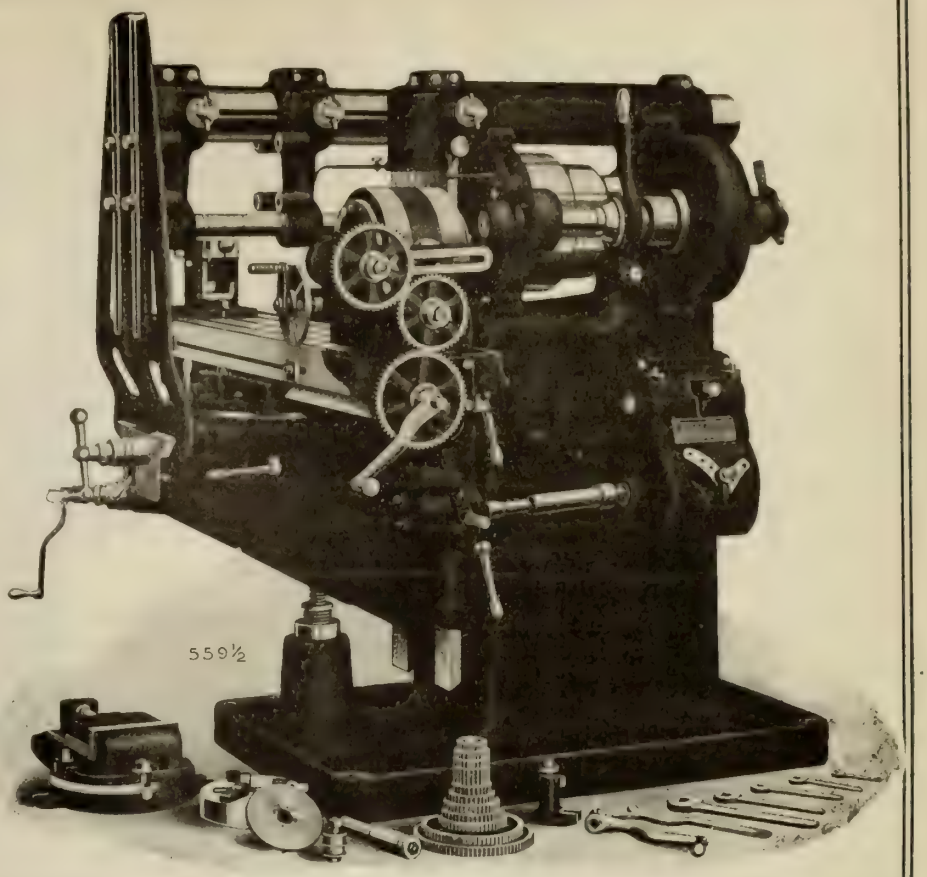
Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control.

Carried in stock by

The A. R. Williams Machinery Co.
LIMITED
TORONTO



Acid Electric STEEL CASTINGS

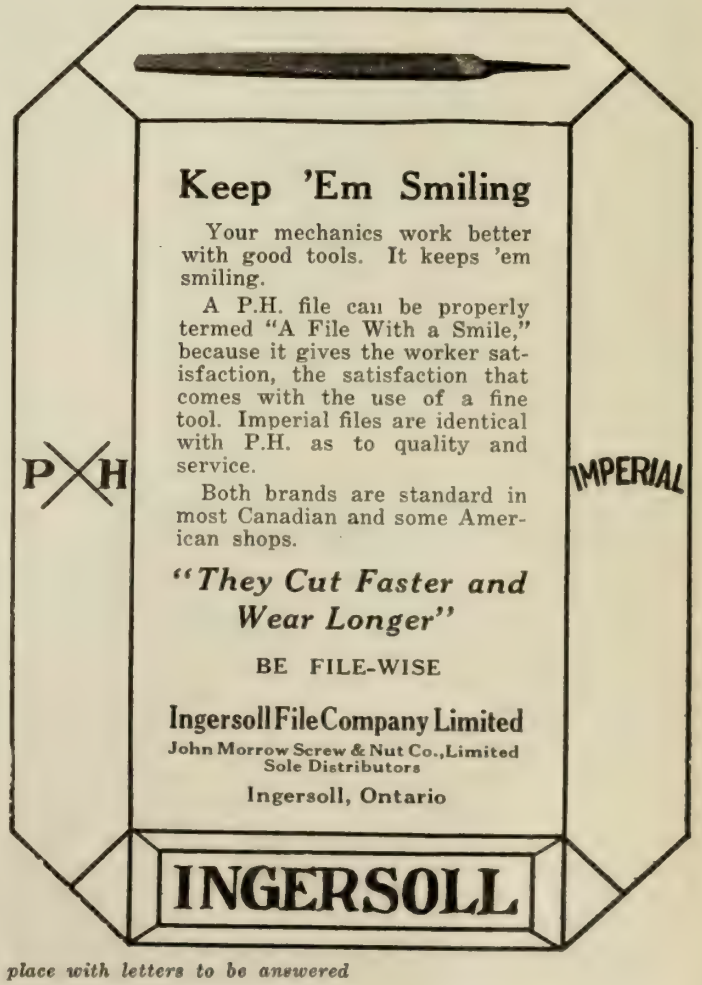
Acid Electric Steel Castings show superior ability to resist wear and crystallization. They are smooth in texture, free from Blow Holes, and machine perfectly. We specialize in

Railroad and Other High Grade Castings

up to 15 tons, any specification. Electric Steel Castings COST NO MORE than ordinary Steel Castings.

Prices on Application—Prompt Deliveries

The Thos. Davidson Mfg. Co., Limited
Steel Foundry Division, Lachine Canal
Head Office: 187 Delisle St. MONTREAL
Phone Victoria 1492



Keep 'Em Smiling

Your mechanics work better with good tools. It keeps 'em smiling.

A P.H. file can be properly termed "A File With a Smile," because it gives the worker satisfaction, the satisfaction that comes with the use of a fine tool. Imperial files are identical with P.H. as to quality and service.

Both brands are standard in most Canadian and some American shops.

"They Cut Faster and Wear Longer"

BE FILE-WISE

Ingersoll File Company Limited
John Morrow Screw & Nut Co., Limited
Sole Distributors
Ingersoll, Ontario

INGERSOLL

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advance it, but there is not enough demand to do this.

The conservative independents, who sell some distance ahead, are displaying distinctly more moderate views than a few weeks ago, and make it plain that they they do not contemplate any advances for third quarter, when they come to open their books generally for that period. This, of course, leaves it as a possibility that prices will prove slightly lower.

Pig Iron

There is much talk in the pig iron market, but very little action indeed. It is argued that the market is strong because so much foundry iron has been sold ahead, but on the other hand buyers have purchased as much as the furnaces have sold, and will have correspondingly little buying to do in future. The buyers were in a very excited frame of mind when they made the purchases, as the market was advancing rapidly and showing no signs that it would ever reach a limit. There were many predictions of $50 iron appearing, but the market fell far short of justifying the predictions. Pig iron prices are higher relative to other commodities. The foundries which bought iron at over $40 may have been entirely justified in doing so, through having sold their castings at commensurate prices, but the steel works that use pig iron have not bought second half iron to any extent and are not justified in buying at present prices, when they are not in position to sell their steel, and when current market prices for steel, for deliveries beyond relatively prompt, are much lower, relatively, than present pig iron prices. The market seems to be quotable at $42 for Bessewer, $41.50 for basic and $42 for foundry, f.o.b. valley furnaces, freight to Pittsburgh being $1.40, but there are odd lots of foundry that might be picked up at concessions, and there is certainly no delivery premium on either of the three grades mentioned, while in all the past there has never been a high market without there being a delivery premium on foundry iron at least.

The Week's Events in Montreal Industry

P. Reynolds, formerly chief inspector of Lymburner's, Ltd., has become associated with the St. Lawrence Welding Company, Montreal.

There is every possibility that the completion of the aqueduct improvements, in connection with the Montreal waterworks, will be approved by the city council. It is understood that a board of engineers will be appointed by the Administrative Commission to carry out the remainder of the contract, which will entail the further expenditure of about $4,000,000.

At a recent meeting of the Engineering Institute of Canada, R. de L. French described the steps taken by the Dominion Government for the development of the lignite fields in this country, the deposits in the Western provinces being estimated at upwards of 3 billion tons. Mr. French stated that considerable experimental work had already been done in the utilization of this class of fuel for industrial purposes. The use of lignite as domestic fuel has not yet received much attention, but the Lignite Utilization Board are making progress in this direction.

At a meeting of the directors of the Dominion Steel Corporation, which will be held this week, it is expected that Roy M. Wolvin will be elected to the position of president of the Board, and that Mark Workman, the present holder of the office, will be made chairman Mr. Wolvin, while not a steel man, is an authority on transportation subjects, and as shipping facilities are to be a feature of the company's business, his experience and ability in this connection should be of inestimable value to the company.

The death of Harry Osborne, late works manager of the C.P.R. Angus shop, removes from the circles of railroad activity an able and efficient personality. He was respected by all who knew him, and his ability to adjust labor disputes to the entire satisfaction of employees and the company has been one of his marked characteristics. He was 61 years of age, and has been in active railroad work for the past 40 years, and with the C.P.R. almost from the time of its organization. On his retirement a year ago, he was presented with a purse of gold by the employees of the Angus shops. His release from active participation in railroad work is said to have affected his general health. He is survived by a widow, two daughters and one son.

PIG IRON TRADE

The pig iron market is generally quiet although a fair amount of business is being done. There are some good enquiries for export iron. Basic is firmly established at $43. Following are reports from various U. S. points:

Philadelphia. — The market here is steady, with a fair volume of business being done. $1.75 to 2.25 silicon iron is being sold Eastern Pennsylvania furnace, but a number of sales of this grade for prompt and second half delivery have been made at $44 and $45. Production is being handicapped by the coke shortage.

Chicago.—The dullness which has been in evidence for a couple of weeks past still prevails, with the exception perhaps of spot iron. Southern iron for spot delivery is selling at $42 Birmingham, while what little northern iron comes through is $45 Chicago furnace for No. 2 foundry.

Pittsburgh.—Ten thousand tons basic has been bought by a local steel company at $43 valley furnace, and this seems to be the minimum price for this grade at present. Bessemer has been quoted at $42 valley furnace for third quarter shipment. There is a good enquiry for foundry iron, and sales of No. 2 foundry for second quarter have been made at $42 valley furnace.

Boston.—New England points are still embargoed and foundries have not yet received the looked for relief. Spot iron is in good demand but there is little interest in last half iron. One Pennsylvania interest is quoting $42 for first half iron and $43 for last half, though the premium is usually on first half rather than last.

U.S. SCRAP METAL

While in some districts prices have gone up, in others they have weakened. This follows the trend of business, which is dull in some districts and active elsewhere. Following are reports from various U. S. centres:

Chicago.—Following a period of dullness the market has improved considerably both in the steel and iron divisions. The movement has been helped by dealers covering their contract requirements. There is little railroad scrap offering.

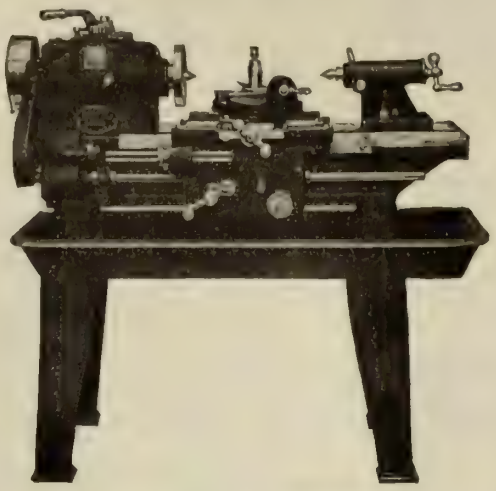
Boston.—The demand is light and the feeling is towards a decline in prices. Scrap prices have dropped on the various grades from 25 cents to $1 during the past week. No 1 machinery is still good and some textile machinery was sold at $46.70 delivered to the Western part of the state.

New York.—The market has been unsettled, there being both advances and declines in prices of scrap material. Heavy melting, machine shop turnings, and clean cast borings dropped from $1 to 50 cents. Stove plate, wrought pipe and city wrought moved up a little.

Philadelphia.—The market is generally easier on steel, wrought, and machine shop turnings. A round tonnage of steel scrap was sold for $24 delivered, not much trading being done.

Pittsburgh. — Freight congestion is holding up shipments of material and is preventing shipments being taken in by melters. Under these conditions steel scrap prices have eased off somewhat. Heavy melting has ranged between $26.50 and $29. The latter is not usual, and probably $28.50 represents the normal price just now.

Reduces Floor to Floor Time in the Machining of Short Parts



The ADAMS
"SHORT-CUT" LATHE

Choosing equipment adapted to the job means economical production. The Adams "Short-Cut" Lathe is designed to handle the kind of pieces which predominate in most shops — those which are comparatively short.

The Adams "Short-Cut" Lathe is enormously powerful, and, having all the features of a standard engine lathe, doesn't need a specially trained operator.

Manufactured by

O. R. ADAMS MANUFACTURING CO. Inc.
Rochester, N.Y.

This lathe is equipped with automatic feed stops. It saves your workmen's time. It will save you money.

You cannot afford to pass over a machine with the capabilities of the ADAMS "SHORT CUT." There's a place for it in your shops.

Write to-day for full descriptive bulletin.

Garlock-Walker Machinery Limited

567 Banning Street
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32 Front Street West
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334 St. James St.
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"Everything in Woodworking and Metalworking Machinery"

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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$42 40
Lake Superior, charcoal, Chicago	57 00
Standard low phos., Philadelphia	50 00
Bessemer, Pittsburgh	43 00
Basic, Valley furnace	42 90
Toronto price:—	
Silicon, 2.25% to 2.75%	52 00
No. 2 Foundry, 1.75 to 2.25%	50 00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 5 50
Steel bars, base, Toronto	5 50
Iron bars, base, Montreal	5 50
Steel bars, base, Montreal	5 50
Reinforcing bars, base	5 00
Steel hoops	7 00
Norway iron	11 00
Tire steel	5 75
Spring steel	10 00
Band steel, No. 10 gauge and 3-16 in. base	6 00
Chequered floor plate, 3-16 in.	9 40
Chequered floor plate, ¼ in.	9 00
Staybolt iron	9 00
Bessemer rails, heavy, at mill	....
Steel bars, Pittsburgh	3 00-4 00
Tank plates, Pittsburgh	4 00
Structural shapes, Pittsburgh	3 00
Steel hoops, Pittsburgh	3 50-3 75
F.O.B., Toronto Warehouse	
Small shapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	**3 62**
Structural shapes	**3 72**
Plates	**3 90**
Small shapes under 3"	**3 62**

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross. Montreal	Toronto
Lake copper	$25 00	$24 00
Electro copper	24 50	24 00
Castings, copper	24 00	24 00
Tin	77 00	75 00
Spelter	12 50	12 00
Lead	12 00	12 00
Antimony	14 50	14 00
Aluminum	34 00	35 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$ 7 25	$ 7 25
Plates, ¼ up	6 50	6 50

Price List No. 38

WROUGHT PIPES

Standard Buttweld

Per 100 feet

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
⅛	$ 6 00	$ 8 00	$.....	$.....
¼	4 83	6 96	5 31	7 44
⅜	4 83	6 96	5 31	7 44
½	6 42	7 99	7 10	8 67
¾	8 11	10 24	9 03	11 16
1	11 99	15 13	13 35	16 49
1¼	16 22	20 47	18 06	22 31
1½	19 39	24 48	21 59	26 68
2	26 09	32 93	29 05	35 89
2½	41 24	52 07	.....	.....
3	53 93	68 09	.....	.....
3½	68 54	85 56	.....	.....
4	81 21	101 37	.....	.....

Standard Lapweld

	Steel Blk.	Steel Gal.	Gen. Wrot. Iron Blk.	Gen. Wrot. Iron Gal.
	Per 100 feet			
2	$29 79	$36 63	$33 49	$39 96
2½	43 58	54 41	49 43	60 26
3	56 99	71 15	64 64	78 80
3½	70 38	87 40	79 58	96 60
4	83 39	103 55	94 29	114 45
4½	95	1 19	1 20	1 45
5	1 10	1 39	1 40	1 69
6	1 43	1 80	1 81	2 19
7	1 87	2 36	2 34	2 83
8L	1 96	2 48	2 46	2 98
8	2 26	2 85	2 84	3 43
9	2 71	3 42	3 40	4 11
10L	2 51	3 17	3 15	3 81
10	3 23	4 08	4 06	4 90

Terms 2% 30 days, approved credit

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$15 00	$14 00
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper wire	18 00	18 00
No. 1 machine composition	16 00	17 00
New brass cuttings	11 00	11 75
Red brass cuttings	14 00	15 75
Yellow brass turnings	8 50	9 50
Light brass	6 50	7 00
Medium brass	8 00	7 75
Scrap zinc	6 50	6 00
Heavy lead	7 00	7 75
Tea lead	4 50	5 00
Aluminum	19 00	20 00
	Per Ton	Gross
Heavy melting steel	18 00	18 00
Boiler plate	15 50	15 00
Axles (wrought iron)	22 00	20 00
Rails (scrap)	18 00	18 00
Malleable scrap	25 00	25 00
No. 1 machine cast iron	32 00	33 00
Pipe, wrought	12 00	12 00
Car wheels	22 00	26 00
Steel axles	22 00	20 00
Mach. shop turnings	11 00	11 00
Stove plate	25 00	25 00
Cast boring	12 00	12 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜-in. and less	10
Carriage bolts, 7-16 and up	Net
Coach and lag screws	25
Stove bolts	55
Wrought washers	45
Elevator bolts	Net
Machine bolts, 7/16 and over	Net
Machine bolts, ⅜-in. and less	15
Blank bolts	Net
Bolt ends	Net
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square, blank	add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 50
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	25 and 5
Sq. and hex. hd. cap screws	22½
Rd. and fil. hd. cap screws	plus 17½
Flat but. hd. cap screws	plus 30
Fin. and semi-fin. nuts up to 1-in.	20
Fin. and Semi-fin. nuts, over 1 in., up to 1½-in.	10
Fin. and Semi-fin. nuts over 1½ in., up to 2-in.	Net
Studs	15
Taper pins	40
Coupling bolts	Net
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$60 00
Open-hearth billets	60 00
O.H. sheet bars	76 00
Forging billets	56 00-75 00
Wire rods	52 00-70 00

Government prices.

F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$5 70
Cut nails	5 85
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 35½
British Manila rope	0 28
New Zealand hemp	0 28
Transmission rope, Manila	0 47
Cotton rope, ¼-in. and up	0 88

POLISHED DRILL ROD

Discount off list, Montreal and Toronto **net**

GEOMETRIC

Adjustable Collapsing Taps

Have overcome all the expense and annoyance of tapping screw threads with a solid tap.

Anyone doing thread tapping knows what backing out a solid tap each time means. It usually means low production, poor threads, and worn out taps.

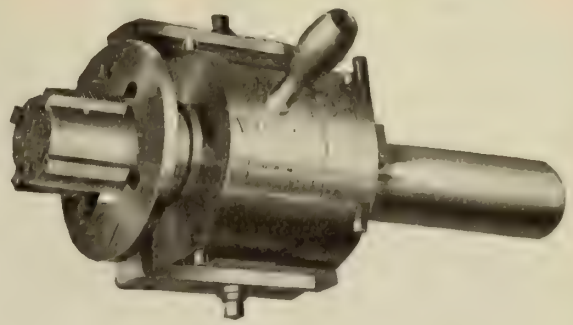
The mechanism of the Geometric Taps takes care of adjustment to correct diameter each time a thread is tapped, it collapses the chasers automatically, leaving a thread clean cut and perfect.

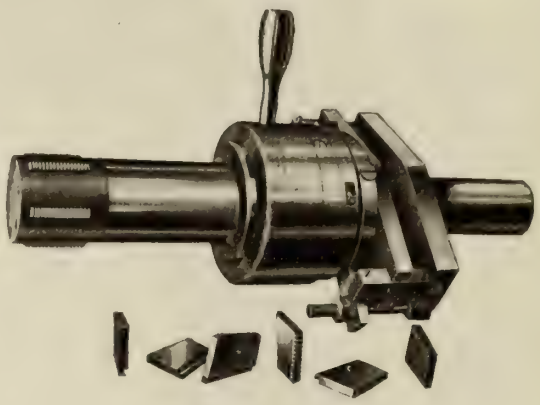
The chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

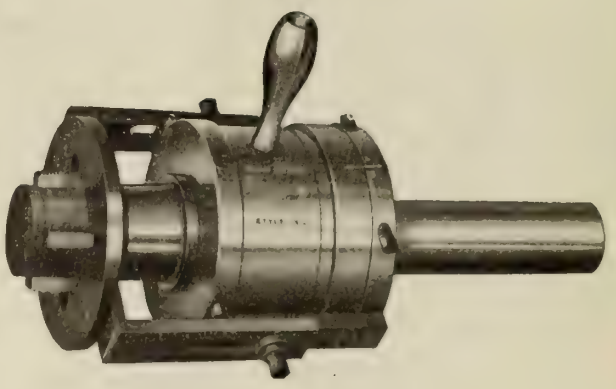
The manufacturers of the Geometric line of Collapsing Taps and Self-opening Die Heads are justly proud of the distinction which is theirs:—

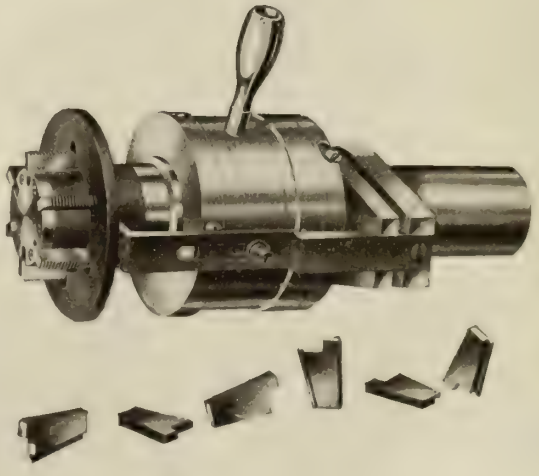
The Originators
and the
Largest and Best Known Manufacturers
of
Automatic Threading Tools

For cutting all classes of screw threads, internal and external, of any diameter and form.









The Geometric Tool Company
New Haven, Conn., U.S.A.

CANADIAN AGENTS:
Williams & Wilson, Ltd., Montreal; The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B.; Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

If interested tear out this page and place with letters to be answered

MISCELLANEOUS

Solder, strictly	$ 0 40
Solder, guaranteed	0 43
Babbitt metals	18 to 70
Soldering coppers, lb.	0 62
Lead wool, per lb.	0 16
Putty, 100-lb. drums	8 30
White lead, pure, cwt.	20 00
Red dry lead, 100-lb. kegs, per cwt.	16 50
Glue, English	0 40
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 35
Benzine, per gal., bulk	0 35
Pure turp., single bbls., gal.	3 60
Linseed oil, raw, single bbls.	3 00
Linseed oil, boiled, single bbls.	3 03
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin, "D," per lb.	0 14
Borax crystal and granular	0 14
Wood alcohol, per gal.	2 70
Whiting, plain, per 100 lbs.	2 75

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes	32½
Can. carbon cutters, plus	20
Standard drills, all sizes	32½
3-fluted drills, plus	10
Jobbers' and letter sizes	32½
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	net
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	20 to 40
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At warehouse]

Rounds and squares	$7 base
Hexagons and flats	$8 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	27	37
Class C	18	27

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 8 50	$ 9 50
Sheets, black, No. 10	8 50	9 00
Canada plates, dull, 52 sheets	8 50	10 00
Can. plates, all bright	8 60	9 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	11 00	....
Fleur-de-Lis, 28 B.W.G.	10 50	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	11 50	10 50
Premier, 10¾-oz.	11 50	10 90
Zinc sheets	16 50	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 50	.....
1½ in.	31 50	29 50
1¾ in.	31 50	30 00
2 in.	30 00	30 00
2¼ in.	35 00	29 00
2½ in.	42 00	37 00
3 in.	50 00	48 00
3¼ in.	.. ..	48 50
3½ in.	63 00	51 50
4 in.	85 00	65 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	24½
Palacine	27½
Machine oil, per gal.	43½
Black oil, per gal.	18½
Cylinder oil, Capital	82
Cylinder oil, Acme	70
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls., net	13½

BELTING—No 1 OAK TANNED

Extra heavy, single and double	10%
Standard	10%
Cut leather lacing, No. 1	2 75
Leather in side	2 40

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 60
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	09
Pumice, ground	06
Emery glue	30
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	60
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

WASTE

XXX Extra	24	Atlas	20
Peerless	22½	X Empire	19½
Grand	22½	Ideal	19
Superior	22½	X Press	17½
X L C R	21		

Colored

Lion	17	Popular	13
Standard	15	Keen	11
No. 1	15		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	20	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

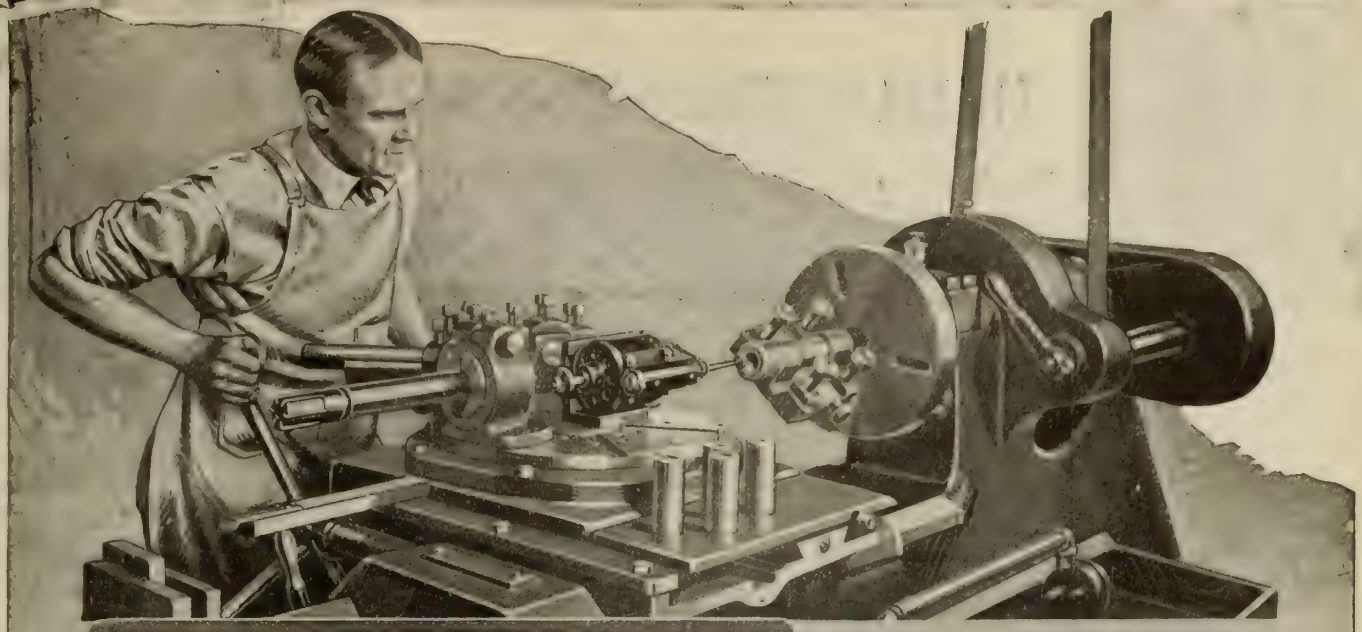
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$14 50
Sheets, 3½ lbs. sq. ft.	10 50	14 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .23
Acid, hydrochloric	.03¼
Acid, nitric	.10
Acid, sulphuric	.03¼
Ammonia, aqua	.15
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy.	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.08
Nickel carbonate	.32
Nickel sulphate	.19
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.11
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.00
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



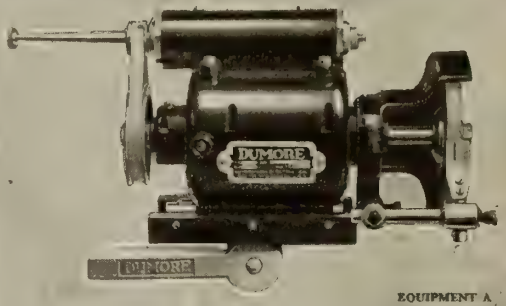
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STARTING and finishing this job with one set-up—from machining the casting to grinding the hardened bearing in place—is a good illustration of the **DUMORE** grinder on production. This method positively aligns each bearing with the rest of the machining, by tempering. And the danger of chatter-marks, taper or bell-mouth is eliminated because the **DUMORE** grinder is perfectly balanced throughout and gives correct cutting speeds to even small emery wheels. Limits of .0001" are easily maintained.

There are any number of jobs in your shop for the **DUMORE** grinder which this illustration will suggest. Give your workmen the use of a tool that will speed their work, turn out better tools and improve the quality of your product. The **DUMORE** grinder is light and portable—may be carried anywhere in the shop and quickly set up.

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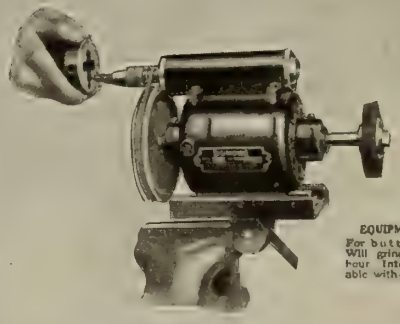
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EQUIPMENT A
For general tool room use. Includes High Speed Internal Spindle A with reach of 3 inches. 30,000 R.P.M. Comes fully equipped. Weighs 17½ pounds.

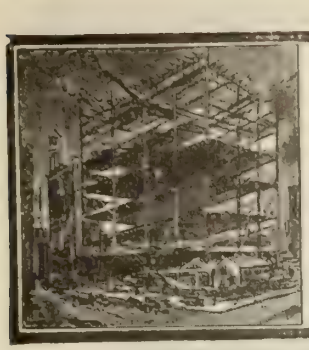


EQUIPMENT B
For deep internal work. Extension arm has 10-inch reach. 10,000 R.P.M. Arm interchangeable with internal spindle on Equipment A.



EQUIPMENT C
For button dies. Will grind 20 an hour. Interchangeable with A and B

DUMORE HIGH SPEED GRINDERS



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE GOSSIP

Invitation to Machinists.—It is understood that the city of Toronto will forward an invitation to the International Association of Machinists to hold their forthcoming convention in that city.

Manufacture New Line.—The Tallman Brass & Metal Company of Hamilton, Ont., have recently acquired the Canadian rights for the Doehler die casting process. The manufacture of these castings is now being carried on in their Hamilton factory.

Free Industrial Sites.—The city of Kingston has decided to offer free sites and exemption from taxation for a number of years to concerns looking for factory locations, when such are judged worthy. This policy has been adopted in view of the unfavorable power conditions prevailing in Eastern Ontario.

To Build Light Railway.—The municipality of Dauphin, Man., is contemplating the building of a narrow gauge light railway. The road would serve for bringing gravel and road building material direct from the pits. Tenders have been asked for seven miles of movable rails, two gasoline locomotives and a number of cars, both flat and dump.

Building Trades Advance Wages.—Port Arthur contractors have received notification from the Building Trades Federation that wages for this year will be at the rate of $1.25 per hour for bricklayers, and $1.10 for carpenters. According to one contractor the number of bricks laid in one day's work has dropped 50 per cent. in the past few years.

The Deputy Minister of Naval Service will receive tenders up till April 14 for the purchase of the steamer "Vigilant," now lying at Collingwood, Ont. The vessel is 117 feet long by 22 feet 1 inch beam, and 13 feet 2 inches depth; gross tonnage, 396.15; registered tonnage, 242.66; and N.H.P., 65. The vessel is built of steel, surface condensing, and has a maximum speed of 16 knots.

Canadian Trade for Eleven Months.—The monthly statement from the Customs Department shows the grand total for the eleven months ending Feb. 29. The total shows an increase in Canadian trade of $103,926,832, as compared with the same period last year. The total of exports and imports was $2,110,540,504. The increase in imports is $77,324,941, and in exports, $29,987,794.

Credit for Serbia.—The Dominion authorities in London have been approached on the subject of granting a Canadian credit of $20,000,000 to Serbia. D. M. Stewart, formerly member of the Canadian Bankers' Association and now representing Canadian interests in Serbia in endorsing the request, states that the Serbians are industrious and progressive, and possess ample resources to secure the credit, and have a stable and capable Government.

Extending Business. — The National Shipbuilding Co. of Goderich have extended their foundry, which consisted of 2,000 square feet of floor space, with a 52 in. cupola, to 14,000 square feet, with another 36 in. cupola. The firm have also installed several modern power moulding machines and are carrying on general foundry practice for both job and production work.

Closing U. S. Salvage.—The U. S. Ordnance Department is closing its salv-

BRITISH VIEW OF NATIONALIZATION

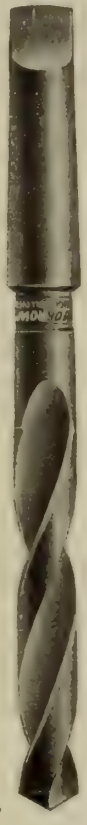


—Whitelaw in "The Passing Show," London.

The Showman — "Hullo! You'd better be careful how you go to work with that saw!"

The Man-Up-the-Tree—"That's all right, mate. I don't care. It ain't my tree!"





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500 LITTLE TWISTERS in daily use giving testified satisfaction. Entire patent rights are for sale. Thorough investigation invited from responsible manufacturers.
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age office on Adelaide St., Toronto. They have been able to clear out almost everything in the plants here and at Brantford. The office will be moved to Montreal now, although the U. S. Ordnance Dept. office will still be retained in the Royal Bank Building. There is still left some pipe fittings, steam coils, electrical apparatus, etc. The work of finishing up in the Maritime Provinces will now be proceeded with.

Cars for Russia.—A. A. Hellers, styling himself "Director of the Commercial Department of the Russian Soviet Government Bureau of the United States," announced recently that he had been authorized to place orders for 2,000 locomotives, cars, and equipment for them. He said that payment would be made in gold, or its equivalent, upon delivery at Russian ports. No further orders would be placed until a general trade agreement had been made between the United States and the Russian Government.

MARINE

Montreal.—Contracts for ten freight ships have been placed with the National Shipbuilding Corporation, Three Rivers, by three different French companies. It is understood that these ships will be used as wine carrying vessels and as oil tankers. The National Shipbuilding Corporation has its head office in the United States.

Collingwood.—The death occurred in Meaford recently of Mr. William Jamieson, in his 72nd year. Mr. Jamieson was the first purser of the steamer Favorite, of the Meaford Steamship Company. He held the position until the boat was sold. Mr. Jamieson was born near Peterborough, going to Meaford as a young man.

Cleveland. — The engineers of the Pittsburgh Steamship Company will join their ships April 5, and the work of fitting out the bulk freighters of the lakes will start early in April. A good number of these vessels will be ready by the middle of the month. Most of the vessels that are at the head of the lakes unchartered will go for ore to begin the season's work.

Atlantic Rates Increased.—There has been a further increase in both passenger and freight rates on the North Atlantic, according to an announcement from New York. The rate on foodstuffs has been increased from 45 to 75 cents per 100 lbs. Passenger fares have been increased 13½ per cent., making a total increase since July last of thirty-three and one-third per cent.

Collingwood.—The annual meeting of the Collingwood Shipbuilding Co. took place recently, and the general statement for the past year was received with satisfaction. Capt. Alex. McDougall resigned from the Board of Directors, and is succeeded by Mr. John S. Leitch. The full Board is as follows: H. B. Smith, S. Dyment, J. W. Norcross, R. M. Wolvin, H. W. Cowan, F. S. Izard, and J. S. Leitch.

Cleveland.—There will be no coal cargoes before the middle of May. The coal handling equipment will be ready by April 11, but the local demand is so great that no coal will be loaded in steamers till they are ready to start. Many ports will want early coal shipments, and some of the coal docks are swept clean. There is no change in the grain freight market, and a number of ships that have been on offer for some time have not been placed.

Ottawa.—Mr. R. A. Willard, of the Marine and Fishery Department, does not despair of an early opening for navigation. He claims that Easter being early this year means that navigation will also be early. The tidal effects of the new moon will soon clear the St. Lawrence of ice, he believes. The "Shamrock" and the "Dollard," which have been wintering at Sorel, are being put in commission, and will be ready for buoy-laying April 15.

London.—The "Imperator" recently acquired by the Cunard Line from the German owners, had a very unpleasant experience on her last voyage. The vessel suddenly took a very sharp list, during a concert in the big saloon, and the 600 passengers were thrown from their seats. Fortunately, there was no panic. The cause of the occurrence is not yet known, but was evidently due to trouble in the engine room. The sailing scheduled for March 27 to New York was cancelled, but no reason given.

BOOK REVIEWS

"Smooth-On Home Repairs" is the title of a valuable booklet just published by the Smooth-On Manufacturing Co. In this book has been explained just how to repair leaks in boilers, stove pipes, radiators, furnaces, tanks, and the many other household fixtures that need attention from time to time. There are from thirty to forty different kinds of repairs with the remedy illustrated and explained.

Automobile repairs also receive attention in this book. Cracked water jackets, leaky radiators, scored cylinders, etc., are taken up, and their repairs explained.

A copy of this book will be sent free on request to the Smooth-On Manufacturing Co., Jersey City, N.J.

PERSONAL

A. B. White, recently chief engineer of the Dominion Shipbuilding Co., Toronto, and Capt. C. E. Henderson, (M.C.), have opened offices in Huron Chambers, Sudbury, where they will carry on an engineering and agency business, for engineering and manufacturing companies in Canada. Their lines will include mechanical and electrical machinery, especially catering to the mining and lumbering interests of the North.

ONTARIO INCORPORATIONS

A company has been incorporated under the Ontario Companies Act to be known as the Ojibway Timber Land Co., Ltd., with a capital of $250,000 divided into 2,500 shares of $100 each. The head office will be at Port Arthur, and the company will carry on a general lumber business.

Toronto Woodworkers, Ltd., has been incorporated with a capital of $100,000 divided into one thousand shares of $100 each, with head office in Toronto. The company will carry on business as manufacturers of wooden furniture, music cabinets, etc.

The Ontario Cement Company, Limited, has been incorporated with a capital stock of $1,000,000, divided into 10,000 shares of $100 each, of which 3,000 shall be preference shares. The head office will be at Brantford and the company will carry on business as manufacturers and developers of cement and ore products.

PIG IRON MARKET

Cleveland.—The market is quiet, but on a very firm basis. Basic is at $43 valley furnace, while No. 2 foundry is at $43 to $44 Cleveland furnace. One maker disposed of 15,000 to 20,000 tons for the last half delivery at $43 Cleveland furnace.

New York.—There are a large number of enquiries for pig iron from Europe, the total of the various grades asked for being about 30,000 tons; 200 tons were sold for Russia via another European country. The local market is quiet.

Buffalo.—About 10,000 tons of foundry iron was disposed of during the past week, the base price being $45 for No. 2 plain, $46.25 for No. 2X, and $48 for No. 1X. No. 2 plain was at $43.

Cincinnati.—There is a brisk demand for immediate delivery, and the market is very strong. The spot demand is occasioned by makers who are not receiving iron they have on contract and wish to cover their needs.

St. Louis.—There is a period of dullness over the market just at present, but there is still a lot of buying to be done by melters before their requirements are filled. Southern iron is quoted at $42 for No. 2 foundry for prompt shipment, and at $43 for second half delivery.

SCRAP MARKET

Buffalo.—Prices have receded on a quiet market. Heavy melting steel is now quoted at from $25 to $25.50. Other grades have also receded. Mills are getting low production owing to coal and coke shortages.

Cincinnati.—A fair amount of heavy melting steel has been sold at $25 Cincinnati. There is not much stock on hand at dealers yards, and the indications are for a heavy buying movement in the near future.

Birmingham.—The market is weak, with heavy melting steel at $20 to $21. Dealers are buying only to meet immediate requirements on contracts, and melters are buying only in small lots.



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(Vulcan Iron Works) OTTAWA, ONT.

ALUMINUM BRONZE

Aluminum bronze contains from 1¼ to 11 per cent. aluminum and the remainder copper. It varies from a tensile strength of 25,000 pounds for the 1¼ per cent. aluminum to 90,000 pounds for the 11 per cent. aluminum alloy. More than 11 per cent. aluminum produces a brittle alloy. Aluminum bronze shrinks more than ordinary brass in casting, and hence care is required in pouring it into the molds. Aluminum bronze containing less than 7½ per cent. aluminum can be rolled, swedged, shorn or drawn.

The death is announced from Smiths Falls, Ontario, of Mr. Wm. H. Frost, president of the Smiths Falls Malleable Castings Co., Ltd. Mr. Frost started the business in the year 1878, in a very modest way, and gradually built it up until it became one of the largest malleable casting industries in the province. The deceased gentleman, who was 73 years old, played an active part in the life of the community, having served as mayor.

Fire losses on the forest reserves in Alberta, Canada, during 1919 aggregated more than 2,250,000 dols., or more than the estimated loss of the previous ten years. Fires swept over 548,000 acres of forest reserve in 1919, while 20,000 acres were burned in 1918.

Victoria Dock Case Judgment.—The case of Grant Smith & Co. and McDonnel, Ltd., against H.M. the King, in connection with excavation work done on the dock at Victoria, B.C., by the plaintiff, has been settled by Sir Walter Cassells, in the Exchequer Court of Canada. The claims were for $333,812. The amount of excavation work was admitted, but the Department of Public Works claimed that rock prices had been charged for material which should have come under a lower classification. The court found that the resident engineer was in collusion with the contractors, and work certified by him should be set aside. The entire claim was thrown out.

The Weekly Metergram is a new publication, published in the interests of the World Trade Club in advocacy of "Meter-Liter-Gram."

The Number 1 issue of Volume 1 was published on January 15, 1920, and is well written and contains the subject matter of what the World Trade Club stands for, the mill, cent, dime and dollar being the bases of a very good argument.

Meter for length, Liter for hulk, Gram for weight is the foundation of the scheme which they propose to urge the world to accept as a world's standard of weights and measures, and the arguments would seem to have good grounds on which to build.

Among the advocates of the new system is Gen. John J. Pershing, who was commander of the American Army in France.

PROCESS FOR REMOVING RIVETS AND CUTTING METALS

A recent invention by the Societe Anonyme L'Acetylene Dissous relates to a process for removing rivets and cutting metals by means of the electric arc.

Certain work in boiler construction and particularly in the repairing of ships in consequence of stranding, collision and the like, necessitates the removal of a large number of rivets. Formerly this removal was effected by cutting off one head of the rivet with a hand or machine tool and then punching the rivet out; but of late, use has been made of the oxygen process of metal cutting. The head of the rivet is first heated by the flame of the blowpipe cutter, and, on reaching a suitable temperature is burnt off by means of a supplementary oxygen jet.

Also electricity has been used for separating or fusing the members of metallic structures by bringing a carbon electrode connected to one pole of any source of electricity into contact with the metallic material which is to be separated, the latter being connected with the other pole of the source of electricity. As is well known in all fusing operations in which an electric arc is used, the metal, as soon as it melts, is liable to oxidize, and the oxide formed interferes with the heat transmitted by the electric arc, and considerable time is lost in the operation.

The object of the present invention is a process which effects the removal of rivets or cutting of metals by means of the electric arc without any loss of time.

The process consists essentially in fusing the head of the rivet by an electric arc of suitable intensity, and at the same time enabling the metal of the rivet head to combine with substances adapted to form therewith compounds which are sufficiently fusible and liquid at the working temperature to flow readily, or be blown away by the wind of the arc. To this end the metal piece, of which the rivet forms part, is connected to one pole of a source of electricity, whilst the second pole is connected to an electrode consisting of an iron or steel rod, the diameter of which may vary between 1-16 in. and ⅜ in., and which is covered by a coating containing the substance which is to enter into combination with the metal of the rivet head. As soon as the electrode is placed in contact with the rivet head the arc develops and the metal and the rivet runs away in the form of liquid slag without loss of time. The most suitable substances for making the coating of the electrode are oxidizing substances, fluxes such as borax and silicates, and substances such as carbon, which form fusible alloys with iron. Particularly interesting results are obtained with a coating essentially composed of hydrated silicates to which a small amount of carbon in powder form may be advantageously added. With an electrode about 3-16 inch diameter coated with such a covering 1-16 inch thick, and with a continuous current of 250 to 300 amperes, the head of a counter-sunk rivet 1 inch diameter can be destroyed in about 20 seconds.

It should be understood that without departing from the scope of the invention other means than the above described may be used for the purpose of bringing into contact with the heated metal substances adapted to enter into combination with same and form fusible products; for instance the fusible substances may be arranged in the form of a rod or the like along the electrode.

It should be remarked that the metal of the rivet head is not necessarily entirely converted into slag or fusible alloy. Part of this metal can be carried away, as is the case in the process with blowpipe cutters, in the slag or fusible alloy without having entered into combination.

The diameter of the electrode and the intensity of the current may vary within fairly wide limits. Nevertheless a current intensity of 250 to 300 amperes (continuous current), should not be exceeded when it is desired to remove rivets without deteriorating the plate in which they are fixed.

This process can be employed with alternating current and for piercing and cutting plates and beams, but it is of more particular interest for the removal of rivets.

HYDRAULIC ROCK BLASTING

A hydraulic device for the blasting of rock, and especially also for the demolition of concrete piers and foundations, is described in the "Zeitschrift fur Schiesswesen." The device is due to Dr. Tubben, of the Armaturenfabrik Westfalia. A pressure pipe leads to a cylinder, 85 mm. diameter, in which eight pistons move, one after the other, in telescope fashion. The cylinder is inserted into a hole drilled into the rock by an electric motor; the pistons are forced out and crack the rock. The drilling of the holes, about one inch in depth, is said to take fifteen to twenty minutes, the blasting five minutes. When the rock has been cracked, a tap is opened and the water allowed to spurt back The device is said to have proved very successful in mines and quarries where the concussions of explosives would be dangerous.

The city of Hamilton will receive tenders up till May 15 for the following fire apparatus:. One two-wheel, front drive, motor-propelled aerial hook and ladder truck; one motor service hook and ladder truck; two motor combination chemical engines and hose cars; one motor-propelled combination pumping engine and hose car. Specifications can be obtained from A. B. Teneyck, Chief Fire Dept.

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Oil Tempered Steel Springs
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Special styles of all kinds to order.
THE CLEVELAND WIRE SPRING COMPANY
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Hull Iron and Steel Foundries Make Additions of Considerable Size

The 1919 programme of the Hull Iron and Steel Foundries for expansion is nearly complete. The principal additions and improvements undertaken and completed during the past year consist of an addition 100 by 80 feet to the main building. Forging plant building 200 by 65 feet, new solid brick two-storey pattern work shop, and pattern storage 200 by 45 feet, also transformer and power house, a total of over 50,000 additional square feet of productive space. New equipment has been purchased and erected, amongst others being a 500-ton hydraulic press, one 1,000-lb. steam hammer, one 3,000-lb. steam hammer, and numerous other improvements aggregating over $300,000.

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Rates (payable in advance): Two cents per word first insertion; one cent per word subsequent insertions. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

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DRAFTSMAN WITH SEVEN YEARS' EXPERience in other lines, would like to get a position in machine drafting office, with a chance of promotion; at present taking course in machine design. Reply Box 666, Canadian Machinery. (c14m)

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SECOND-HAND UPSETTING MACHINE, 3½" or 4"; in good condition; immediate delivery. Apply Canada Foundries & Forgings, Ltd., Welland, Ont. (c14m)

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ONE 6,000-LB. STEAM BEMONT POND TYPE Hammer. In excellent condition. For particulars please write Box 667, Canadian Machinery. (c15m)

ONE 20-FT. BED HEAVY ENGINE GAP LATHE Broadbent make (England), 70" x 15" swing in gap; 46" swing over bed; 4" belt; 5 step cone; 14' between centres; tight and loose pulley; compound rest and face plate. Darling Brothers Limited, 120 Prince St., Montreal. (c14m)

70 DOZEN NEW TWIST DRILLS, $5 PER dozen; Morse Taper Shank, 27/32", 23/32", 53/64", 51/64", 1 1/32"; straight shank, 23/32", 25/32", 53/64", 57/64", 59/64". No. 15 Badger State punch and shear, handpower, 800 lbs. weight, very powerful tool, $100. Minnesota Steel & Tool Company, 2701 Thirty-sixth Avenue South, Minneapolis, Minn., U.S.A. (c16m)

CROSSLEY GAS ENGINES — USED. GOOD condition. Two. Built in Manchester, England. Complete with mufflers, gas scrubbers, air compressor for starting. Four Cycle Trunk Piston Type. 20" bore, 30" stroke, 160 R.P.M. Aproximate net weight, each engine, 21 tons. Further particulars on application. Canada Foundries & Forgings, Limited, Brockville, Canada. (c13m)

Opportunities are offered every week on this page.

Are you making use of them?

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FOR SALE

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Box 668 Canadian Machinery

(c14m)

THE FOLLOWING MACHINE TOOLS FOR IMmediate delivery, all in good condition: One 42" Bickford Radial Drill with Countershaft; one 20" Back Geared Rockford Drill; one DodgeMfg. Co., Double Disc Grinder, 18" discs; one No. 1 Cincinnati Cutter Grinder; one No. 1½ Cincinnati Milling Machine. These tools can be inspected at our plant and are offered subject to prior sale. Prices reasonable. L. & P. Manufacturing Co., Ltd., Niagara Falls, Ont. (c13m)

A second-hand straight-line 8-inch Mill, in good condition; five stands of rolls, buckeye engine, with gears and pinions complete, all in good operating condition.

This mill includes a set of used rolls dressed for making all 8-inch mill sizes. Inspection can be made at plant of the Slatington Iron and Steel Company, Slatington, Pa.

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Closes April 19

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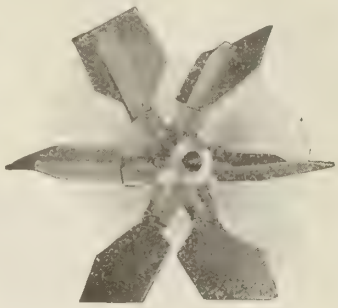
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Canadian

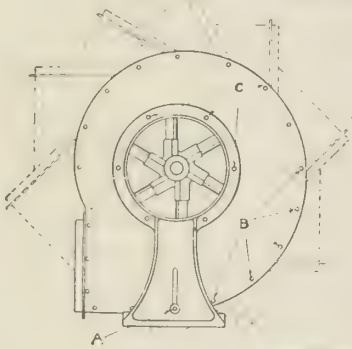
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

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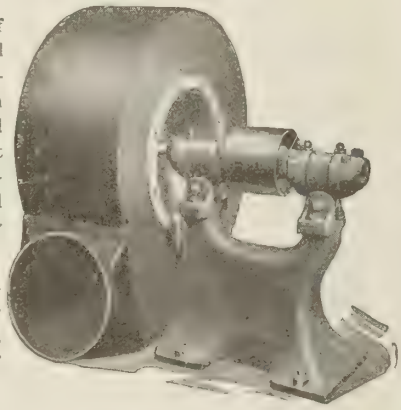


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The housing is of heavy rolled steel plate securely bolted together with angle irons. Round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

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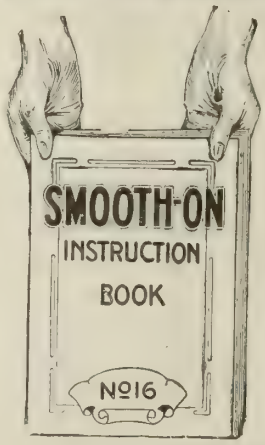
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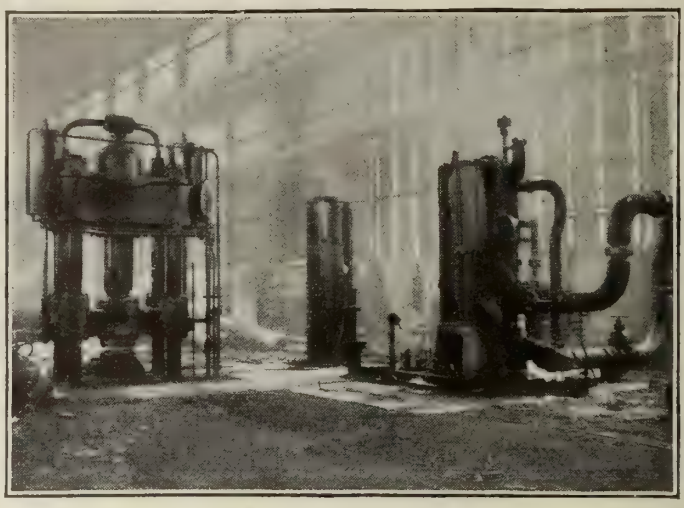
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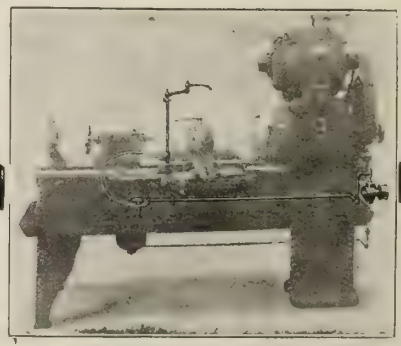
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are rotary geared because experience has proven this construction to be the most practical for machine tool use.

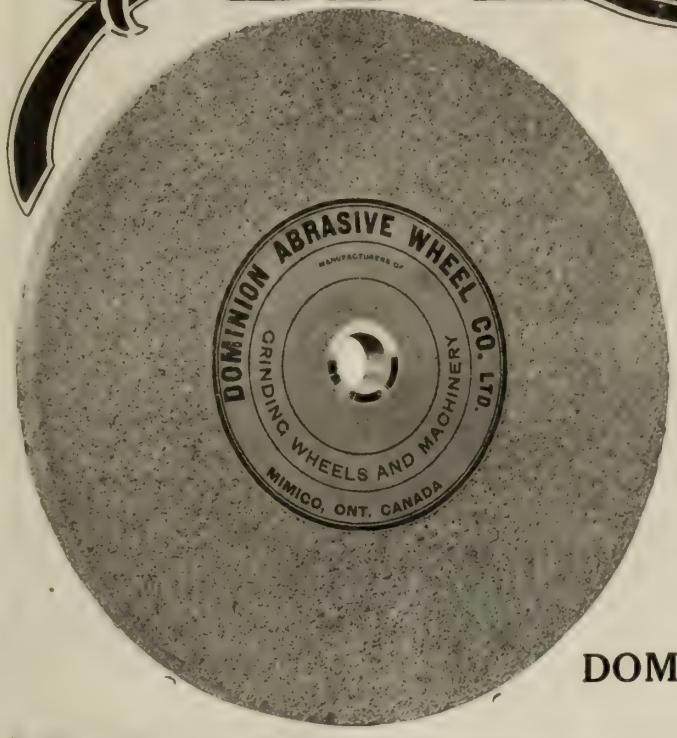
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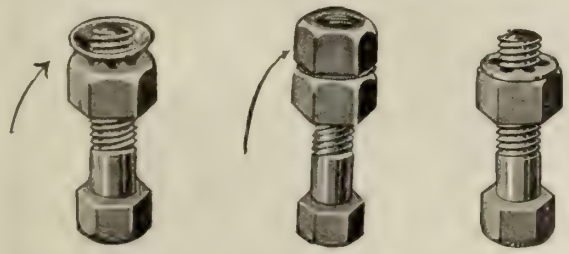
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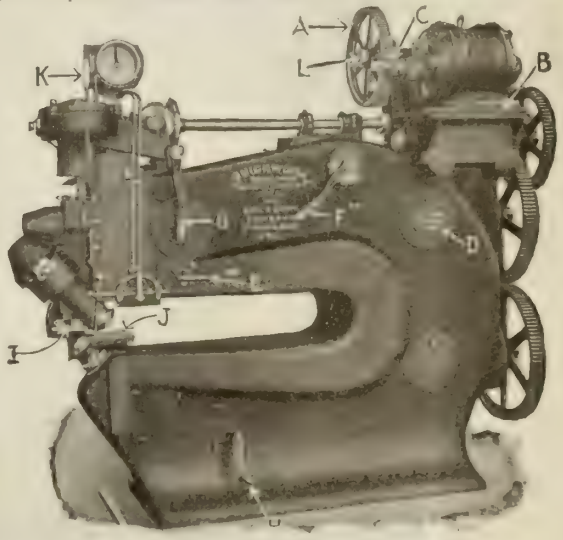
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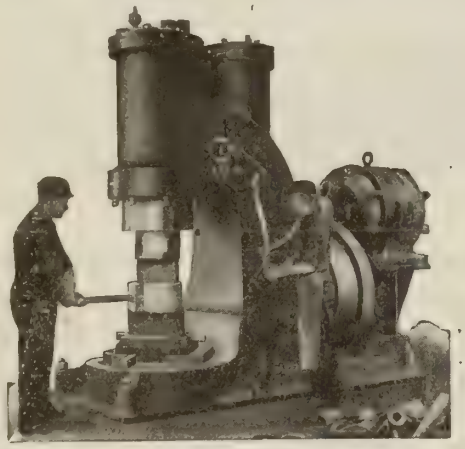
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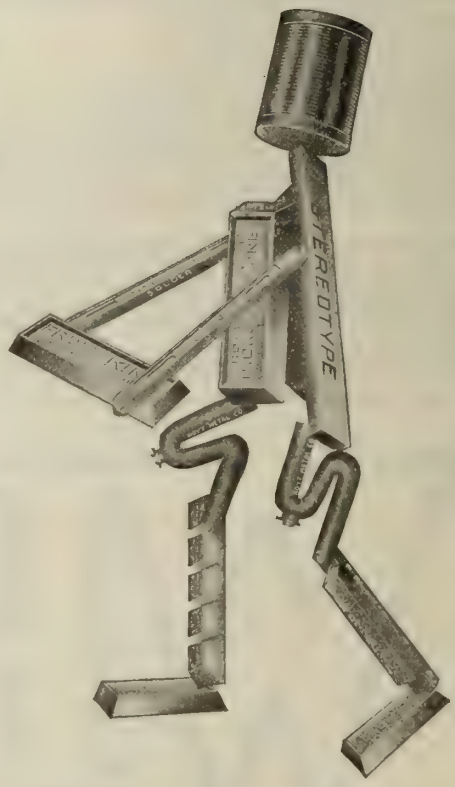
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will withstand heavy pressure without increasing its temperature

For general machinery bearings it is without a peer.

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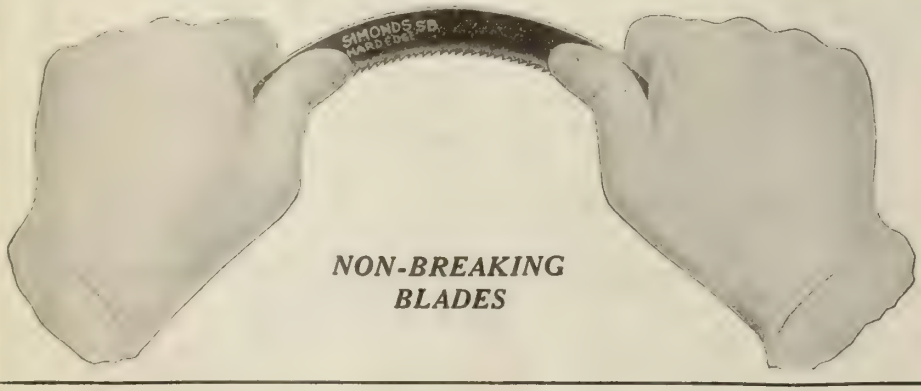


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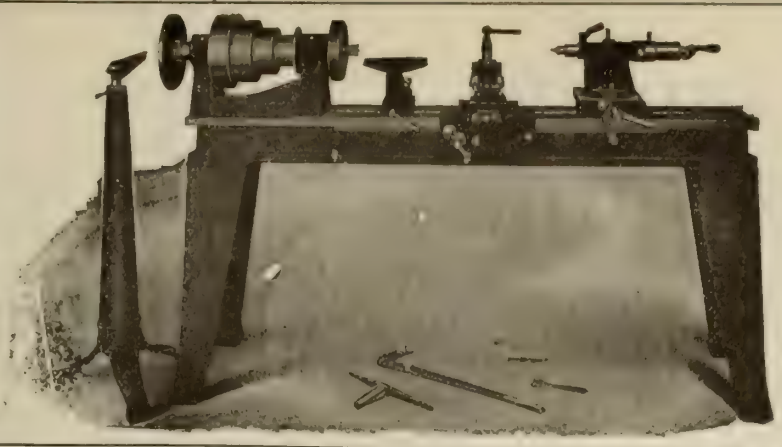
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Any Size or Length

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FAST AND ACCURATE. Equipped with set over swivel tailstock and carriage, and outside face plate and tripod. Built in 16" swing with beds 6 or 8 feet in length. Spindle is made of high carbon steel, is hollow and fitted with Morse Taper and runs on self-oiling bronze bearings.

Out catalog gives a full description of this strong and highly efficient machine, also our other quality speed lathes and grinders. Give us your address.

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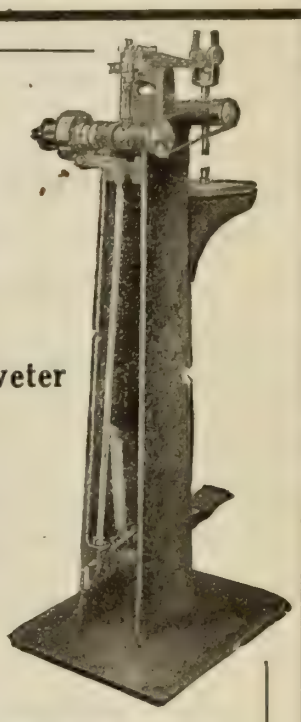
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will do better work and more work than any man with any other riveter.

A dollar-a-day boy will place rivets in small, out-of-the-way corners or close up to the shoulder of the casting that will be as smooth and good looking as any placed in easy-to-reach spots. Can you say that of any other riveter, even with a man operating?

And a boy and a Grant Rotary Riveter are a safe combination. For although the Grant can be operated at a speed limited only by that at which one operator can feed the machine, its friction stopping device enables a boy to regulate its speed at will. **Write us.**

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Western Canada—Centre of Drug Smuggling

IS Western Canada the centre of the illicit drug traffic of the continent? Does the underground system, by which the body and soul-destroying narcotics are distributed to the addicts of America begin on Canadian soil?

Official U.S. investigators say so, and, in discussing the drug traffic in the March 15th issue of MACLEAN'S, Mrs. Murphy (Janey Canuck) acknowledges that there may be some truth in the statement.

In this article, the second in a series that she is writing after thorough investigation, Mrs. Murphy traces the ramifications of the underground system—how the drugs are smuggled in and purveyed to the hopeless thousands, the whole sordid story of the filching of souls and the degrading methods by which it is done.

Mrs. Murphy's articles are beginning to stir things up in Canada on the drug question. Ottawa is showing an interest, the police of many cities are displaying unusual zeal, the newspapers are awakening to the menace. Mrs. Murphy will continue her series until she has laid bare the whole truth about this danger that is gripping Canada.

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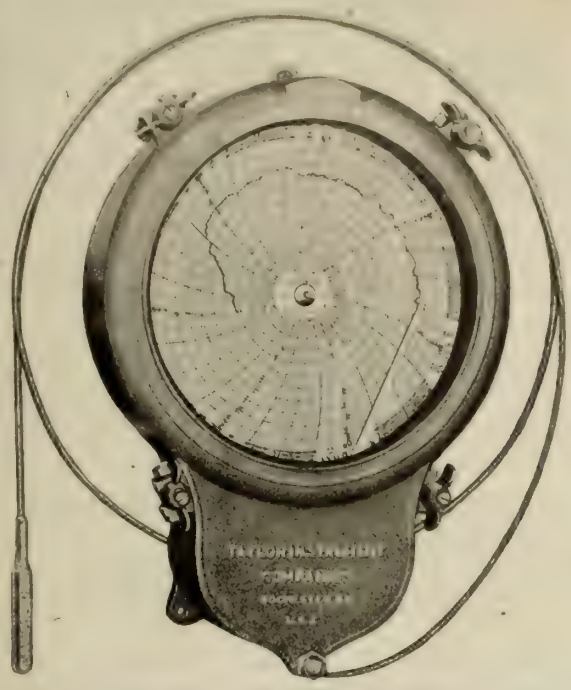
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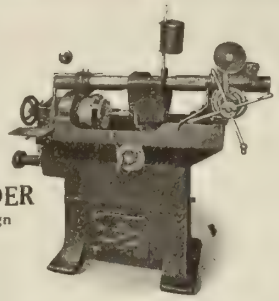
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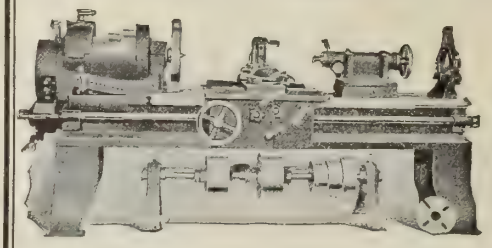
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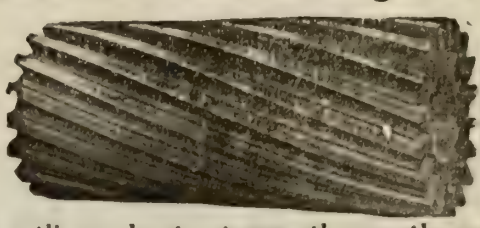
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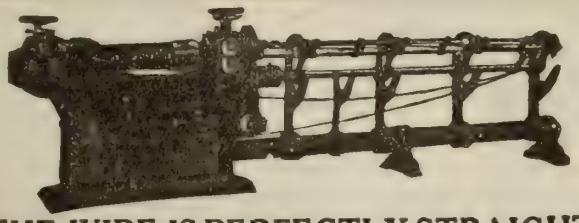
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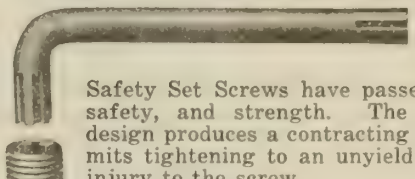
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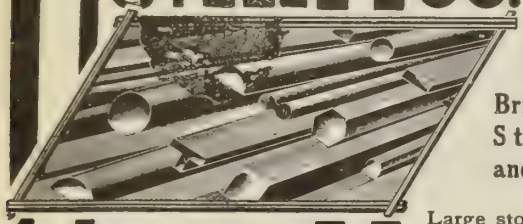
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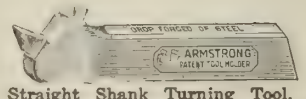
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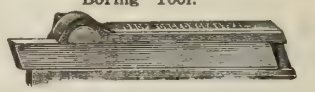
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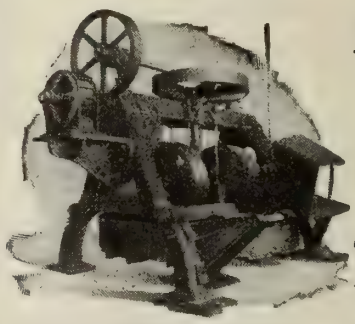
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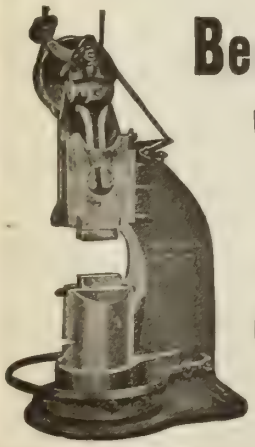
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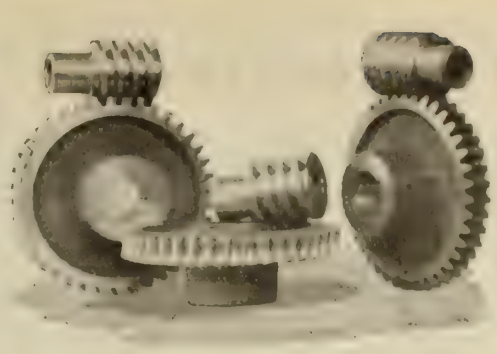
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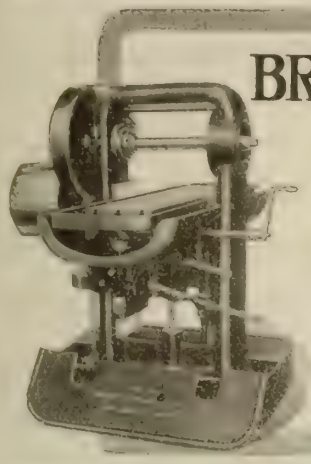


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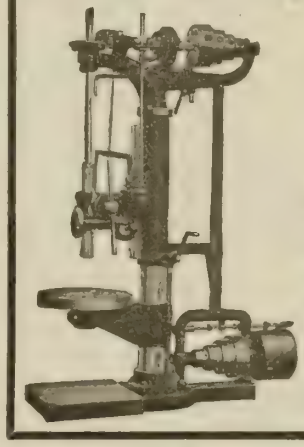
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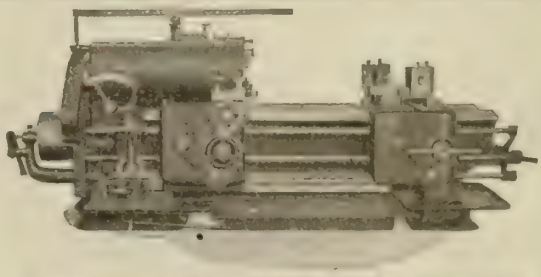


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Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.

AUTOMATIC METAL CUTTING-OFF MACHINES
Atkins & Co., E. C., Hamilton, Ont.
Greenfield Tap & Die Corp., Greenfield.
Wells Bros., of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto.
G. F. Foss Mchy. & Sply. Co., Montreal.

AUTOMATIC SCALES
Can. Kron Scale Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
British Smelting & Refining Co., Ltd., Montreal.
Canada Metal Co., Ltd., Toronto, Ont.
Cumiss, Clarke & Co., Montreal, Que.
G. F. Foss Mch. & Sply. Co., Montreal.
Hoyt Metal Co., Ltd., Toronto.
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

BAND SAWS
Atkins & Co., E. C., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., John, Ingersoll
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Roker & Co., Inc., Montreal, Que.
Chapman Double Ball Bearing Co., Toronto
Gray Ball Bearing Co., Ltd., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Marshall Son & Bunney, Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BALLS, BURNISHING
Gray Ball Bearing Co. Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Petrie, Ltd., H. W., Toronto.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams & Co., J. H., Brooklyn, N.Y.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.
Peckovers, Ltd., Toronto, Ont.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BATTERIES
Northern Electric Co., Ltd., Montreal Que

BEADING MACHINES
Quickwork Co., St. Marys, Ohio.

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BEARINGS, DIE CAST
Franklin Mfg. Co., Syracuse, N.Y.

BEARINGS, GRAPHITE BRONZE
Lyman Tube & Supply Co., Montreal, Que.

BEARINGS, ROLLER
Lyman Tube & Supply Co., Montreal, Que.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. F. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto.
Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto.
Gutta Percha & Rubber Ltd., Toronto, Canada.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Whitney Mfg. Co., Hartford, Conn.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Can. Link-Belt Co., Ltd., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto.
Gutta Percha & Rubber, Ltd., Toronto, Canada.
Graton & Knight Mfg., Worcester, Mass.
International Mchy. Spls., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Petrie, Ltd., H. W., Toronto.
Quaker City Rubber Co, Philadelphia, Pa.
Rice, Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams Mchy Co., A. R., Toronto, Ont.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
Gutta Percha & Rubber, Ltd., Toronto, Canada.
John Tullis & Son, Glasgow, Scotland.
C. S. Ordnance, Toronto, Ont.

BELTING, RUBBER
International Mchy. Spls., Ltd., Montreal.
Quaker City Rubber Co, Philadelphia, Pa.

BELTING, STITCHED COTTON DUCK
Dominion Belting Co., Hamilton, Ont.
Gutta Percha & Rubber, Ltd., Toronto.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John, Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Mach. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BLACKSMITH WORK
St Lawrence Welding Co, Ltd., Montreal

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal.
Algoma Steel Corp., Sault Ste. Marie
Kayser-Ellison & Co., Ltd., Montreal
Marshall, Son & Bunney, Toronto.

BILLETS, FORGING
Kayser-Ellison & Co., Ltd., Montreal

BINS, STEEL
Dennis Wire & Iron Works, London, Ont.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke

BLOCKS, CHAIN
Oliver Engineering Co., Montreal.

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto
MacGovern & Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
U.S. Ordnance, Toronto, Ont.

BLOWING ENGINES
General Combustion Co., Ltd., Montreal Que.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield Mass

BOILER TUBES
Lyman Tube & Supply Co., Montreal, Que.

BOILER BREECHINGS
Que.
Can. Ingersoll Rand Co., Ltd., Sherbrooke,
St Lawrence Welding Co, Ltd., Montreal
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto.

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros., of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.

BOILERS, RANGE
Can. John Wood Mfg. Co., Ltd., Toronto Ont.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A.B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Petrie, Ltd., H. W., Toronto

BOLTS
Aikenhead Hardware Co. Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Peckovers, Ltd., Toronto, Ont.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd, Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Gest Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Barber Mchy Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Gardner & Son, Robt., Montreal.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Universal Mach, Co., Bowling Green, O.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., B., Hespeler.
Landis Machine Co., W esboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Barber Mchy Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg., Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Rockford Drilling Mchs. Co, Rockford, Ill

BORING AND TURNING MILLS
Barber Mchy. Co., Ltd., Toronto, Ont.
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & S'ply Co., Geo. F., Montreal
Knight Metal Products, Toronto.
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
Cleveland Wire Spring Co., Cleveland.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRASS ALLOYS
British Smelting & Refining Co., Ltd., Montreal, Que.

BRASS AND COPPER TUBING
Lyman Tube & Supply Co., Montreal, Que.

BRASS FOUNDERS
Canada Metal Co., Toronto.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

BRASS GOODS
Crane, Ltd., Montreal. Que.

BRASS PIPE AND TUBE
Crane, Ltd., Montreal, Que.

BRASS WORKING MACHINERY
Barber Mchy. Co., Ltd., Toronto, Ont.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Brown's Copper and Brass Rolling Mills, New Toronto.

BRAZING EQUIPMENT
Chicago Flexible Shaft Co., Chicago, Ill.

BRICKS, FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

BRIDGES, RLY. AND HIGHWAY
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRINELL MACHINES
U. S. Ordnance, Toronto, Ont.

BRONZE—SHEETS, ROLLS, PLATES, and RODS
Brown's Copper and Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Canada Metal Co. Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BRUSHES, CARBON
Lyman Tube & Supply Co., Montreal, Que.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy. & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd , Montreal

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co Sherbrooke Que
ence Welding Co. Ltd., Montreal

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville
St Lawrence Welding Co, Ltd., Montreal

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.
Williams, White & Co., Moline, Ill.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque,.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.
St Lawrence Welding Co, Ltd., Montreal

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CABLES, TRANSMISSION AND TELEPHONES
Northern Electric Co., Ltd., Montreal.

CALKS, BOOT
Luftin Rule Co., of Can., Windsor, Ont.

CANNERS' MACHINERY
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.

CARBIDE
Union Carbide Co., of Canada, Limited, Weland, nt.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
Swedish Crucible Steel Co. Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal.

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd, Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.
St Lawrence Welding Co, Ltd., Montreal

CASES, FILING
Economy Drawing Table Co., Adrian, Mich.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Can. Elec. Steel Castings, Aurora, Ont.
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CASTINGS, ELECTRIC AND ALLOY STEEL
Can. Elec. Castings Co. Ltd., Orillia, Ont

CARRIERS
COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa.
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie.
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt. Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q.
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Can. Elec. Castings Co, Ltd., Orillia, Ont
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound.
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, ELASTIC, IRON AND FURNACE
Warminton Co., J. N., Montreal.

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CEMENT TOOLS
Atkins & Co., E. C., Hamilton, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas.
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch. Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls- Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy. Co., Toronto.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Oliver Engineering Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Can. Link-Belt Co., Ltd., Toronto, Ont.
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHAINS, POWER TRANSMISSION
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, New York.
Glasgow, N.S.

CHAINS, SPROCKET WHEEL
Can. Link-Belt Co., Ltd., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley-General Co., Inc., Bay City, Mich.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Ltd., Brantford
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin Machine Co., Ltd.
Knight Metal Products, Toronto.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.

CHUCKS, FRICTION AND TAP
Victor Tool Co., Waynesboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co, Ltd., A. R., Montreal

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Barber Mchy. Co., Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams Mchy Co., A. R., Toronto, Ont.

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven Conn.

CLAY FIRE
Elk Fire Brick Co., Can., Ltd., Hamilton, Ont.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York.

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

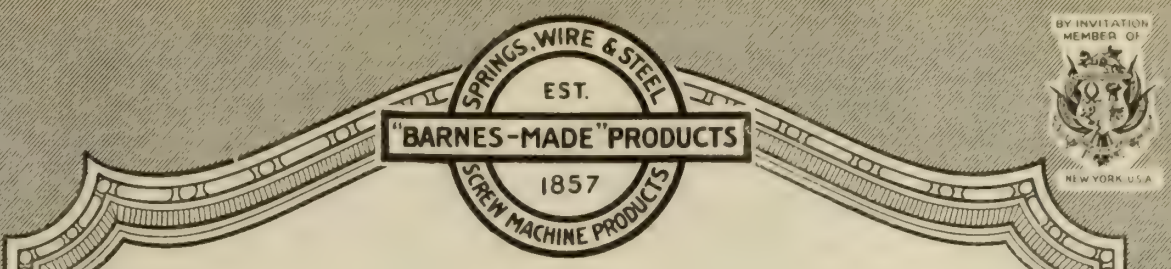
CLOSETS
Crane, Ltd., Montreal, Que.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Aurora, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.

COAL CRUSHERS
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COAL HANDLING MACHINERY
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Canadian Mead-Morrison Co., Limited, Montreal, Que.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
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"Spring Makers for Three Generations"

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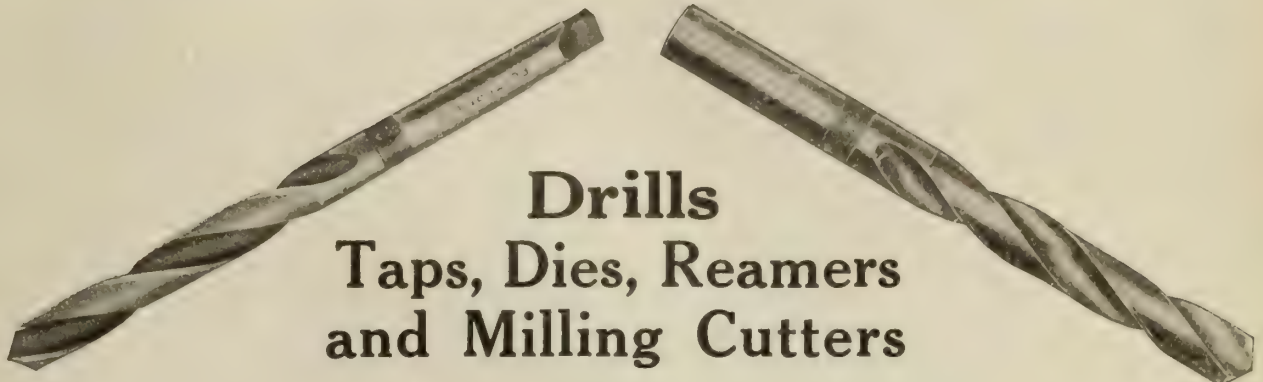
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BUTTERFIELD



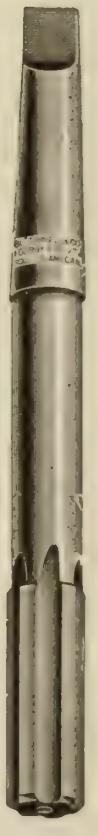
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Taps, Dies, Reamers and Milling Cutters

If your Production needs Stimulating Use Butterfield Tools



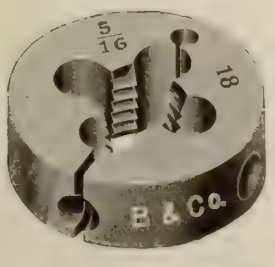
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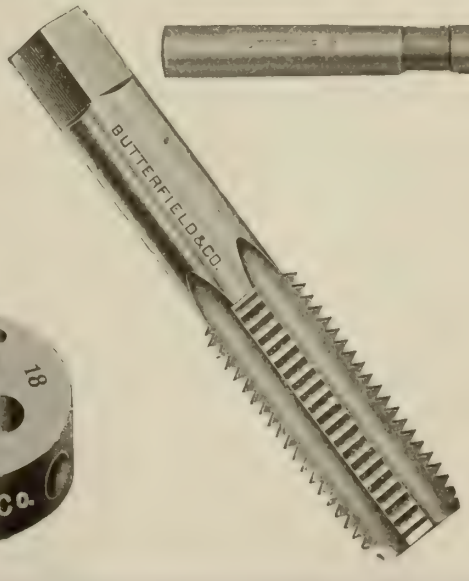
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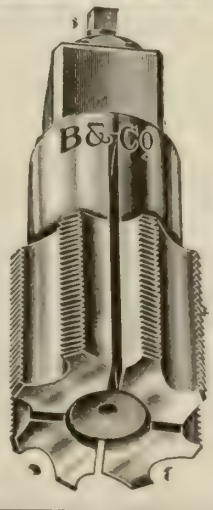


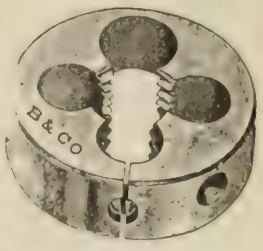
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Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
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Garlock Walker Mach. Co., Toronto, Ont
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Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Haskins Co., R. C., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, HAMMER
Samuel Osborne, Ltd., Montreal, P.Q.

DRILLS, EMERY
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd. Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Lyman Tube & Supply Co., Montreal, Que.
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Osborne, Samuel, Montreal, P.Q.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Petrie, H. W. Toronto.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Williams Mchy Co, Ltd., A. R., Montreal
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock-Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
Samuel Osborne Ltd., Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.

DRILLS, SQUARE & HEXAGON
Globe Engineering Co.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Crane, Ltd., Montreal, Que.
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See **Belting, Chain.**

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Lyman Tube & Supply Co., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
Sturtevant Co., B. F., Galt, Ont.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Lawrence Welding Co, Ltd., Montreal

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Sturtevant Co., B. F., Galt, Ont.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Northern Electric Co., Ltd., Montreal Que

ELECTRIC FURNACES
Hamilton & Hansell, Inc., New York City
Volta Manufacturing Co., Welland, Ont.

ELECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Lincoln Electric Co. of Canada, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
Volta Manufacturing Co., Welland, Ont.

ELECTRIC TRUCKS
Cowan Truck Co., Holyoke, Mass.
Goad Engineering Co., Toronto, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Kane Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.

ELEVATING AND CONVEYING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Petrie, Ltd., H. W., Toronto.

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Oliver Machinery Co., Grand Rapids, Mich

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
H. H. Barton & Son Co, Philadelphia, Pa
Wausite Abrasives Co., Chicago, Ill.

EMERY PAPER
Atkins & Co., E. C., Hamilton, Ont.
Atkins & Co., E. C., Hamilton, Ont.
Wausau Abrasives Co., Chicago, Ill.

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Atkins & Co., E. C., Hamilton, Ont.
Brantford Emery Wheel Co., Brantford, Canada.
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wilkinson & Kompass, Hamilton, Ont.
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

ENAMELWARE
Crane, Ltd., Montreal, Que.

EMERY WHEEL DRESSINGS
Dominion Abrasive Co., Ltd., Mimico, Ont.
Wheel Trueing Tool Co., Windsor Ont.

END MILLS
John Morrow Screw & Nut Co., Ingersoll

ENGINEERS—INDUSTRIAL CLEANING (Free Consultation)
Oakley Chemical Co., New York, N.Y.

ENGINEERS
Samuel Osborne (Canada) Ltd., Montreal.

ENGINES—HOISTING, PILE DRIVING, BRIDGE ERECTING, MINING
Canadian Mead-Morrison Co., Limited, Montreal, Que.

ENGINES, STEAM, GAS, GASOLINE
Furniss, Clarke & Co., Montreal, Que
Canadian Fairbanks-Morse Co., Montreal.
Johnson Mach. Co., Carlyle, Manchester, Conn.
MacGovern & Co., Montreal, Que.
Sturtevant Co., B. F., Galt, Ont.

ENGINES, HORIZONTAL AND VERTICAL
Johnson Mach. Co., Carlyle, Manchester, Conn.
A. R. Williams Machy. Co., Toronto.
Petrie, Ltd., H. W., Toronto.

ENGINES, OIL
Ker & Goodwin Machine Co., Ltd., Brantford, Ont.

ENGINES, HEAVY OIL, DIESEL TYPE
Dom. Steel Products Co., Ltd., Brantford

ENGINES, MARINE
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Sturtevant Co., B. F., Galt, Ont.

ESCUTCHEON PINS
Parmenter & Bulloch, Gananoque, Ont.

EXHAUST HEADS AND HOODS
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Sturtevant Co., B. F., Galt, Ont.

EXHAUSTERS
Can. Blower & Forge Co., Kitchener, Ont.
Pangborn Corporation, Hagerstown, Md.
Petrie, Ltd., H. W., Toronto.
Sturtevant Co., B. F., Galt, Ont.
St Lawrence Welding Co, Ltd., Montreal

EXTRACTORS, TAP
Walton Co., The, Hartford, Conn.

EYE BOLTS AND NUTS
Can. Foundries & Forgings, Ltd., Welland, Ont.

EYE PROTECTORS
Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

FACTORY GATES
Page Steel & Wire Co., Adrian, Mich.

FACTORY LOCATIONS
City of St. Johns, Quebec.

FACTORY SITES
City of St. Johns, Quebec.

FANS
Baird Machine Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont.
Sturtevant Co., B. F., Galt, Ont.
Sheldons, Ltd., Galt, Ont.

FENCING, WIRE
Page Steel & Wire Co., New York, N.Y.

FENCE, IRON AND FACTORY
Can. Wire & Iron Goods, Hamilton, Ont.
Page Steel & Wire Co., Adrian, Mich.

FERRO-TUNGSTEN
Vanadium-Alloys Steel Co., Pittsburgh, Pa

FILES
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Wm., Sheffield, Eng.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Marshall, Son & Bunney, Toronto, Ont.
Nicholson File Co., Port Hope, Ont.
Rice Lewis & Son, Toronto, Ont.
Simonds Mfg. Co., Fitchburg, Mass.
Whitman & Barnes Mfg. Co., Akron, O
Wilkinson & Kompass, Hamilton, Ont.

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Lyman Tube & Supply Co., Montreal, Que.

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Barry Mfg. Co., Chicago, Ill.

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Bowser Co., Ltd., S. F., Toronto, Ont.
Can. Wire & Iron Goods, Hamilton, Ont.

FIRE BRICK
Elk Fire Brick Co., Hamilton, Ont.
General Combustion Co., Ltd., Montreal, Que.

FIRE CLAY
Elk Fire Brick Co., Can., Ltd., Hamil-
General Combustion Co., Ltd., Montreal, Que.

FINISHING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.

FIRST AID CABINETS
Strong, Kennard & Nutt Co., Cleveland.

FIRE EXTINGUISHERS
Strong, Kennard & Nutt Co., Cleveland, O.

FITTINGS, CAST IRON, SCREWED, FLANGED
Crane, Ltd., Montreal, Que.

FIXTURES
Brown Engineering Corp., Toronto, Ont.
Crescent Mchy. Co., Ltd., Montreal, Que.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Toronto Tool Co., Toronto, Ont.

FLAT SPRINGS
The Dunbar Brothers Co., Bristol, Conn

FLEXIBLE SHAFT EQUIPMENT
R. C. Haskins Co., Chicago, Ill.

FLOODLIGHTS, ELECTRIC
Can. Electric Co., Ltd., Montreal Que

FLOTATION MACHINERY
Elec. Steel & Metals, Welland, Ont.

FLUMES
Can. Ingersoll Rand Co., Ltd., Sherbrooke,
William Hamilton Co., Peterboro, Ont.

FORGES, HAND PORTABLE
Aikenhead Hardware Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
A. B. Jardine & Co., Ltd., Hespeler, Ont
Rice Lewis & Son, Toronto, Ont.
Sturtevant Co., B. F., Galt, Ont.
U. S. Ordnance, Toronto, Ont.

FORGE TOOLS
Kimber & Hillier Mfg., Co., St. Catharines, Ont.

FORGES, OIL
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

FORGINGS
Mesta Machine Co., Pittsburgh, Pa.
Can. Found. & Forgings, Ltd., Welland
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

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Dominion Bridge Co., Montreal, Que.
Dom. Forge & Stamping Co., Walkerville
Steel Co. of Canada, Ltd., St. Catharines
Victoria Foundry Co., Ottawa.
Williams & Co., J. H., Brooklyn, N.Y.

FORGING MACHINERY
John Bertram & Sons Co., Dundas, Ont.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
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Chicago Flexible Shaft Co., Chicago, Ill.

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Armstrong-Whitworth of Can., Montreal.
Can. Found. & Forgings, Ltd., Welland.
Williams & Co., J. H., Brooklyn, N.Y.

FORMING
Brown & Sharpe Mfg. Co., Providence, R.I.

FOUNTAINS, DRINKING
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

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Bellevue Furnace Co., Detroit, Mich.
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Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co, Can., Ltd, Montreal
Mechanical Eng'g Co., Three Rivers, Q.
W. S. Rockwell Co., New York, N.Y.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

FURNACES, BLAST
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago, Ill.
W. S. Rockwell Co., New York, N.Y.
Toronto Iron Works, Ltd., Toronto.

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General Combustion Co., Ltd., Montreal

FURNACES — CRUCIBLE
Chicago Flexible Shaft Co., Chicago, Ill.

FURNACES, ELECTRIC
Hamilton & Hansell, Inc., New York City.

FURNACES, FORGING
Chicago Flexible Shaft Co., Chicago, Ill.
Gen. Combustion Co. of Can., Ltd., Montreal.
W. S. Rockwell Co., New York, N.Y.

FURNACES — HIGH-SPEED STEEL
Chicago Flexible Shaft Co., Chicago, Ill.

FUSE BOXES, STEEL
Dom. Forge & Stamp. Co., Walkerville.

FUSE PLUGS AND FUSES
Northern Electric Co., Ltd., Montreal Que.

GALVANIZING FLUX
British Smelting & Refining Co., Ltd. Montreal, Que.

GANG PLANER TOOLS
Armstrong Bros. Tool Co., Chicago.

GAS AND STEAM ENGINES
Mesta Machine Co., Pittsburgh, Pa.

GASKETS, LEATHER, ETC.
Graton & Knight Mfg. Co., Montreal.

GASOLINE METERS
Bowser Co., Ltd., S. F., Toronto, Ont.

GASOLINE TANKS
Bowser Co., Ltd., S. F., Toronto, Ont.
St. Lawrence Welding Co., Montreal, Que.

GASOLINE PUMPS, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

GAUGES
Crescent Mach. Co., Ltd., Montreal, P.Q.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.

GAUGE BLOCKS
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGERS, CALIPERS
Williams & Co., J. H., Brooklyn, N.Y.

GAUGES, MERCURY COLUMN, DRAFT
Taylor Instrument Co., Rochester, N.Y.

GAUGES, HYDRAULIC
Taylor Instrument Co., Rochester, N.Y.

GAUGES, MANUFACTURERS, LIMIT, THREAD
Greenfield Tap & Die Corp., Greenfield
Wells Bros. of Can., Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, SNAP, THREAD AND CYLINDRICAL
C. E. Johanson, Inc., Toronto, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, THREAD
Wilton Tool & Mfg. Co., Boston 20, Mass.

GAUGES, VACUUM AND PRESSURE
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Rochester, N.Y.

GAUGES, STANDARD
Brown Engineering Corp., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Crescent Mchc. Co., Ltd., Montreal, Que.
Garvin Machine Co., New York.
C. E. Johanson, Inc., Toronto, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Taylor, J. A. M., 518 Stair Bldg., Toronto
Toronto Tool Works, Toronto, Ont.
Wells Brothers Co. of Canada, Galt, Ont.
Wilton Tool & Mfg. Co., Boston 20, Mass.

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Can. Steel Foundries, Ltd., Montreal.
Dom. Found. & Steel, Hamilton, Ont.
Kayser-Ellison & Co., Ltd., Montreal.
Williams & Co., J. H., Brooklyn, N.Y.

GEAR BLANKS, CAST
Kaiser Foundry, Galt, Ont.

GEAR BLANKS, RAWHIDE
Lyman Tube & Supply Co., Montreal, Que.

GEAR BOXES, REDUCTION
Can. Link-Belt Co., Ltd., Toronto, Ont.

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Fellows Gear & Shaper Co., Springfield, V.

GEAR-CUTTING MACHINERY
Bilton Mach. Tool Co., Bridgeport, Conn.
Fellows Gear & Shaper Co., Springfield, V.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
A. R. Williams Machy. Co., Toronto.

GEAR-TESTING MACHINE
Gisholt Machine Co., Madison, Wis.

GEARS, CHAIN
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, COMPENSATING
Morse Chain Co., Ithaca, New York.
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, CUT, MORTISE, ANGLE, WORM
Can. Link-Belt Co., Toronto, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Dominion Bridge Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Elliott & Whitehall, Galt, Ont.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Found., Ltd., Hull, Q.
Jones & Glassco, Montreal.
Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia
Victoria Foundry Co., Ottawa.

GEARS, RAWHIDE
Gardner, Robt., & Son, Montreal.
Grant Gear Works, Boston, Mass.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Philadelphia Gear Works, Philadelphia.
A. R. Williams Machy. Co., Toronto.

GENERATORS, GEAR
Fellows Gear & Shaper Co., Springfield, V.

GEARS, SILENT CHAIN
Can. Link-Belt Co., Ltd., Toronto, Ont.

GEARS, SPRING
Morse Chain Co., Ithaca, New York.

GEARS, SPUN, BENCH, SPIRAL
Brown & Sharpe Mfg. Co., Providence, R.I.

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St. Lawrence Welding Co, Ltd., Montreal

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MacGovern & Co., Montreal.
Northern Elec. Co., Ltd., Montreal, P.Q.
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U. S. Ordnance, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. Link-Belt Co., Ltd., Toronto, Ont.

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GLOVES, ASBESTOS, ACID PROOF WATERPROOF, ETC.
Strong, Kennard & Nutt Co., Cleveland.

GLUE HEATERS
Oliver Machinery Co., Grand Rapids, Mich.

GLASSES, SAFETY
Strong, Kennard & Nutt Co., Cleveland.
Willson & Co., Inc., T. A., Reading, Pa.

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Aikenhead Hardware, Ltd., Toronto.
Rice Lewis & Son, Toronto.

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Standard Optical Co., Geneva, N.Y.
Strong, Kennard & Nutt Co., Cleveland.
Welding & Supplies Co., Montreal.

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Canadian Mead-Morrison Co., Limited, Montreal, Que.

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GREASE CUPS, PRESSED STEEL, BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES (See Lubricants)

GRINDERS, AUTOMATIC KNIFE
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Garlock-Walker Machinery Co., Toronto.

GRINDERS, CENTRE COLUMN, PEDESTAL AND BENCH
Can. Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Haskins & Co., R. C., Chicago, Ill.
Wisconsin Electric Co., Inc., Racine, Wis.
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Mach. Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto.
Katie Foundry, Galt, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Niles-Bement-Pond Co., New York, N.Y.
Perfect Machine Co., Galt, Ont.
United States Elec. Tool Co., Cincinnati.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Cincinnati Milling Mach. Co., Cincinnati.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Globe Engineering Co., Hamilton, Ont.
Greenfield Machine Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, M.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Norton Co., Worcester, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. of Can., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, DIE AND CHASER
Haskins & Co., R. C., Chicago, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., E. C., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., Worcester, Mass.

GRINDERS, FLEXIBLE CASTING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

GRINDERS, DRILL
Aikenhead Hardware Co., Toronto.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield,
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati.
Wells Bros. of Canada, Galt, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

GRINDERS, CYLINDER, INTERNAL
Barber Mchy. Co., Ltd., Toronto, Ont.
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Foss Mchy. & S'ply Co., G. F., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester, Mass.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Mach. Co., Hamilton, Ont.
Haskins & Co., R. C., Chicago, Ill.
Grant Mfg. & Mach. Co., Bridgeport, Conn
Garlock-Walker Machinery Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Independent Pneumatic Tool Co., Chicago
Petrie, Ltd., H. W., Toronto.
United States Elec. Tool Co., Cincinnati
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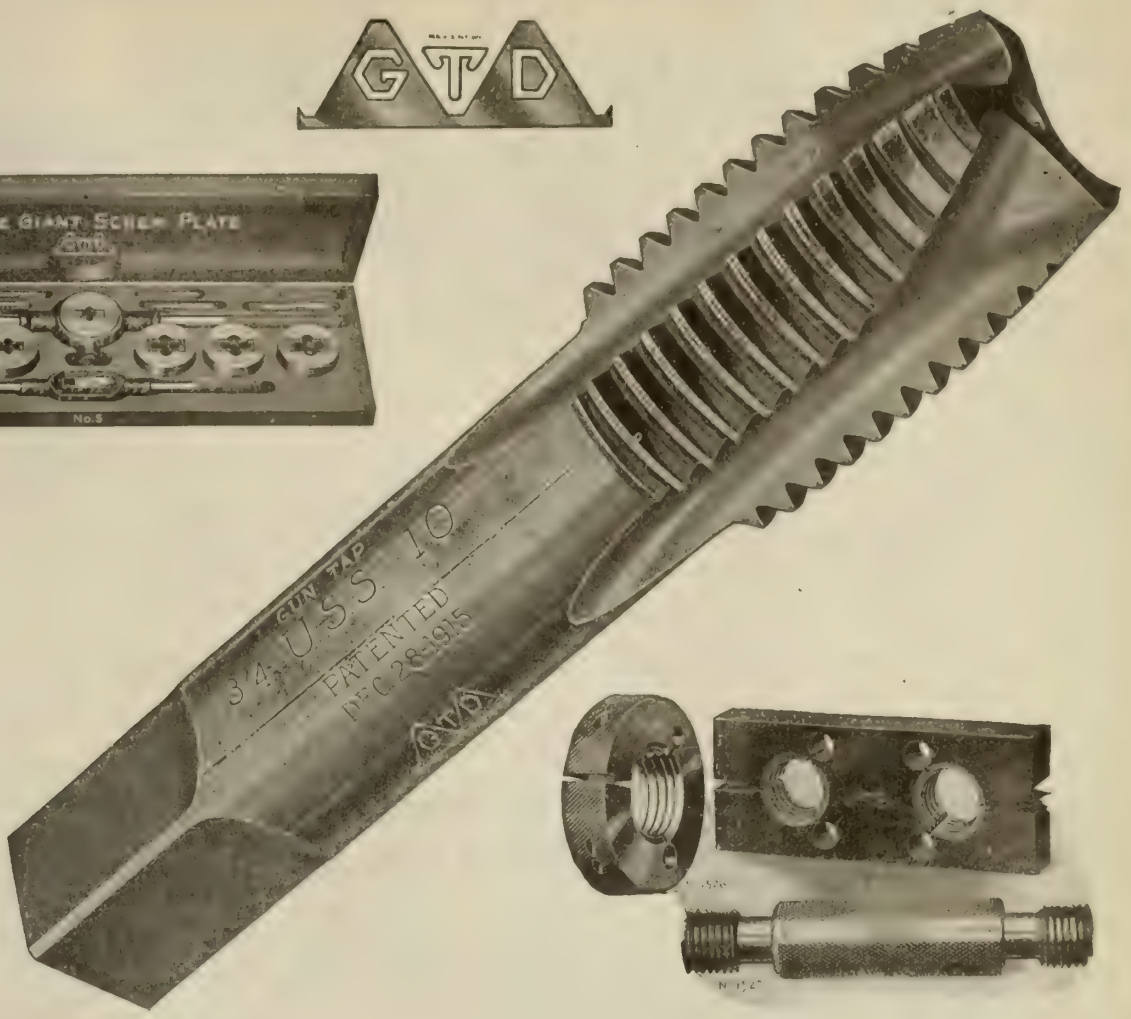
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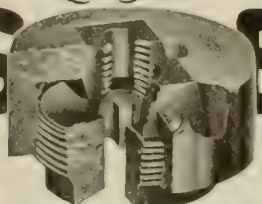
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Globe Engineering Co., Ltd., Hamilton
Hoggson & Pettis Mfg. Co., New Haven Conn.

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Brown & Sharpe Mfg. Co., Providence, R.I.

MAGNETIC BRAKES FOR ELECTRIC MOTORS
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Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.

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Matthews & Co., Jas. H., Pittsburgh, Pa

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Brown, Boggs Co., Hamilton, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal
Perrin, Wm. R., Toronto.
Petrie, Ltd., H. W., Toronto.

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Strong, Kennard & Nutt Co., Cleveland

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MATS, RUBBER MATTING
Quaker City Rubber Co., Philadelphia, Pa
International Mchy. Sply., Ltd., Montreal

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Pratt & Whitney Co., Dundas, Ont.

MEASURES, REGISTERING
Bowser Co., Ltd., S. F., Toronto, Ont.

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Atkins & Co., E. C., Hamilton, Ont.
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METAL SAWS
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METAL, ANTI-FRICTION
Thos. Moore & Son, Montreal.

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Hoefer Mfg. Co., Freeport, Ill.
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Canada Metal Co., Toronto, Ont.
Deloro Smelting & Refining Co., Ltd, Toronto, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.

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General Combustion Co., Ltd., Montreal, Que.

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Taylor, J. A. M., 31st Stair Bldg., Toronto.
Petrie, Ltd., H. W., Toronto.

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Elec. Steel & Metals, Welland, Ont.

MILL SPECIALTIES
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MILLS, SAND
Frost Mfg. Co., Chicago, Ill.

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Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Canada, Galt, Ont.

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Petrie, Ltd., H. W., Toronto.
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United States Mach. Tool Co., Cincinnati.
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Williams Machy. Co., A. R., Toronto.

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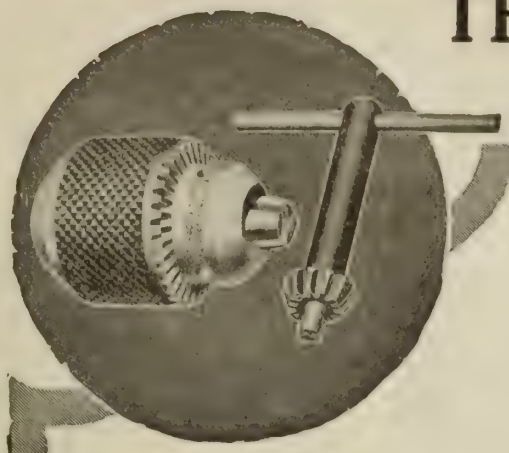
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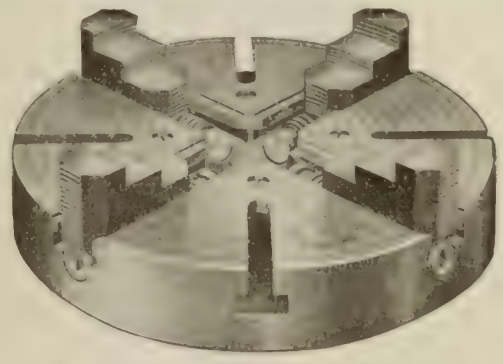
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Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo.
U. S. Ordnance, Toronto, Ont.
Williams Machy. Co., A. R., Toronto

PRESSES, SPRING FOOT
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., Ltd., A. R., Montreal

PRESSES, SCREW
Barnes & Co., W. F. & Jno., Rockford, Ill
Bliss Co., E. W., Brooklyn, N.Y.
Manhattan Machine & Tool Co., Grand Rapids, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.

PRESSES, SEAL
Hoggson & Pettis Mfg. Co., New Haven, Conn.

PRESSES, TIRE
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PRESSES, TRIMMING
Bliss Co., E. W., Brooklyn, N.Y.
Canada Machinery Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.

PROJECTORS, FLOOD LIGHTING
Lyman Tube & Supply Co., Montreal, Que

PROPELLERS
Kennedy & Sons, Wm., Owen Sound.

PROTECTIVE COATINGS
H. H. Robertson, Ltd., Sarnia, Ont.

PSYCROMETERS, SLING
Taylor Instrument Co., Rochester, N.Y.

PULLEYS
Algoma Steel Corp., Sault Ste. Marie, Ont
American Pulley Co., Philadelphia.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., Fortierville, Que.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Ford-Smith Machine Co., Hamilton, Ont.
Kennedy & Sons, Ltd., W., Owen Sound.
Positive Clutch & Pulley Works Ltd., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.

PULLEYS, STEEL SASH, STEEL BELT
American Pulley Co., Philadelphia, Pa.

PULLEYS, FRICTION, CLUTCH
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mch. Co., Manchester, Ct.
Positive Clutch & Pulley Works, Toronto.
Jones & Glassco, Montreal.
Petrie, Ltd., H. W., Toronto.

PULP MILL MACHINERY
Can. Ingersoll Rand Co., Ltd., Sherbrooke,
MacKinnon Steel Co., Sherbrooke, Que.

PUMPS, AIR LIFT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,

PUMPS, BOILER FEED
Can. Ingersoll Rand Co., Ltd., Sherbrooke.

PUMPS, CENTRIFUGAL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, FUEL OIL
Bowser Co., Ltd., S. F., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS, GEARED
Darling Bros., Ltd., Montreal, Que.
Globe Engineering Co., Hamilton, Ont.

PUMPS, HIGH PRESSURE
Perrin, Ltd., William R., Toronto.

PUMPS, HYDRAULIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke,
Clarke & Co., Farnham, Montreal, Que.
Garlock-Walker Machinery Co., Toronto.
Darling Bros., Ltd., Montreal, Que.
Elec. Steel & Metals, Welland, Ont.
Metalwood Mfg. Co., Detroit, Mich.
Perrin, Ltd., William R., Toronto.
Petrie, Ltd., H. W., Toronto.
U. S. Ordnance, Toronto, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

PUMPS, LUBRICATING, OIL STORAGE
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, RETURN AIR
Can. Ingersoll Rand Co., Ltd., Sherbrooke,

PUMPS, SPECIAL
Elec. Steel & Metals, Welland, Ont.

PUMPS, RUBBER CEMENT
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, KEROSENE, OIL, SELF-MEASURING
Bowser Co., Ltd., S. F., Toronto, Ont.

PUMPS, LUBRICANT, OIL, WATER
Darling Bros., Ltd., Montreal, Que.
Trahern Pump Co., Rockford, Ill.

PUMPS — ROTARY
General Combustion Co., Ltd., Montreal, Que.

PUMP LEATHERS
Graton & Knight Mfg. Co., Worcester.

PUNCHES AND DIES
Atkins & Co., Ltd., Wm., Sheffield, Eng.
E. W. Bliss Co, Brooklyn, N.Y.
Boker & Co., Inc., H., Montreal, Que.
Brown, Boggs Co., Ltd., Hamilton, Can.
Can. Blower & Forge Co., Kitchener, Ont.
Crescent Mach. Co., Ltd., Montreal, P.Q.
Can. Fairbanks-Morse Co., Montreal.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gardner & Son, Robert, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Marshall, Son & Blunney, Toronto.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Petrie, Ltd., H. W., Toronto.
Stoll Co., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHES, POWER
John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd, Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto.
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
D. H. Stoll Co., Buffalo, N.Y.
Williams Mchy Co., A. R., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.
Bertrams & Sons, John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton, Ont.
Garlock-Walker Mach'y. Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

PYROMETERS
Bristol Co., Waterbury, Conn.
Shore Instrument & Mfg. Co., New York
Taylor Instrument Co., Rochester, N.Y.
U.S. Ordnance, Toronto, Ont.

QUARTERING MACHINES
Bertram & Sons, John, Dundas, Ont.
Canadian Mead-Morrison Co., Limited, Montreal, Que.
Niles-Bement-Pond Co., New York.

QUARRY HOISTS
Canadian Mead-Morrison Co., Limited, Montreal, Que.

RAIL BENDERS
Algoma Steel Corp., Sault Ste. Marie, O.

PUNCHES, HAND
Niles-Bement-Pond Co., New York.

RAILROAD TOOLS
Can. Fairbanks-Morse Co., Montreal.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Williams Mchy Co., A. R., Toronto, Ont.

RASPS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.

RAWHIDE PINIONS (See Gears)

REAMERS
Butterfield & Co., Inc., Rock Island, Que.

REAMERS, ADJUSTABLE
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
The Kelly Reamer Co., Cleveland, O.
J. A. M. Taylor, 318 Stair Bldg., Toronto.
Wells Bros. of Can., Galt, Ont

REAMERS, BRIDGE, EXPANDING AND HIGH SPEED
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Aikenhead Hardware Co., Toronto.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Lyman Tube & Supply Co., Montreal, Que
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Samuel Osborne, Ltd., Montreal, P.Q.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
U.S. Ordnance, Toronto, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, STEEL TAPER AND SELF-FEEDING
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, CHUCKING
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que
Elliott & Whitehall Machine and Tool Co., Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
Ingersoll Machy. Co., Ingersoll, Ont.
Marshall, Son & Bunney, Toronto.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Canada, Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, HAND
Butterfield & Co., Inc., Rock Island, Que.
Elliott & Whitehall, Galt, Ont.
Greenfield Tap & Die Corp., Greenfield.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMERS, PIN
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
Morrow Screw & Nut Co., John, Ingersoll.
Wells Bros. of Can., Galt, Ont.
Wilt Twist Drill Co., Walkerville, Ont.

REAMER FLUTING MACHINES
Garvin Machine Co., New York.

REAMING MACHINES, PNEUMATIC
Cleveland Pneumatic Co. of Can., Toronto
Garlock-Walker Machinery Co., Toronto.

RECORDING INTRUMENTS
Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Rochester, N.Y.

REELS, WIRE AND TEXTILE MFG.
American Pulley Co., Philadelphia, Pa.

REGULATORS, AUTOMATIC
Electric Steels & Metals, Ltd., Welland.

REGULATORS, PRESSURE, TEMPERATURE
Can. Fairbanks-Morse Co., Montreal.
Taylor Instrument Co., Rochester, N.Y.

REPAIR WORK — SAWS
Atkins & Co., E. C., Hamilton, Ont.

REPAIR WORK, ALL KINDS
Elec. Steel & Metals, Welland, Ont.
St Lawrence Welding Co, Ltd., Montreal

RESPIRATORS
Strong, Kennard & Nutt Co., Cleveland.

RIVETS,
Aikenhead Hardware Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque.
Rice, Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.

RIVETERS, PNEUMATIC, HYDRAULIC, HAMMER, COMPRESSION
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

RIVETING MACHINES, ELASTIC, ROTARY BLOW
Grant Mfg. & Machine Co., Bridgeport.
High-Speed Hammer Co., Rochester.
Petrie, Ltd., H. W., Toronto.
F. B. Shuster Co., New Haven, Conn.

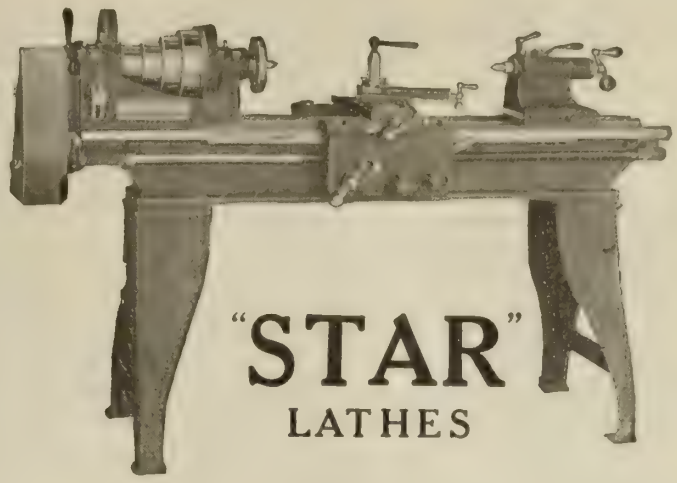
ROAD BUILDING EQUIPMENT
Can. Ingersoll-Rand Co., Ltd., Sherbrooke.

ROAD-MAKING MACHINERY
G. F. Foss Mchy & Sply. Co., Montreal.

RODS, ROPE AND SPRING
Page Steel & Wire Co., Adrian, Mich.

RODS, PURE NICKEL, MONEL METAL, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville.

ROLL ENGRAVING
Hoggson & Pettis Mfg. Co., New Haven, Conn.



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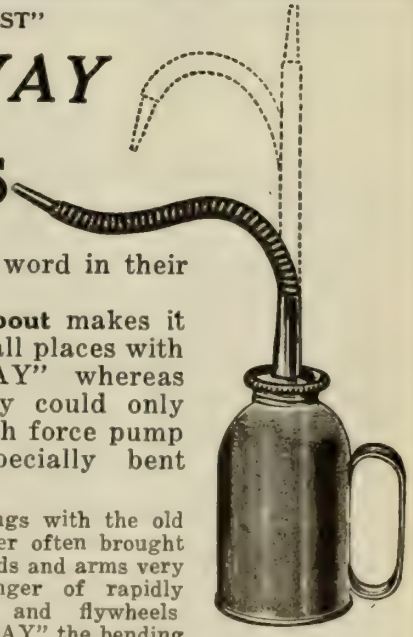
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RAILROAD
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The **flexible spout** makes it possible to oil all places with one "ALL-WAY" whereas previously they could only be reached with force pump cans with specially bent spouts.

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Jones & Glasco, Montreal.
Lyman Tube & Supply Co., Montreal, Que

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John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton.
Can Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machinery Co., Toronto
Niles-Bement-Pond Co., New York.
Petrie Ltd., H. W., Toronto.
Toledo Machine & Tool Co., Toledo, O.

ROLLS CRUSHING
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS AND TABLES
Ojax Steel & Metals, Welland, Ont.

ROOFING
H. H. Robertson, Ltd., Sarnia, Ont.

ROPE, GALX. MONEL METAL. BRONZE, TILLER AND SASH CORD
Can. Driver-Harris Co., Ltd., Walkerville

ROTARY SHEARS
The Quickwork Co., St. Mary's, Ohio.

ROOF COOLERS
Electric Steels & Metals, Ltd., Welland

ROLLING MACHINES, SHEET METAL
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLING MILL MACHINERY
Dom. Steel Products Co., Ltd., Brantford
Mesta Machine Co., Pittsburgh, Pa.

ROLL LATHES
Mesta Machine Co., Pittsburgh, Pa.

ROLLS, BENDING, STRAIGHTENING
Manhattan Machine & Tool Co., Grand Rapids, Mich.

ROLLS, CRUSHING
Can. Link-Belt Co., Toronto.

ROLL ENGRAVINGS
Hoggson & Pettis Mfg. Co., New Haven Conn.

RUBBER MFRS.' SUPPIES
Hoggson & Pettis Mfg. Co., New Haven Conn.

RUBBER MOULDS AND CORES
Elliott & Whitehall, Galt, Ont.

RUBBER MILL DRIVES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford
Can. Link-Belt Co., Toronto.

RUBBER MILL MACHINERY
Bertrams Ltd., Edinburgh, Scotland
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Dom. Steel Products Co., Ltd., Brantford

RUBBER MOULDS & CORES
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

RUBBER PRODUCTS, MECHANICAL
Dunlop Tire & Rubber Goods Co., Ltd., Montreal.

RUBBING BRICKS
Dominion Abrasive Co., Mimico, Ont.

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Brown & Sharpe Mfg. Co., Providence
James Chesterman & Co., Ltd., Sheffield
Rice, Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

RULES, STEEL, STRAIGHT, AND FOLDING
Lufkin Rule Co. of Can., Windsor

RULES, BOXWOOD, FOLDING
Lufkin Rule Co. of Can., Windsor

RULES, BOARD AND LONG
Lufkin Rule Co. of Can., Windsor

RUST PREVENTATIVES
Oakley Chemical Co., New York N.Y.

SAW MILL CONVEYORS
Can. Link-Belt Co., Toronto.
Petrie, Ltd., H. W., Toronto.

SAFETY DEVICES
Strong, Kennard & Nutt Co., Cleveland

SAND MILLS
Frost Mfg. Co., Chicago, Ill.

SAND-BLAST EQUIPMENT
SAND BLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md
St. Lawrence Welding Co. Ltd., Montreal

SAFETY APPLIANCES
Strong, Kennard & Nutt Co., Cleveland

SAFETY APPLIANCE GOGGLES
T. A. Willson Co., Inc., Reading, Pa.

SAND BLAST ABRASIVES
Pangborn Corporation, Hagerstown, Md

SAND MIXING MACHINERY
Frost Mfg. Co., Chicago, Ill.

SANITARY DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville,

SANDING MACHINES
Canada Machinery Corp., Galt.

SAW MILL MACHINERY
Can. Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt.
Robert Gardner & Son, Montreal.
Curtis Pneumatic Machy Co., St. Louis
A. R. Williams Machy Co., Toronto
Williams Mchy Co., A. R., Toronto, Ont.

SASH SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

SAWS FOR EVERY USE
Atkins & Co., E. C., Hamilton, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., E. C., Hamilton, Ont.
Wm. Atkins & Co., Ltd., Sheffield, Eng
Hunter Saw & Machine Co., Pittsburgh.
Marshal, Son & Bunney, Toronto.
Plewes Ltd., Winnipeg, Man.
Simonds Mfg. Co., Fitchburgh, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

SAWS, HACK (See Hack Saws)
SAW GUARDS
Atkins & Co., E. C., Hamilton, Ont.

SAWS, METAL, HACK AND BAND
Atkins & Co., E. C., Hamilton, Ont.

SAWS, SILVER STEEL
E. C. Atkins & Co., Inc., Indianapolis.

SAW SHARPENERS
Greenfield Tap & Die Corp., Greenfield.
Hunter Saw & Machine Co., Pittsburgh.
Wells Bros. of Can., Galt, Ont.

SAWS, SLITTING
J. A. M. Taylor, Stair Bldg., Toronto.
Atkins & Co., E. C., Hamilton, Ont.
Elliott & Whitehall Machine and Tool Co., Galt, Ont.

SAWS — HIGH-SPEED FRICTION
Atkins & Co., E. C., Hamilton, Ont.

SAWS — PATTERN SHOP
Atkins & Co., E. C., Hamilton, Ont.

SAWS — SWING
Atkins & Co., E. C., Hamilton, Ont.

SCALES
Can. Kron Scale Co., Montreal, P.Q.
U. S. Ordnance, Toronto, Ont.

SCALES, MECHANICS'
Lufkin Rule Co. of Can., Windsor.

SCLEROSCOPES
Shore Instrument & Mfg. Co., New York.
U. S. Ordnance, Toronto, Ont.

SCREENING MACHINERY
Can. Link-Belt Co., Toronto.

SCREW EXTRACTORS
Cleveland Twist Drill Co., Cleveland.

SCREW MACHINES, HAND, AUTOMATIC
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machy. Co., Ltd., Toronto
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas, Ont.
U. S. Ordnance, Toronto, Ont.
Warner & Swasey Co., Cleveland, O.
Wells Bros. of Can., Galt, Ont.
Wood Turret Mach. Co., Brazil, Ind.

SCREWS, MACHINE, SET, CAP AND SPECIAL
Galt Machine Screw Co., Galt.
John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Barber Mchy. Co., Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
Galt Machine Screw Co., Ltd., Galt, Ont.

SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que.
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

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Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

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Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

SHAPERS
Barber Mchy. Co., Ltd., Toronto, Ont.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt.
Gen. F. Foss Mchy. & Sply. Co., Montreal
Robt. Gardner & Son, Montreal.
Garlock-Walker Mach'y Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Milwaukee Shaper Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto.
Rae Mach. Tool Co., Hamilton.
Standard Equipment & Tool Wks., Montreal.
U. S. Ordnance, Toronto, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Mchy Co., A. R., Toronto, Ont.

SHAPERS, GEAR
Fellows Gear & Shaper Co., Springfield, V.
Knigh Metal Products, Toronto.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O.
Can. Fairbanks-Morse Co., Montreal.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasco, Montreal.
Niles-Bement-Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Peckovers, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams Mchy Co., A. R., Toronto, Ont.

SHARPENING STONES
Norton Co, Worcester, Mass.
Rice, Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
John Bertram & Sons Co., Dundas.
Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
A. B. Jardine & Co., Hespeler, Ont.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo, O.

SHEARS, POWER
John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co, Ltd., Hamilton.
Can Blower & Forge Co, Kitchener.
Canada Machinery Corp., Galt, Ont.
Dom. Steel Products Co., Ltd., Brantford.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatler, Hamilton, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
National Machy. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.
Petrie, Ltd., H. W., Toronto.
H. D. Stoll Co., Inc., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, O.
Williams, White & Co., Moline, Ill.
Williams Mchy Co., A. R., Toronto, Ont.

SHEARS, ROTARY
The Quickwork Co., St. Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio

SHEARS, PLATE CUTTING, SLITTING
Dom. Steel Products Co., Ltd., Brantford.
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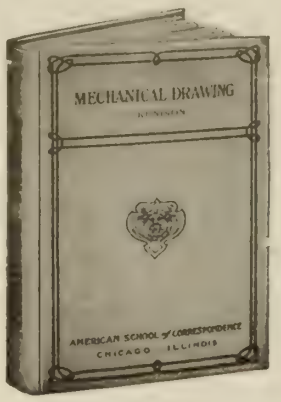
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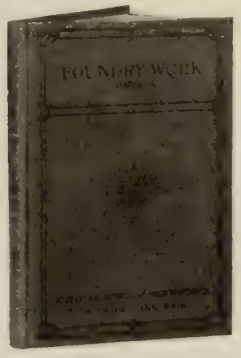
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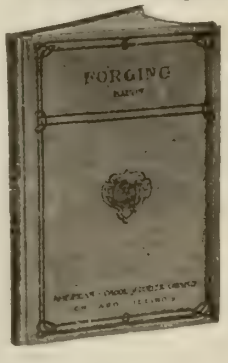
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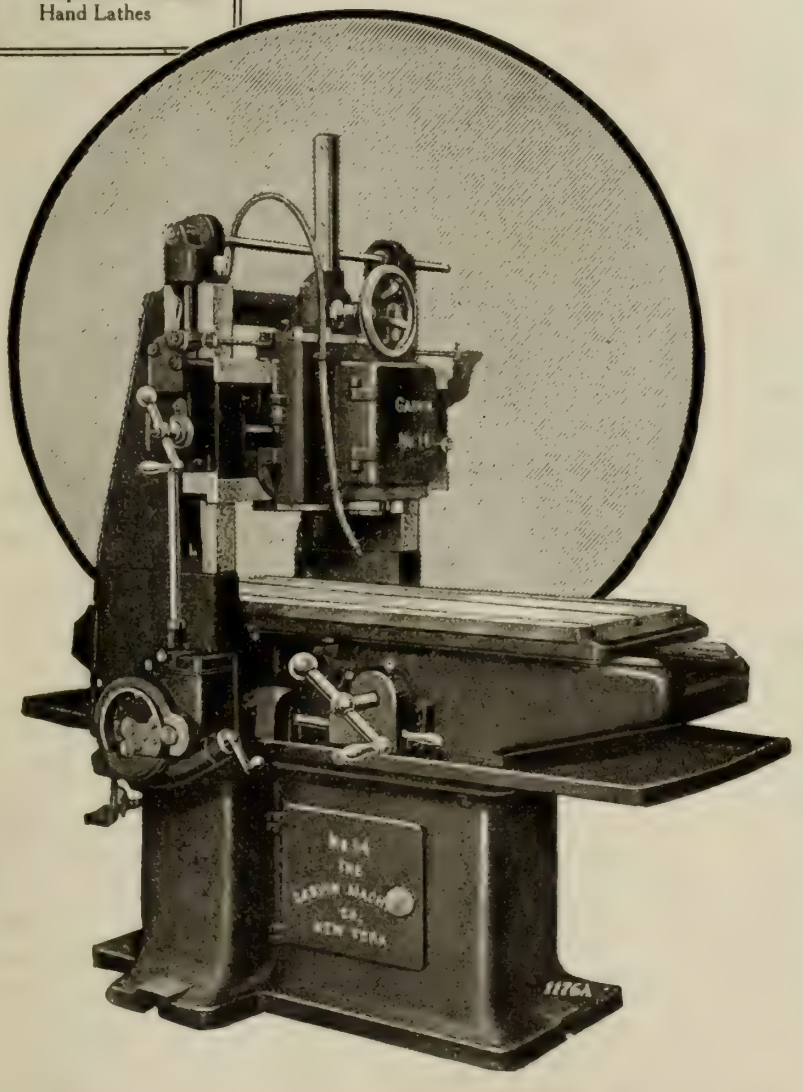
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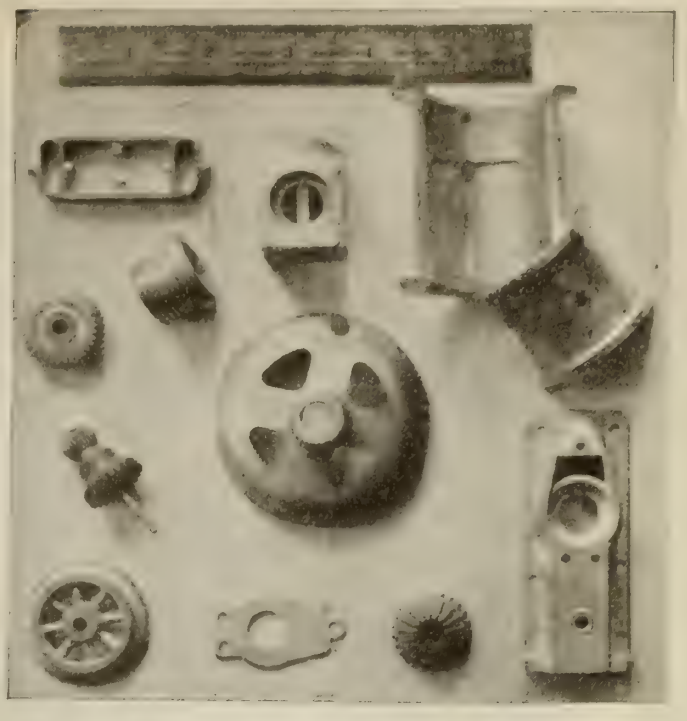
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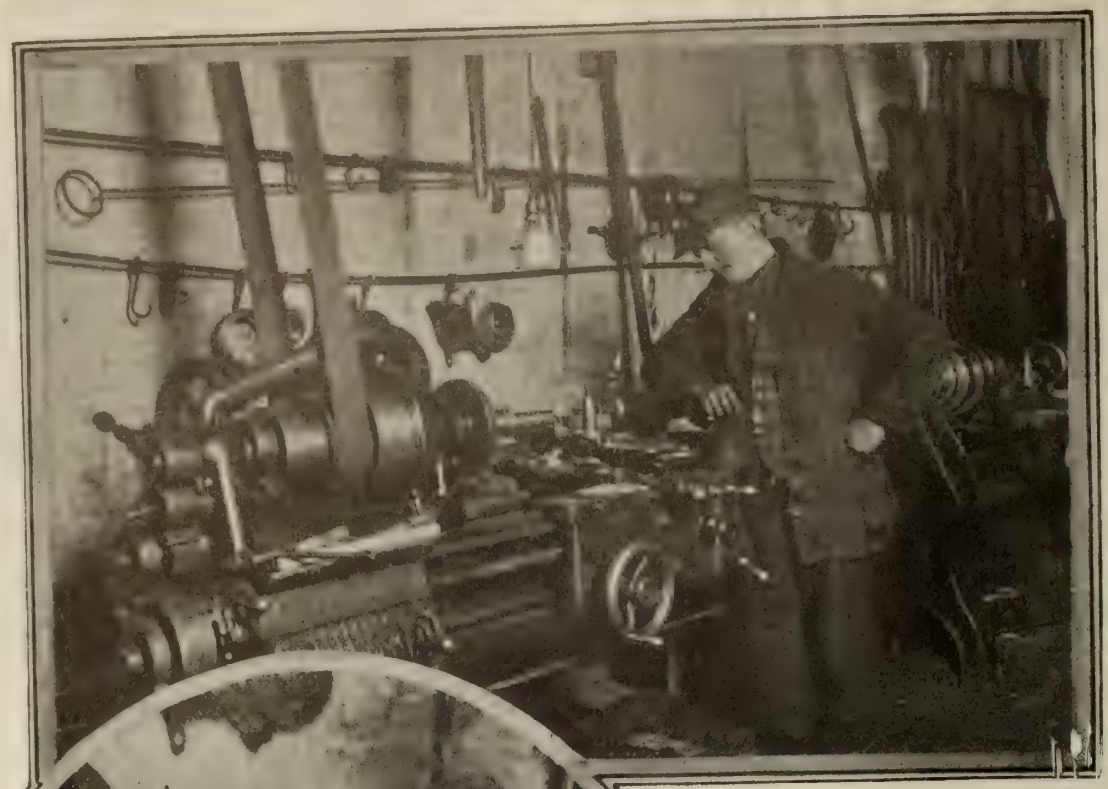
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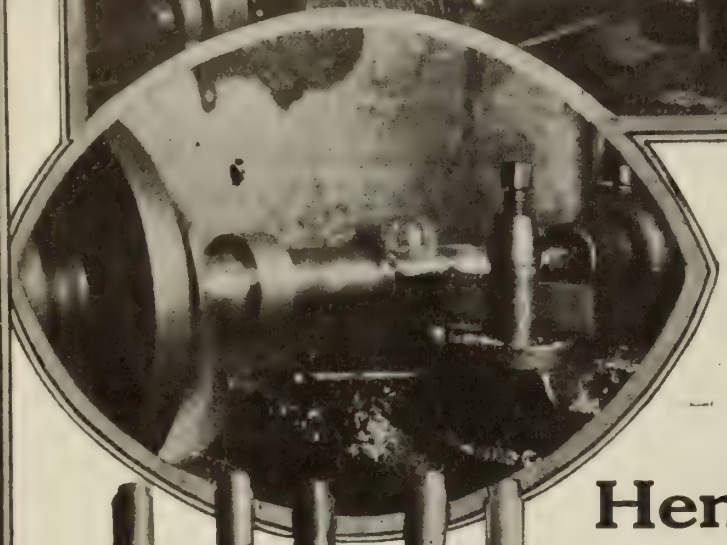
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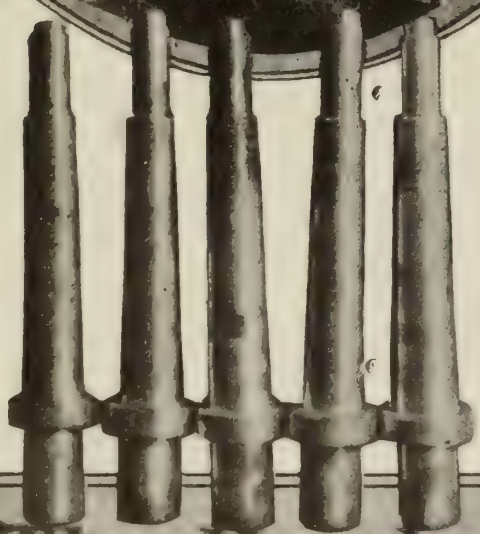
Union Carbide Co. of Can., Ltd. 17
Union Drawn Steel Co. 80
Union Manufacturing Co. 95
Universal Grinding Machine Co. 82
U. S. Ordnance 69

Victoria Foundry Co. 78

Weisgerber, Frank R. 62
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Hendey Lathe

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Hendey lathes are demonstrating their superior ability and speed on such rush jobs every day.

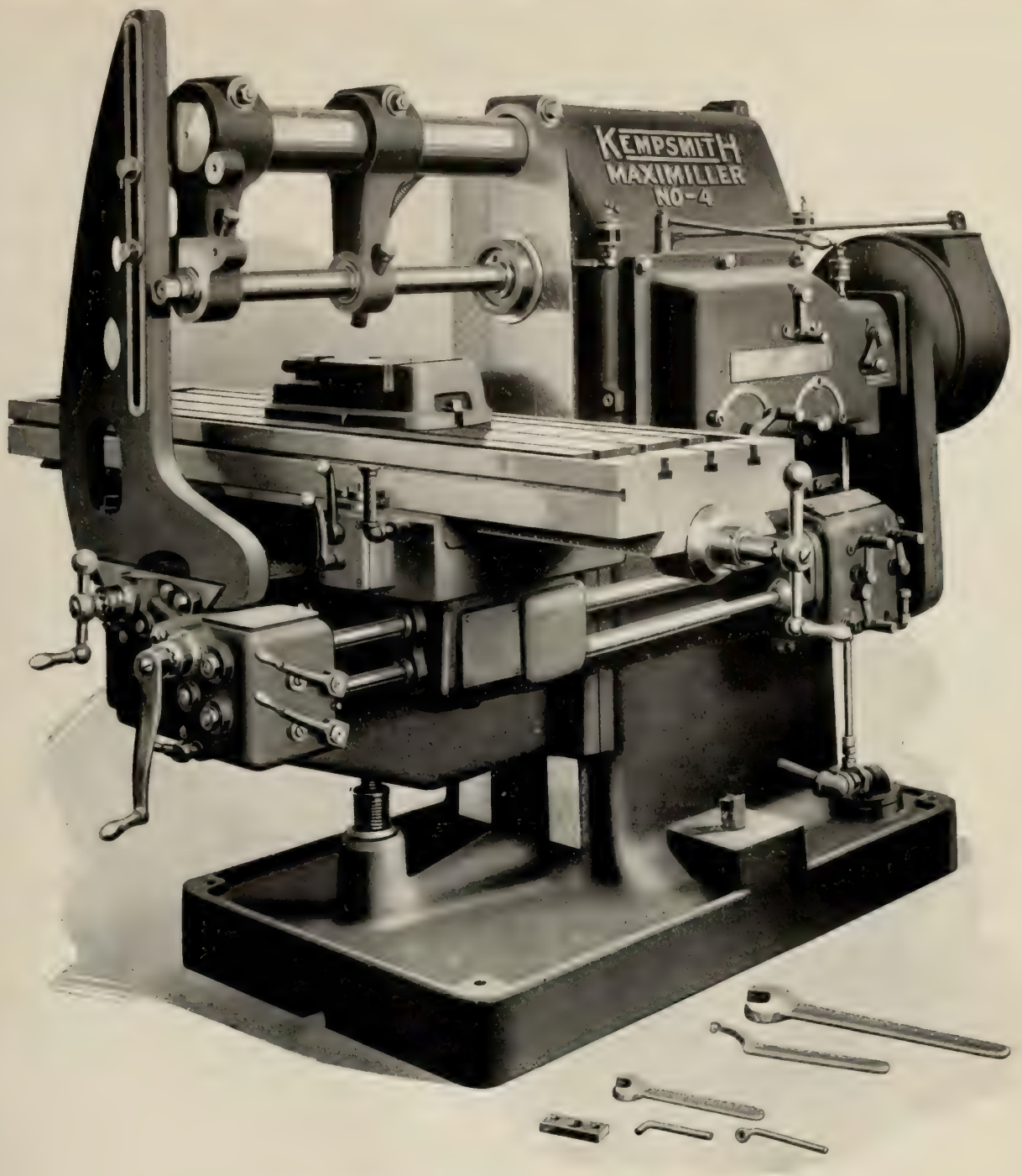
The Hendey here shown in the illustration above, has stood the strain of eleven years round-house service where the jobs are generally variety jobs requiring speed and accuracy. It is still going strong.

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Single Pulley Drive

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The Kempsmith No. 4 Plain Maximiller has been designed in recognition of the growing demand for a heavier and more powerful machine than the usual cone type miller. It is the product of some twelve years' experimentation by an experienced and thoroughly seasoned organization. In all features of general design, such as weight, rigidity, convenience of operation and efficiency in production we offer this machine as the maximum milling machine of similar rating.

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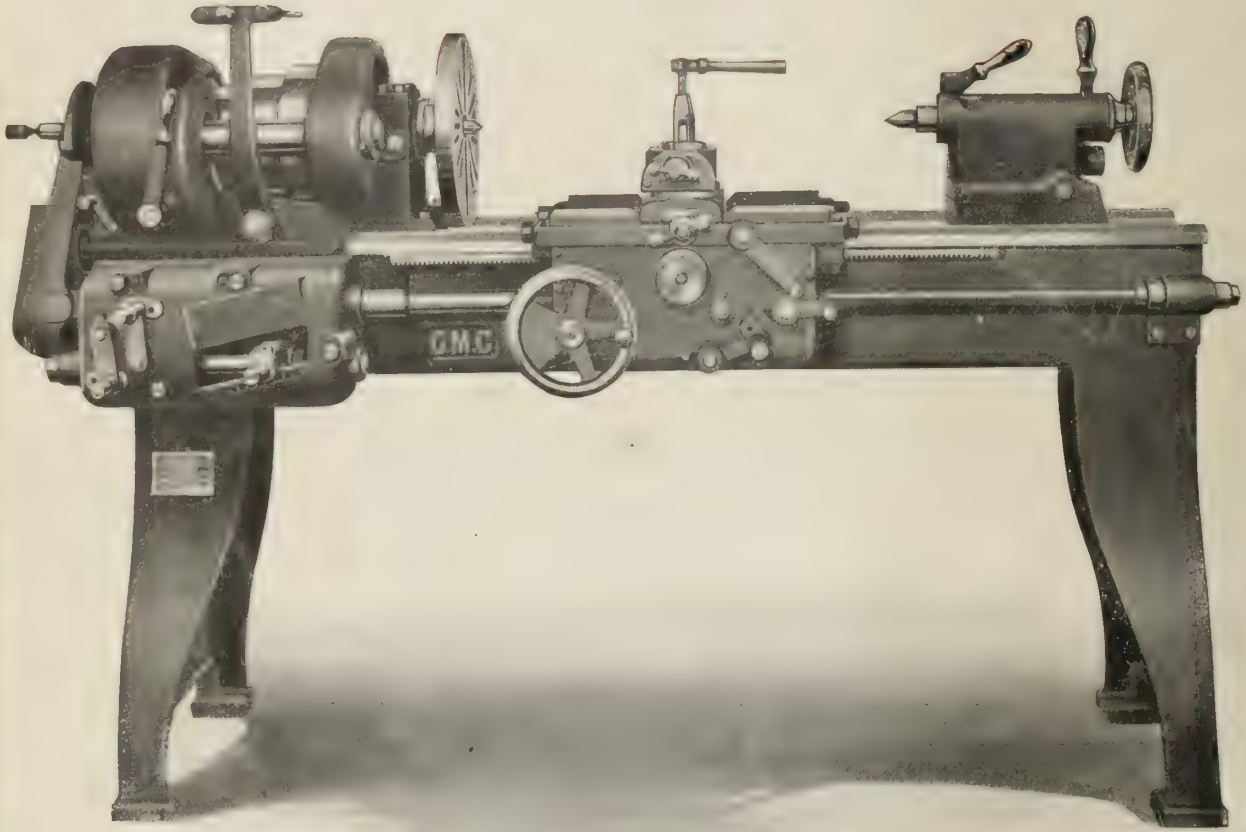
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